AN INSTRUCTIONAL MODEL DEVELOPMENT BASED ON COGNITIVE-BASED APPROACH TO ENHANCE TRAINEE STUDENT CRITICAL THINKING AND CRITICAL THINKING TEACHING ABILITY AT REGIONAL TEACHER TRAINING CENTER, TAKEO PROVINCE, CAMBODIA: COGNITIVE AND PROFESSIONAL DEVELOPMENT

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A Thesis Submitted to the Graduate School of Naresuan University
In Partial Fulfillment of the Requirements
for the Doctor of Philosophy Degree in Education
November 2015

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Dissertation entitled "AN INSTRUCTIONAL MODEL DEVELOPMENT BASED ON COGNITIVE-BASED APPROACH TO ENHANCE TRAINEE STUDENT CRITICAL THINKING AND CEITICAL THINKING TEACHING ABILITY AT REGIONAL TEACHER TRAINING CENTER IN TAKEO PROVINCE, CAMBODIA: COGNITIVE AND PROFESSIONAL DEVELOPMENT"

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has been approved by the Graduate School as partial fulfillment of the requirements for the Doctor of Education in Curriculum and Instruction of Naresuan University

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11 NOV 2015

ACKNOWLEDGEMENT

I would like to express my profound and heart-felt thanks to my advisor, Associate Professor Dr.Wareerat Keawurai, for her continuous support and invaluable advice for my research paper. The gratitude is extended to my dedicated lecturers, Assistant Professor Dr.Amornrat Wattanatorn, Associate Professor Dr.Chaiwat Sutthirat, Dr.Wichian Thamrongsotthisakul, Dr.Angkana Onthanee, and Assistant Professor Dr.Pufa Savagpun who enlightened me both theoretical and practical knowledge to be competent and powerful learner. I would also like to pay my sincere thanks to the dean of Faculty of Education, Naresuan University who accepted me to be one of the students and to all staff, particularly Mrs.Rattana Parnpoothong who offered me both instrumental and emotional support.

My honest thanks is also extended to Miss.Phim Sreyneang, who positively encouraged and motivated me while I was working on my research paper, especially for her potential guidance leading to achieving the fruitful and productive results of my study. I am also extensively indebted to my beloved and caring mother who gave me a birth and continuously supported me. Without them, there would not be today.

Vong Sam Aun

Title AN INSTRUCTIONAL MODEL DEVELOPMENT BASED ON COGNITIVE-BASED APPROACH TO ENHANCE TRAINEE STUDENT CRITICAL THINKING AND CRITICAL THINKING TEACHING ABILITY AT REGIONAL TEACHER TRAINING CENTER, TAKEO PROVINCE, CAMBODIA: COGNITIVE AND PROFESSIONAL DEVELOPMENT

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Academic Paper Thesis Ph.D. in Curriculum and Instruction, Naresuan University, 2015

Keywords Instructional Development, Critical Thinking, Trainee Students

ABSTRACT

The main purposes of this research study were: 1) to develop an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center, 2) to implement an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center, and 3) to evaluate an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center. The model was designed utilizing 4 main components of research and development processes and implemented with 15 trainee students whose major are English and Khmer at the Regional Teacher Training Center. The received data was analyzed using scoring rubrics, descriptive statistics, Wilcoxon, and content analysis. The results revealed that there were six 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, S.D.=0.23). Critical thinking learning instruction was designed into eight steps including 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 higher than pre-critical thinking implementation at the statistical significance of .01. Also, their critical thinking teaching ability was at the exemplary level ($\overline{X}$=20.62, S.D.=0.28), and their perceptions towards critical thinking learning and teaching instruction were at the highest level ($\overline{X}$=4.28, S.D.=0.19).



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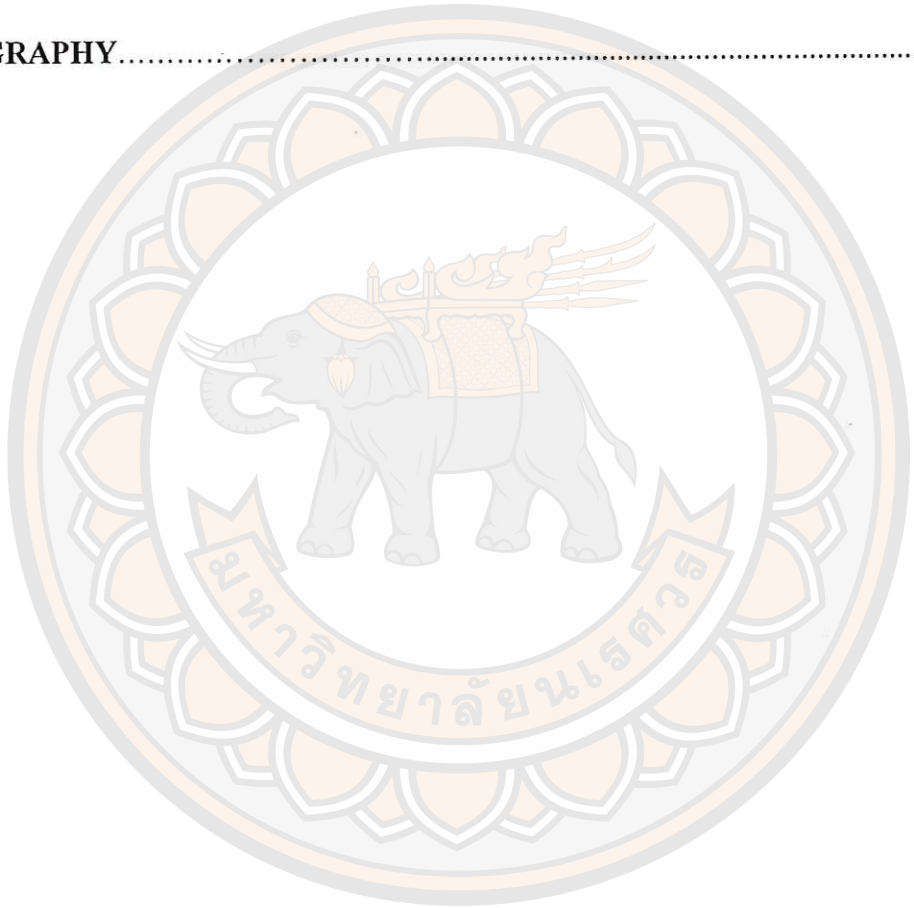

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CHAPTER I

INTRODUCTION

Statement of Problem

The teacher education and training system in Cambodia were almost completely shattered during the years of civil war from 1975 to 1979, and about 80% of teaching staffs were lost during this genocidal regime. This loss persistently continued until 1993 [1]. Since then Cambodia has made great attainments in reconstructing the entire education and training systems. Teacher education and training are amid the priorities which have been extensively rebuilt since the end of civil war in 1998 [2].

The teacher training institutes have been established and extended at the national, regional and provincial levels [2]. At provincial levels, there are 6 Regional Teacher Training Centers (RTTC) for lower secondary school teachers, and one of these is situated in Takeo province, Cambodia. The RTTC in Takeo province was founded in 1981 and has yearly trained more than 300 secondary school teachers [3].

Concerning the efforts to rebuild teacher training and training system, some challenges remain serious. These challenges include the lack of comprehensive training system, teachers to fulfill the current needs, guidance from the concerned authorities, and particularly the limitation of qualities of teacher training, curriculum and program. Also, policies of training improvement which are under the process of development need to be immediately enhanced [2].

Moreover, Educational Strategic Plan, ESP stated that the quality of education and competency of teacher trainees are required to be reinforced by advancing the human resources capacity, creativity, and innovation [4], and by building capable and professional human resources for developing local, regional and international labor markets [4]. Furthermore, due to the shortage of teaching resources and the growing demands for teachers in rural/remote or disadvantaged areas, teacher training institutes in Cambodia still primarily focus on extending quantity rather than upgrading the competency of teacher trainees.

The pedagogy within the Cambodian system is relatively facing minimal interaction; students rarely raise their hands in class, and teachers rarely ask questions [5]. In addition, curriculum development is central control which may inhibit education from being more locally resonant. The curriculum extensively reflects the French system which gears towards class of civil servants and has failed to provide skills that lead to the real world requirements. Also, the curriculum does not include environmental science which in turn causes much disaster in the country [2]. Furthermore, the recent surveys report that experienced teacher trainers in Cambodia view the present curriculum as too varied, without depth and coordination [6].

The Ministry of Education, Youth and Sport (MoEYS) also recognizes that the education sector could not reach the policy target for ESP 2006-2010 in which its effort is to increase and improve teacher quality. Teacher Development Master Plan 2010-2014 sees the following challenges such as limitation of qualified teachers, insufficient in-service training, and lack of opportunities for further training in teacher devolvement although MoEYS has recently offered the opportunity for teachers to upgrade their existing capacities [6].

Another concern was stated during the first meeting of the Council of Ministers organized in Phnom Penh on the 26th September 2008. The Prime Minister of Cambodia mainly stated 17 major challenges confronted by the government. Concerning these serious challenges, the quality of education at all levels is one of the main concern [2]. Teacher education is the highly academic nature of the teacher-training curriculum. A large amount of time is spent on academic upgrading as opposed to teaching methodology and in-school teaching practice. Noticeably, the current curriculum of the Regional Teacher Training Colleges does not particularly meet the emerging requirements [2].

Pertaining to these matters and in response to the Royal Government Rectangular Strategy Phase II, Educational Strategic Plan (ESP) 2009-2013 was introduced to make improvements in the educational sector [7] and "to establish and develop human resources of the very highest quality and ethics in order to develop a knowledge-based society within Cambodia" [7]. Teacher professional development is one of the areas in the educational project which is needed to improve the teaching skills and competency of teacher trainees [7].

Also, the current reform of the Ministry of Education, Youth, and Sport has extensively focused on the reform of personnel including qualification of teachers and their salaries, public financial reform at the ministry, the issue of education quality, a think tank to assist the ministry in policy recommendation and feedback, higher education reform, examination reform, giving young people skills, and reform of physical education and sport [8].

Likewise, Rectangular Strategy Phase III, Educational Reform 2014-2018 is to improve many crucial areas, especially the quality of education and capacity of educational human resources [9]. In 2003, Accreditation Committee of Cambodia (ACC) was established to assure the quality of education; however, the management of higher education remains difficult and needs to be clarified and strengthened across several fundamental domains, particularly by fortifying the educational human resources capacity.

Moreover, the appraisal of education system in Cambodia indicated that the status of education has significantly fortified over the past two decades, extending and promoting equal rights and access to education regardless of their demographic status, but the incumbent education system has unmet the employment and social mobility due to lack of participatory learning and particularly critical thinking [2].

Concerning these matters, higher education institutions should provide opportunities and encourage trainee students to develop professional skills, teach them to have complete personality and characteristics, promote scientific, technical, cultural, and social researches. The institutions should also train trainee students to be competent human resources by nurturing them to have high capacity, knowledge, skills, morality, inventive, and creative ideas, enterprise spirits, and in particular critical thinking skill.

The lack of development of critical thinking skills can seriously impact students' ability to express their opinions, evaluate arguments, provide reasons, or even draw conclusions. Notably, this poor enhancement of critical thinking has permitted the perpetuation of a dictatorship and the traditional patron/client social order [2].

Also, Vong and Kaewurai [10] conducted the research "Exploration of Critical Thinking of Trainee Students at Regional Teacher Training Center in Takeo Province, Cambodia" with 101 trainee students using Watson-Glazer Critical Thinking Appraisal (WGCTA) and with an aim at examining critical thinking of trainee students. The results indicated that trainee students' critical thinking was generally at low level ($\overline{X}$ = 1.88). The result also indicated that the mean scores from the highest to the lowest are: the interpretation subscale ($\overline{X}$ = 2.56), deduction ($\overline{X}$ = 2.55), evaluation of argument ($\overline{X}$ = 2.31), recognition of assumption ($\overline{X}$ = 2.27), and inference ($\overline{X}$ = 1.01).

Critical thinking is seen as key to reform education and enhance students' abilities because it is considered as the important goal of education [11]. The goal of education for critical thinking is to develop students drawing on thorough thoughts, reasons, and good judgments in searching for clarity and authenticity [12]. Critical thinking is also considered as one of the compulsory skills needed to improve in the 21st century [13, 14], and considered as a skill that can be enhanced in human's life [15, [16]. In the daily life, critical thinking is utilized to create a sharp decision making, to form an opinion based on reason, to surmount individualistic discernment and predisposition, and to indicate persuading motives in sustaining conclusions of what should be done and accepted as true [17].

An in-depth survey conducted with over 400 American employers revealed that 77.8 percent of those regarded critical thinking as a very important skill for the success in the workplace, and the report also identified critical thinking deficiency in 69.6 percent of new entrants [18]. In favor of this matter, effective and efficient instructions should be considered to produce graduates who are able to think critically.

Regarding quality of academic education, graduated students were criticized for having poor critical thinking skills when hired to work, and in particular the capacity to persuade, to work out conflicts, to comply with the necessary stated standards, to be inflexibly dubious, or daily operations of job knowledge [19]. Also, students who have practiced classroom activities of only asking and answering questions tend to reflect poor critical thinking which is required to clearly identify and determine problems banking on valid sources, rationale, and contextualization [20]. In this essence, critical thinking needs to be intentionally and thoroughly instructed with precise explanation in every subject content area [21].

The most fundamental role of educators, especially those of adults, is to encourage and develop critical thinking not only because critical thinking is a central component of education, but also it is the only one function that many learners find most difficult to perform themselves [22]. Smith [23] discovered that educators have proposed a number of interesting ideas to improve students' critical thinking, but they have reported little experimental research on the effectiveness of instructional strategies. Also, McMillan [24] observed there is little evidence that critical thinking is shaped by the specific instructional variables.

Gadzella and Masten [25] found that the previous studies have not found overwhelming evidence that one best way for teaching critical thinking has been discovered. However, these studies identify numerous approaches intended to better promote critical thinking in the classrooms. A previous review of the literature by [26] cited seven studies to demonstrate that discussion classes are more effective than lecture classes in promoting retention and higher-level thinking. It was also found that student-centered classes rather than instructor-centered classes promoted higher-level cognitive outcomes [26].

Bloom, Madaus and Hastings [27] stated that education is a process of change, and that students must be changed in some way through the instruction they receive. Halpern [28] claimed that "better critical thinking can be improved with appropriate instruction", and good thinking is a skill that can be taught [29] and considered learnable [30]. Also, critical thinking can be taught through drills, exercises, or problem solving [31] and enhanced through teaching and facilitation [32].

According to a research study "Perceptions of the Use of Critical Thinking Teaching Methods" done by Kowalcyk, Hackworth and Case-Smith [33], the classroom activities that support critical thinking include team-based learning, collaborative projects, simulation modules, scenarios with alternative methods/solutions, concept mapping, problem-based learning modules, and reflective journaling and portfolio development, research reports/critical analysis papers.

In relation to what has been taught at school, Sternberg [34] notified that the way in which critical thinking is used insufficiently helps students solve the problems confronted in their daily lives. To ease this matter and improve students' abilities, the

instruction of critical thinking in lieu of identifying suppositions and motives, verifying similarities, discrepancies, and concerned data, utilizing suitable questions to dig out the cases, searching for reliability of sources, finding out solutions for problems, and providing acceptable conclusions should be clearly introduced to students [35].

Additionally, increasing critical thinking requires critical thinking abilities "focusing on questions, analyzing arguments, asking and answering questions of clarification, judging credibility of sources, observing and judging observational reports, deducing and judging deductions, inducing and judging inductions, making value judgments, defining terms and judging definitions, identifying assumptions, deciding on an action, and interacting with others" [19].

In a different sense, Bassham, et al. [17] expressed five impediments that can hinder critical thinking, namely: 1) egocentrism is self-interested thinking and self-serving bias considered as selfish and self-absorbed in viewing own interests, ideas, and values as superior to others; 2) sociocentrism is group-centered bias and conformism regarding rational thinking by focusing excessively on the group; 3) unwarranted assumptions concern believes to be true without any proof, reason, or conclusive evidence; 4) relativistic thinking is subjectivism and cultural relativism in viewing that the truth is a matter of opinion, and 5) wishful thinking is believing something not based on good evidence but wishing to be true."

Stupinsky, Renaud, Daniels, Haynes and Perry [36] conducted a research on "critical thinking dispositions and perceived academic control and achievement of pre-service teachers." The findings revealed that college students possessing high academic achievements had a strong commitment to think critically. In investigation of discernment of critical thinking, Alazzi [37], in his study, agreed with the recognition of critical thinking in junior high school environment and inferred that more exploration on how critical thinking taught, learned, and judged are required to explicate. Gehrett [38] McMahon [39] clarified that any student who are 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.

Critical thinking is also considered as higher-order thinking which is necessarily accounted for academic education [17], challenging students to interpret, analyze or manipulate information [40], and significantly dealing with providing, clarifying, and evaluating reasons and employing these reasoned practices to carefully and precisely find out solutions for the problems [41]. With an authentic critical thinking, students are able to interpret and analyze the facts, compare and organize the ideas, create and defend points of view, criticize, make a decision, or draw conclusions [29, 42]. However, the improvement and assessment of critical thinking in higher education remains a crucial point needed to identify and discuss [43].

According to Eby and Harrell [44], critical thinking is defined as a "complex of thinking skills and processes that are believed to lead to fair and useful judgment and designed to train people to think about a single hypothesis deductively to arrive at a rational conclusion." Starting with observations and completing with generalizations and predictions [45] and postulating ideas and settling on innovative solutions to issues, building up capacities to learn from others, drawing one's own viewpoints are vital to critical thinking [46]. Critical thinking is not limited to "a single discipline but multiple such as using multiple disciplines to investigate the topic, addressing complex problem, or examining interdisciplinary themes" [47].

Critical thinking generally calls for reflecting on routine problems that go through several areas needed to determine and judge [48], also reflective thinking relied on making a decision of what to implement or take into consideration [19], through collecting, discussing, selecting, and evaluating information aimed at making informed choices [49], and differentiating between thinking directed at receiving and simplifying the purpose [50].

In higher education, critical thinking can be presented through student's mastery of intellectual skills and abilities, but teaching and evaluation of critical thinking in the current college classrooms and curricula is insufficient [51]. According to the Association of American Association of Colleges for Teacher Education [52], higher education has been criticized for its lack of preparation of students for lifelong learning and working skills such as problem solving, critical thinking analysis, teamwork, and communication skills essential in today's life and workplace.

Moreover, college students make judgments on the basis of unexamined personal preferences, even after four years of higher education [53, 54].

A survey of 300 US employers reported that 33% of new employees lacked the skills needed for entry level positions, and 31% lacked the critical thinking skills necessary for employment [55]. 81% of employers surveyed requested more critical thinking instruction for their current and prospective workforce. This calls for a change in the way students are educated. Much of educational reform seen in the last few decades has emphasized critical thinking instruction. There is much evidence that critical thinking can be taught and learned [56, 57].

The design of instruction is to facilitate students' learning, either as an increase in knowledge, change in behavior, or as an improvement in performance [58], and it is vital for designers to fully understand the needs of the learners for whom programs are being designed [59], especially for those who are considered high risk [60]. Research also confirmed that critical thinking is an academic need of these students, yet critical thinking has not been consistently considered in the design of many instructional programs [61].

As cited in Bangkok Post issued on 6th October 2014, Atipong expressed that "Why are Thai students struggling so much in critical thinking?"Some specific behaviors have been established as obstacles to the development of critical thinking including absolute authority, pushing dogma, rejecting alternative viewpoints, interpretations, and explanations, well-structured problems, and spoon-feeding knowledge. However, critical thinking could begin to develop even in someone who is at as late as the university level [62].

The importance of critical thinking has been noted in the literature, yet surprisingly, few studies have explored which teaching methods are most effective in enhancing critical thinking, particularly in adult students [25]. This is due to the notion that the ideas of teaching students to improve their abilities as critical thinkers "represent a major change in the way the teaching and learning process is viewed" [48].

Glaser [63] explained that the ability to think critically involves three things: 1) an attitude of being disposed to consider in a thoughtful way the problems that come within the range of one's experiences, 2) knowledge of the methods of logical inquiry and reasoning, and 3) skills in applying those methods. However, the majority of teaching and learning instructions were based on memorization of facts from lecturers rather than active participation [64], and also lecturing is less effective for long term knowledge retention, transfer of knowledge to new situations, higher order thinking, attitude, and motivation for further learning [65]. This could be assumed that if teachers use appropriate instructional methods and curriculum materials, students will improve their critical thinking skills [24].

Critical thinking is also 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 investigation [66]. Cognitive approach emphasizes the importance of mental processes in learning which occurs through the surrounded environment with an active role of learners' perceptions, thoughts, beliefs, attitudes, and values in constructions, acquisitions, retrieval, or forgetting [67]. Also, cognitive processing expresses the way that students learn or concerns the development of their thinking abilities such as analysis, inference, induction, and evaluation identified as key elements of critical thinking [68].

Cognitive-based approach covers some certain theories including constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory in which their key principles lay the basic root in fostering learners to use critical thinking in order to construct new knowledge themselves. Constructivist learning theory is extensively related to student constructing new knowledge based on their past experiences [69, 70], cognitive development theory focuses on learning constructed through stages of development [71, 72], social-cognitive theory is that learning occurs through social interaction [73, 74], cognitive information-processing theory concerns student learning through analyzing the information [75, 76], and adult learning theory is that learning is related to individual needs and freedom [77].

It is clear that critical thinking is really important for classroom, workplace, and especially for daily life [78, 79, 80], but teaching and evaluation of critical thinking in the current college and curricula are insufficient [51]. Due to this necessity, this study will investigate how cognitive-based approach consisting of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory can be used to develop an instructional model in order to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center (RTTC) in Takeo province, Cambodia.

Research Questions

The research questions are formulated as follows:

1. What is the best instructional model that can be developed using cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students?

2. How effectively is this instructional model used to enhance critical thinking and critical thinking teaching ability of trainee students?

3. What is the outcome of an instructional model developed by using cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students?

Objectives of the Research

The purposes of this research are as follows:

1. To develop an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center

2. To implement an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center

3. To evaluate an instructional model based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center

Research Hypothesis

1. Trainee students' critical thinking is enhanced after the implementation of the developed instructional model based on cognitive-based approach.

2. Trainee students' critical thinking teaching ability is enhanced after the implementation of the developed instructional model based on cognitive-based approach.

Scope of the Research

1. Population of the research

The Regional Teacher Training Centre (RTTC) in Takeo province was founded in 1981 and has annually trained more than 300 secondary school teachers, year I and year II [3]. These trainee students were trained through their selected majors and sub-majors (Currently with only 7 majors and sub-majors). However, the population of this research study is only year I trainee students, majoring in English and Khmer. There are 30 trainee students who were divided into two classes (Classes with 15 trainee students for A1 and other 15 for B1). Concerning the implementation of this research, only15 (B1) trainee students were selected to be the sample and trained with the developed instructional model to enhance trainee students' critical thinking and critical thinking teaching ability.

2. The research content

The crucial content of this research study includes cognitive-based approach, critical thinking theory, and strategy to teach critical thinking. The cognitive-based approach emphasizes the importance of mental processes in learning which occurs through the surrounded environment with an active role of learners' perceptions, thoughts, beliefs, attitudes, and values in constructions, acquisitions, retrieval, or forgetting [67]. The cognitive-based approach which consists of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory was comprehensively utilized to develop an instructional model to improve trainee students' critical thinking and critical thinking teaching ability at RTTC in Takeo province, Cambodia. Critical thinking theory and strategy to teach critical thinking were extensively investigated to develop critical thinking learning and teaching instruction.

Variables of the Research

There are two variables in this research study including:

1. Independent variable: Learning with an instructional model based on cognitive-based approach

2. Dependent variable: Critical thinking and critical thinking teaching ability

Operational Definition

1. Cognitive-based approach: Focuses on the importance of mental processes in learning which occurs through the surrounded environment with an active role of learners' perceptions, thoughts, beliefs, attitudes, and values in constructions, acquisitions, retrieval, or forgetting [67]. In this research study, cognitive-based approach consists of constructivist learning theory, cognitive development theory, social-cognitive theory, information processing theory, and adult learning theory as basically used to develop an instructional model to enhance critical thinking and critical thinking teaching ability of trainee students at RTTC in Takeo province, Cambodia.

2. Instructional model based on cognitive-based approach: Refers to an approach about what should be taught that combines thought, action, and purpose, and it is developed using findings from cognitive-based approach which consists of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory in order to enhance critical thinking and critical thinking teaching ability of trainee students. In this research, the instructional model was developed based on Joyce and Weil's model [81] by including 1) theoretical basis, 2) learning model, 3) application, and 4) instructional and nurturant effects.

2.1 Constructivist Learning Theory: Learning is related to using the complex and interactive experiences, enhancing meaningful challenges, solving realistic problems, strengthening collaboration, and discovering for constructing new ideas [70].

2.2 Cognitive development theory: Learning concerns the ability to think, identify the problem, reason, understand, analyze the fact, make a decision, and draw conclusions [71, 72].

2.3 Social-cognitive theory: Learning occurs through social interactions such as observation and self-instruction in order to acquire new knowledge [74].

2.4 Cognitive information processing Theory: Learning is related to learners' experience, uses various techniques and activities, and requires practice [76].

2.5 Adult learning theory: Learning is related to self-motivated, relevancy-oriented, self-freedom, self-respected, and being practical [77].

3. Critical thinking: Refers to the ability to analyze the information, apply strategies for deciding, be ready to consider ideas, use logical inquiry, make inferences, appraise evidence, test conclusions, make accurate judgments, and analyze assumptions [82]. The result of this critical thinking can be evaluated using five crucial components of critical thinking appraisal including 1) inferences, 2) recognition of assumptions, 3) deduction, 4) interpretation, and 5) evaluation of arguments [83].

3.1 Inferences. Discriminating among degrees of truth or falsity of inferences drawn from given data

3.2 Recognition of assumptions. Recognizing unstated assumptions or presuppositions in given statements or assertions

3.3 Deduction. Determining whether certain conclusions necessarily follow from information in given statements or premises

3.4 Interpretation. Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted

3.5 Evaluation of arguments. Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular issue.

4. Critical thinking teaching ability: Refers to the ability to teach critical thinking using active or student-centered learning with a variety of activities including drills, exercises, examples, and explicit instructions such as problem-solving, collaborative project, concept mapping, simulation modules, or team-based learning, and it can be evaluated with results of critical thinking teaching practice.

5. Trainee student: Refers any student who has successfully passed their diplomat (grade 12 exam) and entrance exams by majors in order to be trained for 2-full year training course at RTTC in Takeo province, Cambodia. The students who are admitted to take this entrance exam are only from four provinces and municipalities including Takeo and Kampot provinces and Kep municipality and Sihanouk Ville [3]. After being completely and successfully trained, they will officially become the public secondary school teachers and deployed to teach secondary school students at their own hometowns. In this research, trainee students refers to only year II trainee students whose majors are English and Khmer and who are trained at RTTC in Takeo province, Cambodia.

Significance of the Research

Critical thinking is considered as a vital part to improve a life of adulthood [84] and enhancing students' abilities for critical thinking is also recognized as the compulsory goal of education. The goal of education for critical thinking is to develop students to use thorough thoughts, reasons, and good judgments in drawing clear and authentic conclusions [12]. Angelo and Cross [85] stated that analysis, synthesis, interpretation, problem recognition, problem solving, explanation, inference and evaluation are the significant elements of critical thinking.

Most of the researches related to adult critical thinking have highlighted on the college students [86]. This study which focuses on improving critical thinking of trainee students is potential for three reasons 1) the literature signifies the demands to enhance capacity of trainee teachers [2], to strengthen the quality of educational human resources [7], and to be illuminated as compulsory skills needed to improve in the 21st century [13, 14], 2) many educators would probably agree that the current of schools does not encourage a clear focus on enhancing students' critical thinking, but to prepare students to take standardized tests. Also, many institutions, particularly in higher education, have conducted courses designed to teach critical thinking; however, most instructions cannot support such a course, so the alternative is to find applicable approaches that can be embedded in the current course curriculum to improve students' critical thinking. This study seeks to develop an instruction based on cognitive-based approach composed of constructivist, cognitive development, social-

cognitive development, cognitive information processing, and adult learning theories in order to enhance trainee student critical thinking and critical thinking teaching ability. Cognitive-based approach emphasizes the importance of mental processes in acquiring knowledge from the surroundings [67] and accelerating critical thinking [87], and 3) no research has recently been conducted on the improvement of critical thinking teaching ability of trainee students.

Expected Benefits of Research

The expected benefits of this research were divided into two parts, namely:

1. Application Policy

1.1 A new instructional model to enhance critical thinking and critical thinking teaching ability is developed.

1.2 The key elements to enhance critical thinking and critical thinking teaching ability are revealed.

1.3 The needs to improve the educational human resources are met.

1.4 A useful guideline is indicated for all teacher training institutes.

2. Research Policy

An indicator for critical thinking and critical thinking teaching ability is formulated for future research.

CHAPTER II

LITERATURE REVIEW

The main purpose this literature review was to explore the findings from three compulsory theories: cognitive-based approach, critical thinking theory, and teaching critical thinking theory. The cognitive-based approach consisted of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory. The findings were used to develop an instructional model to enhance critical thinking and critical thinking teaching ability of trainee students. This literature review also investigated the design of an instructional model and the researches related to the enhancement of critical thinking of trainee students and adult learners at teacher training institutes and higher education.

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Teacher Training Program

1. Teacher Training Process and Admission

After ending 3 decades of the internal conflict and instability and Khmer Rouge, genocidal regime in 1979, teacher training institutes are reestablished at the provincial, regional, and national levels, and focused on quantity rather than quality due to high demands of human resources extended to the remote areas [2]. There are 26 teacher training centers around the country. At provincial level, it concerns training primary school teachers and pre-school teacher, and lower secondary school teacher for regional level and upper secondary school teachers for national level [6].

Primary school teachers are provided their training through 18 Provincial Teacher Training Colleges (PTTCs), and pre-school teacher is provided through one pre-school teacher training center (PSTTC) [6]. Concerning the admission to be trained

in a primary school teacher education program, the applicants need to have completed general education program for 12 grades and passed a placement exam. Initially, primary school teacher trainees required only seven years of basic education to enter PTTCs and complete one year of pre-service training (7+1). Then training system for primary school teachers have gradually changed from 7+1 to 8+1 and then to 11+2 in 1994 before reaching at 12+2 in 1998 which is the current standards. After graduating, they become pedagogically trained teachers and teaching staff [88].

Regarding lower secondary school teachers, training is offered by six Regional Teacher Training Colleges (RTTCs). To attend a lower secondary teacher training program, the completion of grade 12 is required as well as the examination in three subjects, two from the specialization to teach and another one in general culture [88]. As a part of pre-service training of lower secondary school teachers, 14 weeks of practical training-six weeks in the first year and eight weeks in the second year are included in the program [2].

For upper secondary school teachers, the requirement is to have completed the four years of university level (any bachelor degree) before taking an admission examination and entering the National Institute of Education (NIE) for an additional year of training [88].

All teacher trainees need to have completed a required practicum and passed a final exam in order to graduate.

The quality of teaching is a key factor in keeping and enhancing human resources at schools. A number of trained lower secondary school staff increased gradually and constantly after the reconstruction of education system in 1979. However, the quality of pre-service training is low and the opportunity for professional development is limited. These are considered as sensitive barriers of acquiring mastery of curricular content knowledge or putting pedagogically pertinent teaching practices into practice [88].

With regards to formal training, teacher average levels of formal education are low. Secondary teachers had more educational training than primary school teachers. According to survey in 2004 by Education Management Information System (EMIS), a majority of primary school teachers-69% obtained a lower second degree (grade 9), 7% completed primary school, and 24% finalized upper secondary

education. In contrast, 44% of secondary school teachers completed upper secondary education, 38% held lower secondary education, and 0.1 % only completed primary school [88].

There were about 25,000 secondary school teachers in Cambodia, and it has increased over time. The teaching profession has traditionally been male-oriented, but this is increasingly changing over time. A majority of Cambodian teachers are young. 85% of them were under age 40 in urban, rural, and remote primary schools respectively. Interestingly, age distribution across genders differs little for teachers under age 40 [88].

Related to this matter, MoEYS also recognizes that the education sector could not reach the policy target for the ESP 2006-2010 that increased efforts have to be made in improving teacher quality. The teacher development master plan 2010-2014 sees the following challenges in teacher devolvement [89]:

Teacher qualifications are still low, insufficient in-service training is noticed and lack of opportunities for further training. However, MoEYS has recently offered the opportunity for teachers to upgrade their existing capacities.

Adequate replacement of teachers, especially in remote areas

Limited effectiveness of resources due to less coordination among teacher training programs

2. Pedagogical Implementation

Teaching methods which are critically considered developing critical and creative thinking abilities are less understood and performed in the classrooms [2]. The lack of development of critical thinking skills can seriously impact students' ability to express their opinions, evaluate arguments, provide reasons, or even draw conclusions. Notably, this poor enhancement of critical thinking has permitted the perpetuation of a dictatorship and the traditional patron/client social order [2].

Traditionally, the education in Cambodia emphasized on French system which geared towards class of civil servants and failed to provide skills that lead to the real world requirements. Relatively, the curriculum is also absent to consider of environmental science which then causes much disaster in the country [2].

Concerning teachers' professional training, teaching skills are developed not only through formal training but also on-the-job-training and professional practice. The consequence revealed that teachers with critically pedagogical content knowledge skills or higher education degrees help students reach high performance and achievement [88].

3. Quality of Training

A shortage of qualified teachers in Cambodia is the main cause permitted poor quality of education. Teaching corps and trainers are partially recovered after Khmer Rouge Regime. Many instructors have attained levels of education no higher than students that they are instructing. Low capacity and quality of instruction undermines the irrelevant education system [2].

The quality of teachers is considered as one of the most crucial contributing factors to upholding individual learner's achievement. Both teachers and teaching practices act an active role in the educational improvement and development. The concern related to teacher education is the highly academic nature of the teacher-training curriculum. A large amount of time is spent on academic upgrading as opposed to teaching methodology and in-school teaching practice. Noticeably, the current curriculum of the Regional Teacher Training Colleges does not particularly meet the emerging requirements [2].

Teacher levels of education are low. 2/3 of secondary school teachers have completed grade 12 while 18 percent had some post-secondary education. Practically all lower secondary school teachers have graduated from teacher training colleges. However, in-service training has remained largely insufficient and professional development opportunities have been relatively scant [88].

Teacher training is low in large part due to the fact that Khmer Rouge destroyed the schooling system and those who had good education. When the schooling system was rebuilt starting after 1979, schools could be operated based on volunteers who assumed the new roles and functions of teachers and educational administrators. Those volunteer teachers, most with a few years of primary education completed, received between two, four, or six weeks of training to support them in their new roles and functions [88].

Teaching remains a highly attractive profession in Cambodia, and there is a great demand for admission into provincial and regional teacher training colleges. Teacher preparedness and performance in addition to poor professional standing of teachers in terms of capacity development opportunities, autonomy, responsibility, and managerial or system support pose significant obstacles to the quality of education. Regarding this matter, urgent need in extensive teacher reform, particularly teaching service condition is required [88].

Regional Teacher Training Center (RTTC) in Takeo province, Cambodia

Following the rearrangement of schools in 1979, the Government of Cambodia has confronted the necessity of recruiting thousands of teachers from a population whose educated members had been targeted by the previous regime. Many pre-1975 teachers had either been killed, emigrated or were seeking shelters in refugee camps. As a result, the government relied on an appointment system whereby any literate person could be recruited as a teacher at the discretion of local authorities. Appointed teachers, equivalency appointed teachers, and contracted teachers were respectively re-introduced by the government with the criteria of passing or not passing the national grade 12 examination [2].

During 1980s, the government reestablished teaching training facilities in many locations, at provincial level, 18 Provincial Teacher Training Colleges (PTTCs) for training primary school teachers, at municipal level, National Institute of Education for upper secondary school teachers at regional level, and 6 Regional Teacher Training Centers (RTTCs) for training lower secondary school teachers with one center serving two to four different provinces. Regionally, Teacher Training Centers were important in that most student teachers from rural areas did not have to travel too far outside their home provinces to be trained [2].

1. Basic Information about Regional Teacher Training Center

Regional Teacher Training Center (RTTC) in Takeo province which is one of six training centers is situated in the southern part of the country about 100 kilometers from Phnom Penh city. RTTC located in III village, Rokaknong commune, Daunkeo district, Takeo province, Cambodia was found in 1981. The campus covers on 02 hectares of land mass with 03 dormitory buildings, 03 classroom buildings, 01

warehouse, 01 laboratory building, 01 meeting hall, 01 administrative building, 01 kitchen building, and 01 deteriorated building [3].

Currently, there are 55 staff working at RTTC in Takeo province including 03 directors and deputy directors, 01 head of administration, 05 deputy heads of administration, 27 trainers, 16 administrative staff, and 03 cleaners [3].

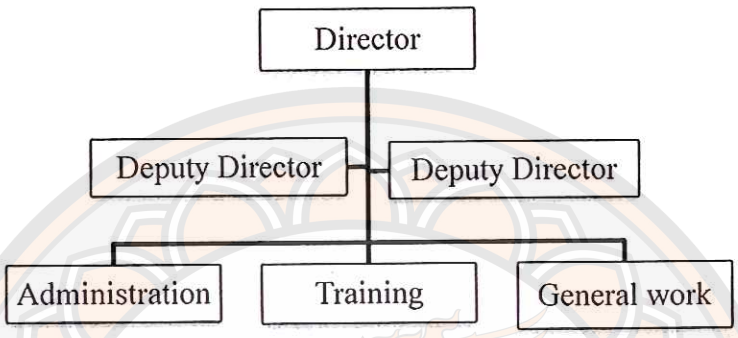


Figure 1 Takeo Regional Teacher Training Organizational Chart

Source: RTTC report [3]

2. Training and Curriculum Management at RTTC

Traditionally, the Regional Teacher Training Center in Takeo province has annually trained about 300 trainee students including year I and II. Trainee students come from 04 provinces and municipalities including Takeo and Kampot provinces and Kep municipality and Sihanouk Ville, and they are annually selected to be trained at this regional training center [3].

The application is admitted in October every year, and about 2000 applicants have applied to study at this training center. The admission requirements are including passing national grade 12 examination and then winning examination in 3 subjects (01 major, 01 sub-major, and another general culture). After succeeding the examination, those students are required to attend training course by their majors for 2 years. The class lasts for 6 days a week starting from Monday to Saturday and 07 or 08 hours a day (See table 1 below).

Table 1 Timetable for Trainee Students at RTTC

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7.00 – 8.00	✓	✓	✓	✓	✓	✓
8.00 – 9.00	✓	✓	✓	✓	✓	✓
9.00 – 10.00	✓	✓	✓	✓	✓	✓
10.00 – 11.00	✓	✓	✓	✓	✓	✓
Lunch Break						
1.00 – 2.00	✓	✓	✓	✓	✓	X
2.00 – 3.00	✓	✓	✓	✓	✓	X
3.00 – 4.00	✓	✓	✓	✓	✓	X
4.00 – 5.00	✓	✓	✓	✓	✓	X

Source: Timetable adopted and presently used by RTTC [3]

Traditionally, there are more than 300 hundred trainees (year I and II) have annually been trained at RTTC in Takeo province. In 2014, there are 311 trainees, 139 in year I and 171 in year II who are grouped and trained by their majors. Every major is consisted of 15-25 trainee students in each class, and a number of male trainee students are greater than females [3].

All trainee students are required to stay in three isolated dormitories (two for males and another for females) offered by RTTC for the completion of their training course without any payment. The dormitories are suited inside RTTC campus about 150 meters from students' classrooms. Additionally, each of trainee students is also provided with some financial support in every month. As a rule and regulation of RTTC, trainee students are strictly required to wear uniforms, white blouses or shirts, black or blue pants or skirts, and black boots or low heel shoes during learning hours [3].

Table 2 Major and Sub-Major Skills at RTTC

No.	Trainees	Major	Sub-Major	No. Trainees	
				Year I	Year II
1	Trainees of English	English	Khmer Lit.	30	42
2	Trainee of Khmer	Khmer	Morality	16	22
3	Trainee of Home Eco-	Home-Econ-	Khmer	16	20
4	Trainee of History	History	Geography	17	22
5	Trainee of Maths	Maths	Physics	18	25
6	Trainee of Physics	Physics	Chemistry	17	20
7	Trainee of Biology	Biology	Geography	18	21
	Total			132	171

Source: RTTC report [3]

Regarding training, all trainee students will take 01 year and a half in class training and 03 months for practicum at different secondary schools in the province by the end of year II (RTTC report, 2014). The curriculum for training is assigned by the Ministry of Education, Youth, and Sport and then implemented by the Regional Teacher Training Center [2].

In class training, all trainees have been extensively trained with their majors, sub-majors, and some other compulsory skills mixed with methodology of teaching. Student-centered approach which focuses on teachers working less than students has been employed and introduced to all trainees [3]. However, training still appears in a form of teacher-centered approach (Teachers talk more but students talk less) which was broadly used in the past years.

Relatively, insufficient and obsolete training materials, achieving results rather strengthening capacity and focusing on individual trainees' needs, lack of participation in curriculum development [89], and quantity rather quality have been meticulously noticed. These issues are considered as obstacles to proliferating quality of education and trainee students' critical thinking.

In complex and multifaceted nature of concepts, quality of education refers to efficiency, effectiveness, equity and quality. Relatively, qualification of education also includes [90]:

1. Learners who are healthy, well-nourished and ready to participate and learn, and supported in learning by their family and communities

2. Environments that are healthy, safe, protective and gender-sensitive, and provide adequate resources and facilities

3. Content that is reflected in relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life, and knowledge in such areas as gender, health, nutrition, HIV/AIDS prevention and peace

4. Processes through which trained teachers use child-centered teaching approached in well-managed classrooms and schools and skillful assessment to facilitate learning and reduce disparities

5. Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society

3. Incumbent Situation of Training and Learning at RTTC

The policy related to strengthening teaching and learning quality is formally conducted by MoEYS and implemented by the Teacher Training Department. This policy concerns the following measures [6]:

1. Designing teacher training curriculum for pre- and in-service training

2. Developing a teacher training plan for pre-service training for all levels (pre-school, primary and lower secondary schools)

3. Training primary and secondary inspectors

4. Managing the technical aspects of the provincial and regional training colleges

5. Monitoring and evaluating the professional competencies and capacities of trainers and all education staff

Recently, curriculum for primary teacher training, teaching practice handbooks for student teachers, and training of teacher trainers, directors, school teachers on multi-grade teaching, child-friendly school program, and school readiness program have been revised, developed and conducted by pre-service training office.

Relatively, pre-service training curriculum deals with managing student teachers entering a two-year primary teacher training program incorporating four subjects: mathematics, science, Khmer literature, moral and civic education, lower secondary teacher training program requires a two-year study of two specialized subjects, and training to upper secondary school level at the National Institute of Education requires one year of training in education theories and practices [6].

According to the research conducted by the Teacher Training Department in 2008 to assess teachers' professional learning, practice, knowledge and ethnics using self-assessment questionnaire, the results recommended that "……require the active construction of meaning rather than passive regurgitation of isolated facts. These assessments engage teachers in learning and require thinking skills and thus they are consistent with cognitive theories of learning and motivation as well as societal needs to prepare students for an increasing complex workplace" [6].

Relatively, Vong and Kaewurai [10] conducted the research "Exploration of Critical Thinking: A Study of Critical of Trainee Students at Regional Teacher Training College in Takeo Province, Cambodia" with 101 trainee students using Watson-Glazer Critical Thinking Appraisal (WGCTA) and with an aim at examining critical thinking of trainee students. The results indicated that trainee students' critical thinking was generally at low level ($\overline{X}$ = 1.88). The highest mean score was the interpretation subscale ($\overline{X}$ = 2.56), respectively followed by deduction ($\overline{X}$ = 2.55), evaluation of argument ($\overline{X}$ = 2.31), recognition of assumption ($\overline{X}$ = 2.27), and the lowest on inference ($\overline{X}$ = 1.01).

There are a number of reasons led to low critical thinking of trainee students including lack of opportunity for further training, limited effectiveness of resources due to less coordination among teacher training programs, teaching methods which are critically considered developing critical and creative thinking abilities are less understood and performed in the classrooms, the current curriculum which does not particularly meet the emerging requirements, insufficient and obsolete training materials, achieving results rather strengthening capacity, less focusing on individual trainees' needs, and lack of participation in curriculum development [10].

4. Pre-Service Training Program for Lower Secondary School Teacher of English

Methodology syllabus which was used for lower secondary school teacher of English was organized the Ministry of Education and Sport. The syllabus was consisted of 25 units for training trainee students to be professional lower secondary school teacher for the entire training course. These units include:

Unit	Title	Unit	Title
1	An introduction to the methodology course	14	Introduction to Language Learning Skills
2	Observation and Giving Feedback	15	Listening Session 1: Introduction to Teaching Listening Session 2: Teaching Listening Using "English for Cambodia" Session 3: Peer Teaching
3	Learner-Centered Teaching	16	Speaking Session 1: Teaching Speaking (Includes Peer Teaching) Session 2: Correcting Spoken Mistakes (Part 1) Session 3: Correcting Spoken Mistakes (Part 2) Session 4: Correcting Spoken Mistakes (Peer teaching) Session 5: Teaching pronunciation Session 6: Pronunciation activities and Peer Teaching
4	Asking Question	17	Reading Session 1: Introduction to Teaching Reading Session 2: Reading Skills (Part 1) (Includes peer teaching) Session 3: Reading Skills (Part 2) (Includes peer teaching) Session 4: Peer Teaching

Unit	Title	Unit	Title
5	Giving Instructions 1. Session 1: Giving Clear Instruction 2. Session 2: Peer Teaching	18	Writing Session 1: Reading Awareness about Writing Session 2: Teaching Handwriting-Basic Principles and Individual letter (Include peer teaching) Session 3: Teaching Handwriting-writing words (Includes peer teaching) Session 4: How to teach alphabet (Includes peer teaching) Session 5: Writing activities in "English for Cambodia" Session 6: Meaningful writing and Parallel Writing Session 7: Correcting written work Session 8: Using dictation (Includes peer teaching) Session 9: Cohesion and Coherence (Includes peer teaching)
6	Different Ways of Working Session1: Organizing a Class Session 2: Pair work (Includes peer teaching) Session 3: Group work (Includes peer teaching)	19	Lesson Planning Session 1: Learning about lesson planning Session 2: Analyzing lessons and lesson plans Session 3: Preparing lesion plans (include peer teaching)
7	Monitoring Session 1: Introduction to Monitoring Peer Teaching	20	Testing Session 1: Introduction to testing Session 2: Different Testing Activities Session 3: Writing Test Items Session 4: Giving and Marking Tests

Unit	Title	Unit	Title
8	Teaching New Language (Structures) Session 1: What Do You Present? Session 2: How to Present New Language Session 3: The Principles of Presenting New Language Session 4: Concept Checking Session 5: Peer Teaching	21	Warmers, Fillers, and Closers
9	Practicing new Language (Structures) Session 1: Drills Session 2: Peer Teaching Session 3: Controlled and Less Controlled Practice Activities Session 4: Less Controlled Practice Activities (Includes peer teaching) Session 5: Other Less Controlled Practice Activities (Include Peer Teaching)	22	Creating an Effective Learning Environment Session 1: Creating something out of nothing Session 2: Using gestures and giving praise Session 3: Gender Awareness
10	Teaching New Language (Vocabulary) Session 1: The Importance of Teaching Vocabulary Session 2: Ways of Teaching Vocabulary Session 3: Peer Teaching	23	Preparation for Teaching Practice
11	Practicing new Language (Vocabulary)	24	Self-Reflection
12	Teaching New Language (Functions/Competencies)	25	Ongoing Professional Development

Unit	Title	Unit	Title
13	Practicing New Language (Functions/Competences)		

Source: Methodology Syllabus for Training Lower Secondary School Teacher [6]

Instructional Model Development

1. Definition of Instructional Model

The term "instruction" refers to teaching approaches that are used to help learners to achieve the overall progresses that are outlined in the curriculum [91]. Good instruction demands that every teaching event involves students as active participants in their own learning, which also allows the teacher to plan subsequent lessons based on student's understanding and misunderstanding [92].

Also, instruction is the delivery of information and activities that facilitate learners' attainment of intended, specific learning goals or the conduct of activities that are focused on learners learning specific things. Instruction includes all teaching and other learning experiences in which instructional is conveyed by other forms of media [93].

The core of teaching process is the arrangement of environment within which students can interact and study how to learn [72]. A model of teaching (instructional model) is a description of a learning environment, including our behavior as teachers when that model is used, ranging from planning lessons and curriculums to designing instructional materials, and multiple media program [72]. The model provides learning tool for students, and it is uniquely suited to the development of programs for students whose learning histories are cause for concern.

Relatively, models of teaching are models of learning [81]. As teachers help students to acquire information, ideas, skills, values, ways of thinking, and means of expressing themselves, teachers also teach them how to learn. The most important long-term outcome of instruction may be the students' increased capabilities to learn more easily and effectively in the future, both because of the knowledge and skills they have acquired and because they have mastered learning processes. Students will

change as their repertoire of learning strategies increases, and they will be able to accomplish more and more types of learning more effectively.

The models of teaching emphasize the need for variety in the classroom by developing teacher's repertoire of instructional approaches to meet a range of objectives [81]. If a teacher create a single environment in the classroom or repeatedly uses the same instructional approach, only those students who learn well in that environment or with that approach will succeed. The teacher who utilizes a variety of instructional approaches is more likely to reach all students in the classroom; moreover, students are encouraged to learn in a variety of ways.

The models of teaching not only had a strong rationale but also had lines of research into their workings, using research to guide practice and into what one could expect if they were used. Also, the models of teaching had strong supporting theories or concepts of learning such as constructivism, metacognition, scaffolding, zone of proximal development etc. that help to recognize the ideas crossing them, better understand how they work, and particularly to make students become powerful learners [94].

Experts in evaluation speak of the relationship among three variables in instruction including input, process, and outcome [95]. Input refers to all the equipment and tools for instruction, the many instructional materials, textbooks, and technology that serve the teacher as tools of the trade. Process refers to the instructional approaches, techniques, and models of instruction that the teacher employs. Outcome refers to instructional objectives, that is, intended learning outcomes.

Instructional models, like patterns or blueprints or recipes, present step necessary for a desired outcome [95]. The selection of a particular model to use in an instructional design depends on the desired outcome or objective of the instruction. The methods selected for teaching a lesson should depend on what the students are expected to learn as a result of instruction. The effective instructional models are to [95]:

1. Allow students to become active participants in the learning process
2. Take students through specific sequential steps
3. Reflect research about thinking. Learning, and behavior

Based on the definition of models of teaching, it can be concluded that models of teaching are frameworks for instruction that use organized sets of strategies to support students' thinking and learning in the content areas, give them learning skills, increase their capabilities to learn more easily and effectively, and make them become more powerful learners in order to accomplish specific learning goals. The models composed of some particular components including theoretical basis, rationale, and also goals which are all interrelated with each other.

2. Types of Instructional Model

Teaching models are frameworks for instruction that use organized sets of strategies to accomplish specific learning goals. Teaching models can be effective tools in planning instruction for differentiation. Four families of models of teaching were discovered and their members shared orientation towards human being and how they learn. These four families include the information-processing family, the social family, the personal family, and the behavioral family [94].

Information-Processing Family

The information-processing models are useful for studying the self and society, and thus for achieving the personal and social goal of education. These models also emphasize ways of enhancing the human being's inmate drive to make sense of the world by acquiring and organizing the data, sensing problems and generating solutions to them, and developing concepts and language for conveying them [94].

There are eight types of information-processing models including inductive thinking model, concept attainment model, the picture-word, scientific inquiry, inquiry training, mnemonics, synectics, and advance organizers, and every one of them provides the learners with different information and concepts such as emphasizing concept information and hypothesis testing, generating creative thinking, or enhancing general intellectual ability [94].

Social Models

The social models of teaching generate a collective energy that is called synergy. The models are constructed to take advantage of this concept by building learning communities. Essentially, classroom management is a matter of developing cooperative relationships in the classroom. The process of developing integrative and

productive ways of interacting and norms supports vigorous learning activity. The models include partners in learning, positive independence, structured inquiry, group investigation, role playing, and jurisprudential inquiry [94].

The Personal Family Models

The personal family models of learning begin from the perspective of the selfhood of the individual. The models attempt to shape the education that is to understand themselves better, take responsibility for their education, and learn to reach beyond their current development to become stronger, more sensitive, and more creative in their search for high quality of lives. Also, the models pay great attention to the individual perspective and seek to encourage productive independence so that learners become increasingly self-aware and responsible for their own destinies. The personal family models include non-directive teaching and enhancing self-esteem [94].

The Behavioral Systems Family

The behavioral systems family models are related to self-correcting communication systems that modify behavior in response to information about how successfully tasks are navigated. The models concentrate on observable behavior and clearly defined tasks and methods for communicating progress to the students. Also, these models are appropriate for learners of all ages and for an impressive range of educational goals. The models include mastery learning, direct instruction, simulation, social learning, and programmed schedule [94].

3. Component of Instructional Model Design

Planning for student learning should be a challenging, exciting, and gratifying activity. To successfully achieve this matter, the appropriate instructional design is required. The goal of instructional design is to make learning more efficient and effective and less difficult. The instructional designer approaches the task by first defining the problem and then determining what knowledge and skills are needed to solve the instructional problem. The instructional design process focuses on what learner needs to know and avoids including nonessential content that is nice to know [96].

The instructional design has drawn from two kinds of theories including descriptive theory (describing phenomena as they are hypothesized to exist) and prescriptive theory (prescribing actions to take that will lead to certain results). These

two theories comprised of some particular theory bases such as general system theory, communication theory, theories of learning, and theories of instruction [93].

According Smith and Ragan [93], an instructional design goes through three stages including:

1. Analysis: Learning environment, learners, and learning tasks
2. Strategy: Determining organizational, delivery and management strategies
3. Evaluation: Conducting formative evaluation

Relatively, Morrison, et al. [96] found that the components of instructional model include learners, objectives, methods, and evaluation. These components are interrelated and could conceivably make up an entire instructional design plan.

1. Learners: Focusing on learner's reading level, general background knowledge, assumptions, or work experiences. The collected information will mainly depend on the problem and audience
2. Objectives: Specifying exactly what the learner must master
3. Methods: Involving designing creative and innovative ways of presenting the information that help the learner integrate the new information with ideas they already understand
4. Evaluation: Assessing the learner's mastery of the objectives

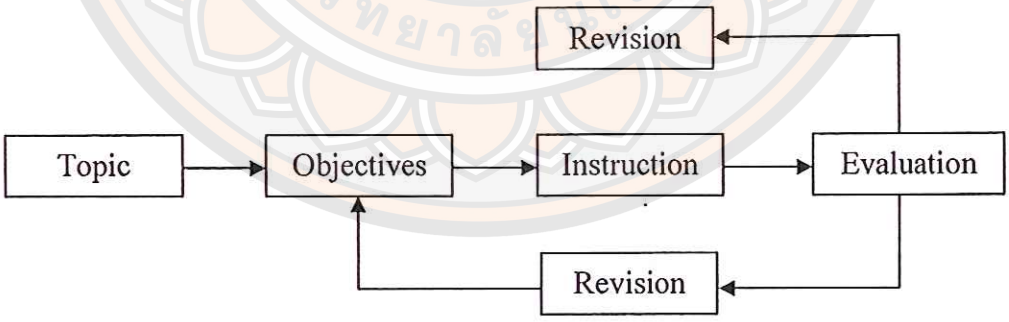


Figure 2 Instructional Design Model

Source: Morrison, et al. [96]

The instructional design is also defined as an iterative process of planning performance objectives, selecting instructional strategies, choosing media, and selecting or creating materials, and evaluation [97]. Regarding this explanation, The ADDIE approach found by Branch [97] was used to conduct an instructional design. ADDIE comprised of

1. Analyze: Identifying the probable causes for a performance gap
2. Design: Verifying desired performances and appropriate testing methods
3. Develop: Generating and validating the learning resources
4. Implement: Preparing the learning environment and engaging the students
5. Evaluate: Assessing the quality of instructional products and processes

ADDIE also adopts an input, process, and output (IPO) paradigm as a way to complete its phases. The input phase reacts to the variables identified in the learning context by accepting data, information, and knowledge. The process seeks ways to stimulate creative and divergent thinking utilizing procedures, to interpret, explain, configure, and display multiple approaches to events that are likely to occur in learning space. The output delivers the results of the process by explicitly presenting ways of knowing that are translated into ways of doing [97].

A careful instructional design takes into account the age and interests of the learners, the knowledge that they bring with them to instruction, and the conditions under which instruction will occur [95]. Dick and Carey [98] have organized their work around five steps or stages for an instructional design including 1) setting objectives, 2) pre-assessment, 3) planning the instruction, 4) trial, and 5) testing and evaluation.

Regarding the definition of the instructional design, it could be concluded that the instructional design focuses on the individual and how to improve individual performance rather than on what content to cover. Also, the instructional design is consisted of some particular elements including learners, objectives, methods, and evaluation.

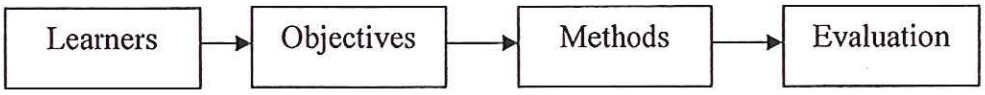


Figure 3 The Fundamental Components of Instructional Design

4. Instructional Design Model

Educational continuously builds idea and emotions. The flux of human consciousness gives the process of education its distinctive character and makes teaching and learning such a wondrous, ever-changing process, as thoughts and feelings are built and rebuilt [94]. To teach well is to embrace the adventure of limitless learning about how ideas and emotions interact with environments and become transformed [94].

At the same time, there are a variety of models of teaching used to support this learning environment. However, models of teaching found by Joyce and Weil [81] were considered the most useful and extensively used for the field of education, and particularly building communities of learners. Models of teaching are the product of teachers who create a repertoire of practices as they interact with their students and shape environments intended to educate them. Models of teaching underpin some particular components including [94]:

1. All have coherent theoretical basis: The provision of rationale that explains why it is expected to achieve the goal for which it is designed
2. All the selected models have long histories of practice behind them
3. The models can be adjusted to the learning styles of students and to the requirements of many curriculum areas
4. All the model are backed by some amount of formal research that tests their theories and their ability to gain effects

How teaching is conducted has a large impact on students' abilities to educate themselves. Rather, teachers engaged their students in robust cognitive and social tasks and teach students how to use them productively. Also, successful teachers teach students how to mine the information in the talk and make it their own. Effective learners draw information, ideas, and wisdom from their teachers and use learning resources effectively [94].

The key of effectiveness of models of teaching is to teacher students to become more powerful learners [94]. Relatively, Joyce and Weil [81] introduce models of teaching which are internationally recognized and implemented. The main components of the models of teaching are including:

1. Models of Teaching

Syntax: The model begins by confronting the students with a stimulating problem. The confrontation may be presented verbally, or it may be an actual experience; it may arise naturally, or it may be provided by a teacher. If the students react, the teacher draws their attention to the differences in their reactions-what stances they take, what they perceive, how they organize things, and what they feel. The model follows six steps as follows [81]:

1. Phase I: Students encounter puzzling situation (planned or unplanned)
2. Phase II: Students explore reactions to the situation
3. Phrase III: Students formulate study task and organize for study
4. Phase IV: Independent and group study
5. Phase V: Students analyze progress and process
6. Phase VI: Recycle activity

Social System: The social system is democratic, governed by decisions developed from, or validated by, the experience of the group-within boundaries and in relation to puzzling phenomena identified by the teacher as objects to study. The activities of the group emerge with a minimal amount of external structure provided by the teacher. Students and teacher have equal status except for role differences. The atmosphere is one of reason and negotiation [81].

Principle of Reaction: Teacher plays a facilitated role directed at group process (helps learners to formulate plan, act, or manage group) and requirement of inquiry (consciousness of method). Teacher's role in group investigation is one of counselor, consultant, and friendly critic. Teacher must guide and reflect group experience over three levels including the problem-solving or task level, the group management level, and the level of individual meaning. The students react to the puzzling situation and examine the nature of their common and different reactions [81].

This teaching role is difficult and sensitive because the essence of inquiry is student activity-problems cannot be imposed. At the same time the instructor must 1) facilitate the group process, 2) intervene in the group to channel its energy into potentially educative activities, and 3) supervise these educative activities so that personal meaning comes from the experience [99]. Because groups vary considerably in their need for structure [100], and their cohesiveness [99], the teacher cannot behave mechanically but must read the students' social and academic behavior and provide the assistance that keeps the inquiry moving without squelching it [81].

Support System: The environment must be able to respond to a variety of learner demands, and the support system for group investigation should be extensive and responsive to the needs of the students. Teacher and student must be able to assemble what they need when they need it. Students should be encouraged to investigate and to contact resource people beyond the school wall [81].

2. Application

Group investigation requires flexibility from the teacher and the classroom organization. If students have not had an opportunity to experience the kind of social interaction, decision making, and independent inquiry, it may take some time before they function at a high level. Students who have participated in classroom meetings and self-directed, inquiry-oriented learning will probably have an easier time. Older students tend to be concerned with more complex issues, and skillful teacher can design inquiries appropriate to the students' abilities [81].

3. Instructional and Nurturant Effects

This model of teaching blends the goal of academic inquiry, social integration, and social-process learning. Also, this model can be used in all subject areas, with all age levels, when the teacher desires to emphasize the formulation and problem-solving aspects of knowledge rather than the intake of pre-organized, predetermined information. The model appears likely to nurture interpersonal warmth and trust, respect for negotiated rules and policies, independence in learning, and respect for the dignity of others [81].

5. Evaluation of Instructional Model

Evaluating learning is essential in the instructional design process. This evaluation is used for the purpose of making judgments about the worth or success of people or things such as lessons, programs, or projects [96]. There are several types of evaluation which are the most useful and used depending on the stage of the instructional design process. These are including placement, formative, diagnostic, summative, and confirmative evaluation [96, 101].

Placement Evaluation

Placement evaluation is concerned with student's entry performance and typically focuses on questions such as 1) does the student possess the knowledge and skills needed to begin the planned instruction?, 2) to what extent has the student already developed the understanding and skills that are the goals of the planned instruction?, and 3) to what extent do the student's interest, work habits, and personality characteristics indicate that one mode of instruction might be better than another.? Some techniques were used to answer these questions including records of past achievement, pretest on the course objectives, self-report inventories, or observational techniques [101].

Formative Evaluation

Formative evaluation becomes an important part of the instructional design process. Its function is to inform the instructor or planning team how well the instructional program is serving the objectives as it progresses in order to improve the instruction. This evaluation is used during the development and tryouts, and it should be performed early in the process, before valuable time and resources are wasted on things that aren't working. In case, the instructional plan contains weakness, they can be identified and eliminated before full-scale implementation [96].

Test results, reactions from learners, observation of learners at work, reviews by subject-matter experts, and suggestions from colleagues may indicate where there deficiencies in the learning sequence, procedures, or materials [96]. The following questions might be used to gather the data during formative evaluation [96]:

1. Given the objectives for the unit or lesson, is the level of learning acceptable? What weaknesses are apparent?

2. Are learners able to use the knowledge or perform the skills at an acceptable level? Are any weaknesses indicated?

3. How much time did the instruction and learning requires? Is this acceptable?

4. Did the activities seem appropriate and manageable to the instructor and Learners?

5. Were the materials convenient and easy to locate, use, and file?

6. What were the learners' reactions to the method study, activities, materials, and evaluation methods?

7. Do the unit tests and other outcome measures satisfactorily assess the instructional objectives?

8. What revisions in the program seem necessary (content, format, etc.)?

9. Is the instructional context appropriate?

Diagnostic Evaluation

Diagnostic evaluation is a highly specialized procedure. It is concerned with the persistent or recurring learning difficulties that are left unresolved by the standard corrective prescriptions of formative evaluation. The aim of diagnostic evaluation is to determine the causes of persistent learning problems and to formulate a plan for remedial action. If a student continues to experience a failure in reading or other subjects, despite the use of prescribed alternative methods of instruction, then a more detailed diagnosis is indicated [101].

Summative Evaluation

Summative evaluation is directed toward measuring the degree to which the major outcomes are attained by the end of the course, and that is to judge the effectiveness after the completion. Key information sources are likely to be the results of both the unit posttests and the final examination for the course [96]. Summative evaluation is also used to measure accuracy and efficiency of leaning, cost of program development, continuing expenses, reactions toward the course or program, and long-term benefits of the program [96].

Confirmative Evaluation

As cited in Morrison, et al. [96], confirmative evaluation was originally introduced by Misanchuk [102] based on extend beyond summative evaluation. Confirmative evaluation relies on multiple data-gathering instruments, such as questionnaires, interviews, performance assessments, self-reports, and knowledge test [103]. This evaluation was done over time. The following questions might be used to gather the data during confirmative evaluation [96]:

1. Do learners continue to perform successfully over time?
2. Do materials still meet their original objectives?
3. How can clients' needs be best met over time?
4. If improvements are needed in the training or materials, how can they be made most effectively?

Summarization of Instructional Model Development

Instruction refers to teaching approaches used to help learners to achieve the overall progresses. The potential goal of instruction is to make learning more efficient and effective and less difficult. The instruction also focuses on what learners need to know and avoids including nonessential content. The components of models of teaching which were developed by Joyce and Weil [81] were basically used to develop an instructional model to enhance critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center in Takeo province, Cambodia.

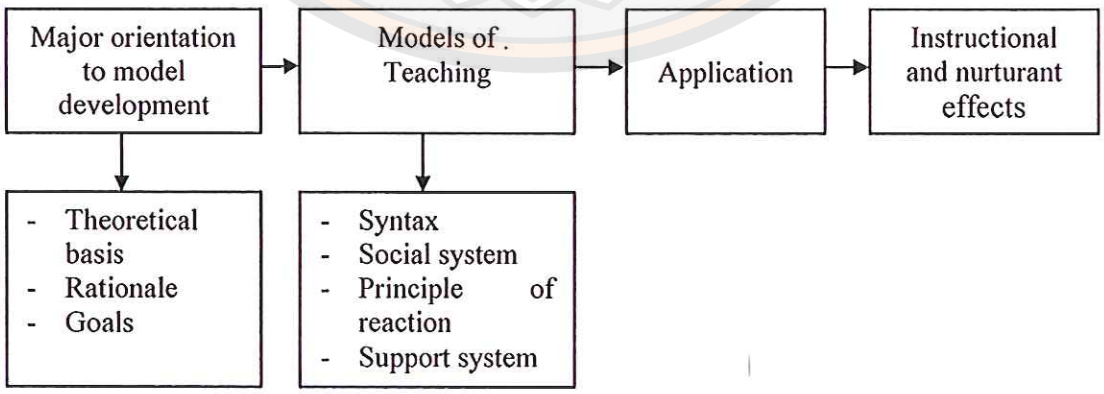


Figure 4 Summarization of Instructional Model Development

Cognitive-Based Approach

1. Definition of Cognitive-Based Approach

Cognitive theories explain learning in terms of information processing, memory networks, and student perceptions and interpretations of classroom factors, and appear to be more appropriate for explaining complex forms of learning. These theories appear to be more appropriate to explain the complex forms of learning such as solving problems or drawing inferences [67].

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 investigation [66]. Cognitive processing expresses the way that students learn or concerns the development of their thinking abilities such as analysis, inference, induction, and evaluation [68]. Unlike deductive learning related to teachers giving explanation and students observing their action which is less active to cognitive processing, inductive learning concerns inside-out in which the students analyze the problem, generate and choose among the hypotheses, gather the information, or design the experiment and emphasizes cognitive process to authentic learning. This process is related to students mind-learning occurs when their minds are positively involved during the lesson [104].

The inductive model relates to the cognitive processing, and it illustrates students' construction of knowledge through collaboration and interactive learning experience. Students generate their meaningful learning from hand-on experiences through enumerating, categorizing, labeling, generalizing and drawing conclusions on their interpretations [105]. The focus of Taba's Inductive Model is on critical thinking, and it is addressed in each Bloom's taxonomy as follows:

1. Observation: Brainstorming through relating the lesson to students' prior knowledge (knowledge and comprehension)
2. Categorization: Categorizing students' fluency in using concepts, generalizations and their applications
3. Analysis: teamwork and collaboration
4. Synthesis: Asking a series of question and facilitating student thinking
5. Evaluation: Providing rationales for their contributions and learning new contents

In Reciprocal Teaching, it reflects students' mental processes and increases their potential for internalization (summarizing, clarifying, predicting, and questioning) in critical thinking [106]. Reciprocal Teaching reflects the development of Metacognition which involves an awareness of one's own thinking and refers to the intentional use of cognitive process [69]. This Reciprocal Teaching also holds that individuals construct understandings through the use of scaffolding which is an essential way of deeming how learning happens generally. When students are capable of supporting themselves, scaffolding is removed and then students assume more and more responsible through mediated interactions with other people and the surrounding environment [69].

The traditional instruction viewed learners as receivers of knowledge through listening, observing or taking notes rather than creators of new knowledge. This view has obstructed students' critical thinking. However, posing a series of questions for students rather than providing answers could enhance their critical thinking [68]. New ideas or beliefs are formed through mental restructure of perception with logical objective and sequential processes. The interaction of four aspects of higher level of thinking including cognition-mental acts of perception, attention, or reasoning, metacognition-cognitive process of learning, conation-link to learning experience, and epistemology-defining and generating the content foments critical thinking [107].

The primary purpose of schooling is to stimulate critical thinking in order for those people to enhance their incumbent capacities and societies. Concerning this matter, schools should not burden students with excessive memorization, test taking, and content irrelevant to their lives and future societies. According to Trilling and Fadel [13] critical thinking refers students' abilities in:

1. Using reasons effectively: Employing various types of reasoning including inductive and deductive which are appropriate to the situation

2. Using system thinking: Being able to analyze all the interacted parts in order to produce the overall outcome in a complex systems

3. Making judgments and decisions: Effectively analyzing and evaluating evidence, arguments, claims, and beliefs, analyzing and evaluating major alternative points of view, synthesizing and making connections between information and

arguments, interpreting information and making conclusions based on the best analysis, or critically reflecting on learning experiences and processes.

As cited in Nitko, dispositions are habits of mind or tendencies to use appropriate critical thinking behavior [108]. These dispositions are including:

1. Seeking a statement of the thesis or question
2. Seeking reasons
3. Trying to be well informed
4. Using credible sources and mention them
5. Taking into account the total situation
6. Keeping their thinking relevant to the main point
7. Keeping in mind the original or most basic concerned
8. Looking for alternatives
9. Being open-mined (Seriously consider points of view other than their own, reason from starting points with which they disagree without letting the disagreement interfere with their reasoning, and withhold judgment when the evidence and reasons are insufficient)
10. Taking a position and changing a position when the evidence and reasons are sufficient to do so
11. Seeking as much precision as the subject permits
12. Dealing in orderly manner with the parts of a complex whole
13. Employing their critical thinking abilities
14. Being sensitive to the feelings, level of knowledge, and degree of sophistication of others

To help students achieve high standards and promote understanding of the subjects, cooperative learning should be adopted and implemented. Cooperative learning has been introduced to assist in enhancing positive relations among learners, improve peer coaching, establish school environments where learning and high standards are valued, promote positive school discipline and finally improve critically thinking skills [109]. Also, students working in cooperative learning groups used higher level thinking skills than did students working individually.

According to Duff [110], the use of cooperative learning to foster critical thinking concerned two aspects. The students are trained in focus lessons and then applications which require to work as teams to help teach, monitor, and evaluate the use of critical thinking skills to problem-solve, and use of oral summarizing, explaining, and gathering information, understanding the cognition and emotion, manipulating different perspectives, and reasoning results.

As cited in Greenstein "Mental activity directed towards purposive adaptation to, and selection, and shaping of real-world environments relevant to one's life" is defined as intelligence. This integrated not only core knowledge but also the individual application of that core knowledge throughout their life. The concept of intelligence is consisted of three main aspects [34] and considered as compulsory to build up critical thinking skills.

1. Analytical or componential intelligence: Intelligence used in problem-solving and decision-making

2. Experiential intelligence: Tasks are well performed based on prior experience

3. Practical or contextual experience: Concerning adapting, shaping, and selecting to assimilate and accommodate the individual and environment

2. Constructivist Learning Theory

The ideas of inquiry-based critical thinkers become the educational purposes of the 21st century. Concerning constructivist perspectives, the individual learners bring their developmental history and experience to support structure when they socially interact to create cognitive changes and construct knowledge. Bruning, et al. [111] expressed that there were two central ideas about constructivism. Learners actively construct their own knowledge, and social interactions are significant in knowledge construction.

Jerome Bruner and Critical Thinking

Bruner [112] defined discovery as "all forms of obtaining knowledge for oneself by the use of one's own mind and rearranging or transforming evidence in such a way that one is enabled to go beyond the evidence so assembled to additional new sights" The process of discovery contributes significantly to intellectual development and that the heuristics of discoveries can only be learned through the

exercise of problem solving. Bruner [112] intended that a true act of discovery is not a random event. It involves an expectation of finding regularities and relationships in the environment. With this expectation, learners devise strategies for searching and finding out what the regularities and relationships are. Characteristics of this searching and finding are an attitude of critical thinking.

Bruner's [113] cognitive growth theory emphasizes the importance of discovery learning and how teachers help students to become constructivists of their own knowledge. Learners construct new ideas or concepts based upon their current/past knowledge and experience. Learners select and transform information, construct hypotheses, and make decisions relying on their cognitive structures. This reflects the process of critical thinking.

Students engage in the active dialogues and should be encouraged to discover principles by themselves. Students learn best when learning instruction leads them to discovering information on their own. Learning instruction should also be appropriate to the learners' current state of understanding and address four major components including 1) curiosity and uncertainty, 2) structure of knowledge, 3) sequencing, and 4) motivation [114]. Knowledge was best acquired when students were allowed to discover concepts and information on their own. According to Bruner [114], learning occurs in three stage 1) enactive stage-experiencing the concrete object, 2) symbolic stage-being able to present materials mentally, and 3) symbolic stage-using logic and higher-order thinking [114].

Discovery Learning and Critical Thinking

Discovery learning involves encouraging students to ask questions, formulate their own tentative answers, and to deduce general principles from practical examples or experiences. The principle content of what is to be learned is not given but must be independently discovered by the students and making them active participating in their learning. Discovery learning also requires students to participate in exploring the examples, discovering the principles or concepts, and making decisions about what, how, and when something to be learned [70].

Discovery learning is the broad-based constructivism focused on the individual learning behavior, each new concept built on what was previously learned and associated with three principles including [114]:

1. Instruction must be concerned with the experiences and contexts that make the students willing and be able to learn

2. Instruction must be structured so that it can be easily grasped by the students

3. Instruction should be designed to facilitate extrapolation or fill in the gaps

Discovery learning refers to obtaining knowledge for oneself, and it is important for cognitive learning. Discovery learning involves formulating and testing hypotheses rather than simply reading or listening to teacher presentations. It is also a type of inductive reasoning because students move from studying specific examples of formulating rules, concepts, and principles. Teachers arrange activities in which students search, manipulate, explore, and investigate. Students learn new knowledge relevant to the domain through formulating rules, testing hypotheses, and gathering information [112], and thus, it develops critical thinking.

The process of discovery is often contrasted with scientific inquiry, relying on the use of logic and rational examination. The discovery relies on a natural consequence of a logical line of inquiry by discovers. Presenting questions, problems, or puzzling situations to resolve encourage student involvement in using discoveries. Students require background preparation including the well-prepared for declarative, procedural, and conditional knowledge. Discovery seems more appropriate when the learning process is important, such as problem-solving activities that motivate students to learn and acquire the requisite skills [115].

The discovery learning occurs in a form of role playing, independent or group projects and computer simulation. Learning becomes more meaningful when students explore their learning environments rather than listen passively to teachers. Discovery learning can enhance inductive thinking [70]. To foster inductive thinking requires using different examples and reasoning inductively. Reasoning refers to mental process involved in generating and evaluating logical arguments [116]. Reasoning involves working through problems to explain why something happened or what will happen [100]. According to Ennis [19], reasoning skills including:

1. Clarification: Identifying and formulating questions, analyzing elements, defining terms

2. Bias: Determining source (s) of support for conclusions about a problem

3. Inference: Reasoning inductively from specific cases to general principles to specific cases

4. Evaluation: Using criteria to judge adequacy or a problem solution

Instead of using preselected and prearranged materials, Bruner [117] believed that students should be confronted with problems that help them seek solutions either independently or by engaging in group discussion. Learning is involved in figuring out how to use what you already know in order to go beyond what you already think. Discovery is simply too inefficient a process to be used that widely, and learning from others can be as meaningful as personal discovery [118]. Bruner [117] argues that understanding the ways in which ideas connect with one another, the possibility of solving problems on our own, and how what we already know is relevant to what we are trying to learn are the essence of education and can be best achieved through personal discovery.

Teacher's role must be to create situations in which students can learn on their own, rather than to provide prepackaged information to students. Students should learn through their own active involvement with concepts and principles, that they should be encouraged to have experiences and conduct experiments that permit them to discover principles for themselves. According to Gilstrap and Martin [119], there are several important advantages to discovery learning. It arouses students' curiosity, motivating them to continue to work until they find answers [120] and concerns independent problem-solving skills that force students to analyze and manipulate information rather than to simply absorb it.

Students construct meaning for themselves, and that teacher's role is to give students opportunities to experiment with ideas and to help guide their discovery of critical concepts [121, 122]. Students engage in authentic activities beginning with problems generated by them, and then figure out how to do the operations [123]. In discovery learning, students are active in learning process and construct knowledge based on new information and data collected by them in an explorative learning environment [124, 125].

Discovery learning is also relevant to inquiry learning which requires active participation of students in the learning process [126]. Discovery learning is also a method that encourages students to arrive at a conclusion based on their own activities and observations [127]. Learners take part in an inquiry, get a complementary excitement and satisfaction by what they do, sense, and share, what and how others do and sense during the discovery process.

Students construct knowledge actively, using their pre-existent knowledge. Learning is activated through the learner's action in problematic situation. To solve any problem, learners must determine what variables are relevant, what information should be sought about those variables, and, when the information is obtained, what should be done with it. Every function of the learner's cultural development appears twice: initially in a social level and then in a personal level [69]. According to De Jong [128], discovery learning was also defined as "an approach to learning that involves a process of exploring the natural or material world and that leads to asking questions, making discoveries and rigorously testing those discoveries in the search for new understanding."

Discovery teaching generally involves not so much the process of leading students to discover what is out there but rather their discovering what is in their own heads [129]. In discovery learning, students construct an understanding on their own, figure out things for themselves, and also allow learners to experience on their own. Bruner [130] exemplify the notion of discovery teaching as rules for organizing the regularities of experience which is constructed and internalized.

Discovery learning emphasizes active student-centered learning experiences through which students discover their own ideas and derive their own meaning [114]. To accomplish discovery learning, there are needs for active students' involvement in the learning processes and beliefs that true learning comes through personal discovery and invention. Inductive reasoning, inquiry processes, and in particular, activity-based instruction in which students were expected to use their own direct experiences and observation to gain information and to solve scientific problems are used in discovery learning. Discovery learning requires teachers to work as facilitators and question askers rather presenters and demonstrators of information [114].

The amount of information and the number of concepts presented in a single lesson or unit of work should be careful and highly taken into account and lessons should be related to students' prior knowledge and abilities [113]. Too much irrelevant information hampers in students' learning key ideas. Hence, the difficult concepts should be made them clear and simple for students that help them examine critical ideas in depth, not bombarding and taking easy concepts but make them difficult [113].

Learners acquire concepts b setting forth tentative hypotheses about the attributes that seem to define a concept and then testing specific instances against these hypotheses [130]. The discovery of concepts proceeds from a systematic comparison of instances for what distinguishes examples from non-examples. To promote concept discovery, the teacher presents the set of instances that will best help learners to develop an appropriate model of concepts. At the same time, learners learn how to cut their losses, to pose good testable guesses, to persist in seeking appropriate evidence, and to be concise. Reflecting back on the problem and recasting what occurred in a mode of thought understood by learners may help them to figure it out, to make the knowledge their own [114].

Readiness to explore contrasts provides a choice among the alternatives that might be relevant in a discovery learning situation [129]. Discovery learning is also a means by which students engage in problem solving in developing knowledge or skills. Problem-solving which is emphasized in discovery learning is the intentional elimination of uncertainty through direct experiences and under supervision [131]. Discovery learning is intentional learning through supervised problem solving following the scientific method of investigation. With discovery learning, the learning must be planned and supervised, and it must follow the scientific method of investigation [131].

Discovery learning can take place at three different levels of problem-solving (See figure 5 below).

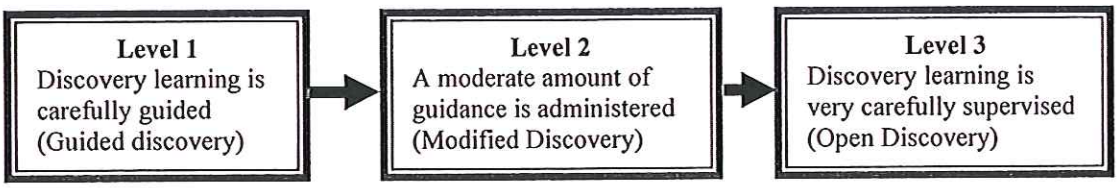


Figure 5 Level of Discovery Learning

Source: Moore [131]

Discovery learning follows the general scientific method for conducting an investigation. The components of this investigation include [131]:

1. Identifying problem: Being aware of problem exists and writing problem statements
2. Developing possible solutions: Proposing testable hypotheses
3. Collecting data: Gathering evidence, conducting experiment(s), and surveying a sample
4. Analyzing and interpreting data: Developing data supported meaningful statements, testing hypotheses, establishing relationships or patterns, and making generalizations
5. Testing conclusions: Obtaining new data and revising original conclusions

The degree of success of discovery learning depends in a large part on the ability to plan and execute the problem-solving process effectively. Discovery learning is active rather than passive learning. Active learning tends to result in a higher degree of intrinsic motivation. In discovery learning, motivation comes from the activity itself and the excitement of direct involvement. This has the added advantage of increased learning and better attention [131]. Discovery learning also fosters the development of positive social skills. It requires that students work cooperatively, and students must develop skill in planning, following established procedures, and working together toward the successful completion of common tasks [131].

The goal of education was not only to increase the size of a student's knowledge base but also to create possibilities for students invention and discovery Bruner [112] found four key benefits of discovery learning including an increase

intellectual potency, a shift from extrinsic to intrinsic rewards and motivation, the opportunity to learn enquiry and problem-solving methods, and the advantage it gave for remembering facts and ideas. Discovery learning emphasizes the importance of helping students understand the structure or key ideas of a discipline, the need for active student involvement in the learning process, and a belief that true learning comes through personal discovery.

Bruner [112] also identified three modes of learning including learning by doing, called the enactive mode, learning by forming mental images, called the iconic mode, and learning through a series of abstract symbols or representations, called the symbolic stage. Discovery learning occurs through these three modes.

Table 3 Summarization of Constructivist Learning Theory

Constructivist	Characterized by	Contribution	Summarization
Bruner	Discovery learning	Anderson [116], Hunt [100], Ennis [19], Schunk [115], Gilstrap and Martin [119], Berlyne [120], Matson [126], Kipnis [124], Njoo [125], Kaptan and Korkmaz [127], Vygotsky [69], De Jong [128], Moore [131]	1. Learning appears in a form of asking questions, formulating own answers or deducing from general practices. 2. Learners construct new ideas or concepts based on the current or past experiences. 3. Learning is involved in both inductive and deductive reasoning. 4. Learning focuses on the individual behavior. 5. Learning by doing 6. Learning is involved in working through problem. 7. Learners learn to learn independently.

3. Cognitive Development Theory

The cognitive development approach was fully stated for the first time by John Dewey and Jean Piaget. This approach describes how cognitive is developed through learning life. Cognitive development also refers to changes in our thinking that occur as a result of maturation and experience [80].

Development is defined as orderly or adaptive changes that go through from conception to death. This development includes 1) physical development-changes in body structure and function over time, 2) personal development-changes in personality that take places as one grows, 3) social development-changes over time in the way we relate to others, and 4) cognitive development-gradually orderly changes by which mental processes become more complex and sophisticated. Generally, it is recognized that people develop at different rates, development is relatively orderly, and development takes place gradually [20].

Cognition is the act of recognizing or of having knowledge. Cognitive development theory explores the mental processes used in the formation of all internal processes such as perception, intuition, and reasoning. It also concerns how students perceive, understand, evaluate, and think. The mind is a processor of information-the information was received through the senses, and then it was interpreted [132]. Without cognition, full understanding and realization of mental processes is impossible. It also explicitly acknowledges the existence of internal mental states such as belief, desire, idea, knowledge, and motivation [67].

Cognitive theorists are concerned with what occurs inside the mind-how we think, process information, remember and forget information, and acquire and use language to communicate. Vygotsky [133] believed that cognitive growth is fostered when learners operate in the zone of proximal development, the area slightly above their present functioning but in which they can be successful with the assistance of adults and peers.

Jean Piaget and Critical Thinking

Piaget, who is a cognitive constructivist, stresses that learners need to investigate their environment and construct personally meaningful knowledge [134]. To know an object is to act on it. To know is to modify, to transform the object, and to understand the process of this transformation and as a consequence to understand the

way the object is constructed [135]. Human are always striving to make sense of their interaction with environment and their social experiences combine to influence how they think about things, and the way the concepts are learned is affected by their ages, language development, and level of intellectual development [71].

Cognitive constructivist views that learners use past experience to interpret and understand new experiences. According to Piaget's cognitive view [71], is that how people construct knowledge through the process of assimilation and accommodation are contributions to constructivism. Assimilation is the way of assimilating new knowledge into existing knowledge, and accommodation is the way of accommodating existing structures modified into fit new knowledge [136].

Piaget [137] viewed that development precedes learning. Learners progress in a linear fashion from one stage to the next only when they exhibit development readiness. Each stage is characterized by a qualitative change in cognition, and requires a reorganization of the individual's cognitive structure. The four stages of development are including 1) sensorimotor-from birth to 2 years adapting to the situation, 2) preoperational-from 2-7 years using egocentric communication, 3) concrete operational-from 7-11 years making conversation and reversibility, and 4) formal operational-from 11-onwards having systematic and logical thinking. According to Piaget, there are four factors influencing cognitive development-maturity, physical experience, social transmission of knowledge and equilibrium.

According to Piaget, assimilation occurs when learners incorporate new information into their existing schematic knowledge, but accommodation occurs when learners adjust their knowledge schemas to new information and information [138], and then reflect in improving critical thinking. Piaget's theory of cognitive development indicates that learning should be equally matched with learners' cognitive development. To achieve this, differentiated instructions should be used.

At the formal stage which is related to adult learning, Santrock [138] proposes that learning instruction should be 1) proposing a problem and invite students to form hypothesis about how to solve it, 2) presenting a problem and suggest several ways that it might be approached, 3) demonstrating how to conduct experiments that require the separation and control of variables, and 4) encouraging students to create

hierarchical outlines. Learners also begin to use deductive logic, or reasoning from a general principle to specific information. The process of this learning instruction enhances higher-order thinking that is the main element of critical thinking.

Piaget viewed that learners learn best when they are active and seek solutions for themselves by making discoveries, reflecting on them, and discussing them. Students construct their knowledge by transforming, organizing, and reorganizing the previous knowledge. Relatively, individual learners also need supportand guidance to explore their world and discover knowledge [138], and this reflects the process of strengthening critical thinking.

Piaget [139] stresses four elements of processes that help students construct their knowledge of the world including schemas, assimilation and accommodation, organization, and equilibrium. Schemas refers to actions or mental representations that organize knowledge through using strategies and planning for solving problems; assimilation concerns the concepts of the incorporation of new information into existing knowledge; accommodation refers to the concepts of adjusting schemas to fit new information and experiences; organization refers to the concepts of grouping isolated behaviors into a higher-order, more smoothly functioning categories, and equilibrium refers to shifting from one stage to the next.

Piaget [139] also proposes how learners shift from one stage of thought to the next. The shift occurs as learners experience cognitive conflict or disequilibrium, in trying to understand the world. At the end, they resolve the conflict and reach a balance or equilibrium. There is a considerable movement between states of cognitive equilibrium and disequilibrium as assimilation and accommodation work in concert to produce cognitive change.

Cognitive development depends on four factors including biological maturation, experience with the physical environment, experience with social environment, and equilibration [139]. Equilibrium refers to a biological drive to produce an optimal state of equilibrium (or adaptation) between cognitive structure and the environment [140]. Cognitive development can occur only when disequilibrium or cognitive conflict exists, and it also seeks to resolve the conflict through assimilation and accommodation.

Piaget [139] also explains that a schema describes both the mental and physical actions involved in understanding and knowing. Schemas are categories of knowledge that help learners to interpret and understand the world. In Piaget's view, a schema includes both a category of knowledge and the process of obtaining that knowledge. As experiences happen, this new information is used to modify, add to, or change previously existing schemas.

In addition to this, a number of instructional strategies have been derived from Piaget's work. These strategies include providing a supportive environment, utilizing social interactions and peer teaching, and helping learners see fallacies and inconsistencies in their thinking [141]. Ausubel [142] believe that learning should take place deductively-from the general to the specific rather than inductively from the specific to the general [143] which is indirect opposition to the constructivists. This difference supports several important principle of learning.

One is that students form personalized and unique knowledge structures, called schema. This prior knowledge influences how new information, whether self-discovered or received, will be processed and understood. Also, the more actively students process new materials by relating them to prior knowledge influence new learning. When cognitive demands exceed processing capacity, degree of learning is reduced. Relatively, when new information can be connected in memory to prior knowledge (schema), the chances for meaningful learning as opposed to rote memorization to occur will increase. For meaningful learning to take place, learners must construct knowledge themselves through their actions, reflections, and experiences [96].

Development would proceed naturally through regular interactions with the physical and social environments. The impetus for developmental change is internal. Environmental factors are extrinsic; they can influence development but not direct to it. Teachers can arrange the environment to cause conflict, but how any particular student resolves the conflict is not predictable [139]. Learning occurs when students experience cognitive conflict and engage in assimilation or accommodation to construct or alter internal structures.

Piaget [139] also suggests some implications for education including understanding cognitive development, keeping students active, creating incongruity, and providing social interaction. Students need rich environments that allow for active exploration and hands-on activities. This arrangement facilitates active construction of knowledge. Teachers need to know how their students are thinking so they can introduce cognitive conflict at a reasonable level where students can resolve it through assimilation and accommodation [139].

The social environment is a key source for cognitive development. Teachers must design some activities that provide social interactions. Any learner assign meaning to stimuli and events based on their cognitive capabilities and experiences with the social and physical environments [70]. Students who believe that learning outcomes are under their control may expend greater mental effort, rehearse more, use organizational strategies, and employed their tactics to improve learning [144].

Kolb [145] emphasizes that learning is a continual process rather than having a single measurable outcome. The four stages of learning are including concrete experience, reflective observation, abstract conceptualization, and active experiment. Learning should be active rather than passive through reviewing the experience and discussing what happened and why. Also, students should be encouraged to learn from experience and then apply that learning in new situations.

Piaget's concepts fostered a new view of students as active agents constructing their own world [146]. When students encounter something that is inconsistent with or contradicts what they already know or believe, this experience produces a disequilibrium that they are driven to eliminate. Activities that encourage students to create new ideas or schemes through experimentation, questioning, discussion, and discovery often produce meaningful learning.

Meaningful learning occurs when students create new ideas or knowledge from existing information. To solve a problem, memory for information can be used for a solution. Using information can mean experimenting, questioning, reflecting, discovering, inventing, and discussing. This process of creating knowledge to solve a problem and eliminate disequilibrium refers to constructivism [139, 147].

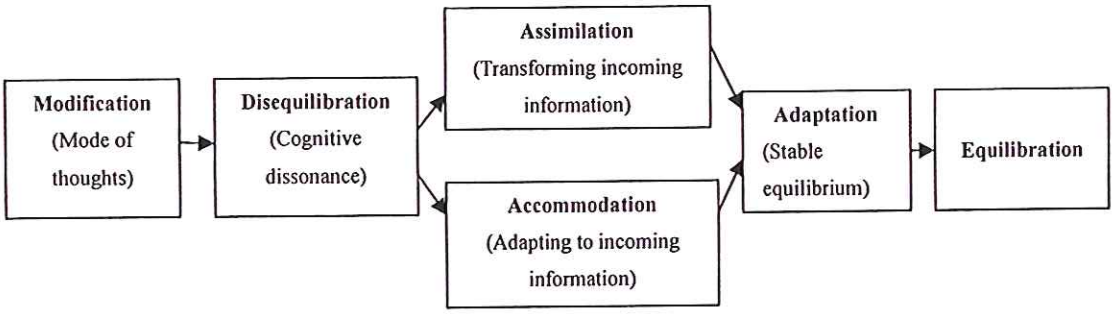


Figure 6 Summarization of Cognitive Developmental Process

John Dewey and Critical Thinking

Group investigation dealing with democratic problem-solving is introduced to students in order to enhance their reflective thinking through identifying a problem, forming a hypothesis, gathering and analyzing data, and drawing conclusions [148]. To reach a complete training in the ability to think, analysis, synthesis, application, and inference are necessarily required and considered as critical thinking skills. Based on their own experiences, students are encouraged to use inquiry to solve a social or interpersonal problem, to handle the information, or to develop their own ways in viewing the world to improve capacity and produce knowledge [149]. Deep learning relates new ideas and concepts to the previous knowledge and experiences in which learners choose their own ways to learn with effective learning environment provided and help from highly qualified educators [150].

Additionally, child-centered which deals with interests and needs of learners [151] must be taken into consideration; by knowing that students come along with their own experiences, minds and souls, and teaching should focus on occupation to manage them for a life of work [72]. Dewey [148] expressed four senses of thinking. First, thinking is a continuous thought which is not exactly an order, and it occurs through our heads or minds. Second, thinking is not a direct perception but restricted to issues. It is an accident and episode of imagination which then stimulates the reflexive thought. Third, thinking is about the belief rested on some basis. This belief could be accepted or rejected depend on insinuation of probable or improbable grounds. Fourth, thinking is a reflexive thought which its belief is constituted based on firm basis of reasons and conscious inquiry into nature and conditions.

Steadying and guiding factors demanded for the solution of complexity is the process of critical thinking [148]. In critical thinking instruction, students think, discuss, and develop freedom and self-reliance in work and study with sturdy inquiry and discovery rather than relying on teachers to teach and dominate the class [152]. Reason which is including identifying the reason, giving the reason and evaluating the reason and evidence are considered as key elements in critical thinking [153]. Also, Dewey [148] expressed critical thinking as reflection through "proof, witness, evidence, warrant, or voucher" which is recognized as the ground of belief.

Critical thinking is centrally concerned with understanding, constructing, and evaluating the argument-a statement with a clear reason, evidence and conclusion [153] and a reflective experience consisting of "examination, inspection, consequences, exploration, and analysis, attainable consideration used to define and clarify the problem, and a consequence elaboration of the tentative hypothesis to make it more precise and consistent with a wider range of facts" [72]. Reflexive attention is also related to critical thinking, and it is regarded as the sake for learning. This reflection attention primarily involves judging, reasoning, and deliberation in engaging to seek and select the relevant materials for the problem [154].

Critical thinking occurs when any suggestion is not at once accepted and critical reflection is required to hunt for additional evidence and new data and make obvious its absurdity and irrelevance [148]. Proof and inference are thought as main elements of critical thinking, and to prove a thing means primarily to try and test it [148]. Critical thinking requires thinking skills. Thinking plays an active role in fostering new knowledge, for its main function is concerned with given or ascertained facts which are used to indicate other indirectly ascertained facts [148], and it includes "sense of a problem, observation of conditions, formation and rational elaboration of a suggested conclusion and the experimental active testing [72].

To help students improve what to think and how to think in order to become self-directed and critical thinkers, it is required critical thinking skills. "Nurturing the profound habits of discrimination tested beliefs from mere assertions, guesses, and opinions to develop sincere and open-minded preference for properly grounded conclusions and ingrain into individual's working habits methods of inquiry and reasoning appropriate to various problems is conducive to critical thinking" [148].

Relatively, Dewey [72] wrote that thinking is experience which proceeds from credible reasoning occupied with spiritual or literary things and the correlation of "facts, data, knowledge, suggestions, inference, conjectured meanings, suppositions, tentative explanations with a strong support of careful observation and recollection to determine what is given, what has already been there, and hence assured" [72].

Additionally, thinking is involved in the suggestion of accepted conclusion which searches for inquiry to test the value of that suggestion before it is finally accepted [148] and this process of suggestion is related to three main implications including (a) the suggested proceed related to experiences and facts (b) the suggestions of promptness, flexibility, and fertility and (c) what is suggested concerning orderliness, consecutiveness, and appropriateness which are crucial to critical thinking [148]. Obviously, one of these three dimensions may interrupt a person's thoughts due to being irrelevant, narrow, or crude and not having enough materials to base conclusions or fail to evoke suggestion [148].

Normally, solving a problem demands variety and change of ideas which then are drawn into a single steady trend moving towards a unified and reasonable conclusion, and this reflects critical thinking [148]. Of course, thinking cannot go in a vacuum. It requires suggestions and influences which can incur based upon a basis of information as to the matters of facts [148] and recall the previously learned experience which is including credible information or basic principles [155]. According to Bloom, et al. [155], the ability of thinking and reasoning to improve cognitive development concerned with critical thinking is classified into six categories including:

Table 4 Higher and Lower-Order Thinking

Level	Student Action
Lower-order thinking	
Knowledge	Identify, define, list, match, state, name, label, describe, or select
Comprehension	Translate, convert, generalize, paraphrase, rewrite, summarize, distinguish, infer, alter, explain
Application	Use, operate, produce change, solve, show, compute, prepare, determine

Table 4 (cont.)

Level	Student Action
Higher-order thinking	
Analysis	Discriminate, select, distinguish, separate, identify, break down, analyze, compare
Synthesis	Design, plan, compile, compose, organize, conclude, arrange, construct, devise
Evaluation	Appraise, compare, justify, criticize, explain, interpret, conclude, summarize, or evaluate

Relatively, the attitude of mind also deals with critical thinking. Taking into a thorough consideration before making any judgment or conclusion is an example of this matter. According to Dewey [72], the attitude of mind is centrally in intellectual ways of dealing with subject matter which is including directness, open-mindedness, single-mindedness, whole-heartedness and responsibility. Mental attitude also influences on critical thinking, and it is fixed to the ways that the problem is tackled. Reasonable of inference which is the result of mental attitude will be reached when the habits of active inquiry and careful deliberation in the significant and vital problems of conduct afford the best guarantee [148].

Logical disposition which is synonymously defined as "wide-awake, thorough, and careful reflection" is vital to critical thinking [148]. Logical thought begins with analysis of all related elements and proceeds in a regular order which then moves to more complex synthesis-each element is definitely recognized, clearly acquired and defined into the same type of classes [148]. Concerning careful reflection, it mainly focuses on how to think which is linking all things to one another and then together through having thorough weigh, ponder, deliberate, scrutiny, examination, consistency, inspection, attention, accuracy, definiteness, exactness, orderliness, vision, or methodic arrangement [148].

Free self-expression, individuality, and spontaneity are also primary and fundamental to critical thinking [148]. When students are given chance to utter their own thoughts, to follow their own choices, or express their own genuine freedom, their

ideas definitely reach reasonable and desirable conclusions. Regarding this genuine freedom, it is the "intellectually trained power of thought in the ability to turn things over, to look at matter deliberately, to judge whether the amount and kind of evidence requisite for decision which is at hand or to tell where and how to seek such evidence" [148]. In response to this, both external and internal factors are seriously counted in. The external factor is the outside environment which directly and indirectly impacts the characteristics of thinking, and these are including parents, friends, school, work or culture. With the internal factor, it concerns every individual internalizing process and intrapersonality such as courage, self-belief, value, or anxiety.

The essence of critical thinking is a suspended judgment which is inquiry to determine the nature of problem before proceeding to attempt at its solution and then transforms mere inference into tested inference and suggested conclusion into proof [148]. In favor of this suggestion, it is a heart of inference which involves from what is present to something absent and selection and arrangement of the particular facts upon perception of which suggestion issues. However, this suggested conclusion is not accepted due to being characterized as supposition, conjecture, guess, and hypothesis and needs further belief or evidence [148]. Acceptance of the suggestion in its first form is prevented by looking it into more thoroughly, and reasoning is needed. Reasoning shows that if the ideas be adopted, the certain consequences follow. This reasoning requires condition which is deliberately arranged in accord with the requirements of an idea or hypothesis which is proofed by the experimental corroboration or verification [148].

Systematic thinking is also considered as critical thinking. Systematic thinking comprises of inductive discovery-the movement toward building up the ideas from a connected view of situation to general truth and deductive proof-the movement toward developing, applying and testing from fragmentary elements to specific details. Premises are called grounds, foundations, bases, and are said to underlie, uphold, and support the conclusion.

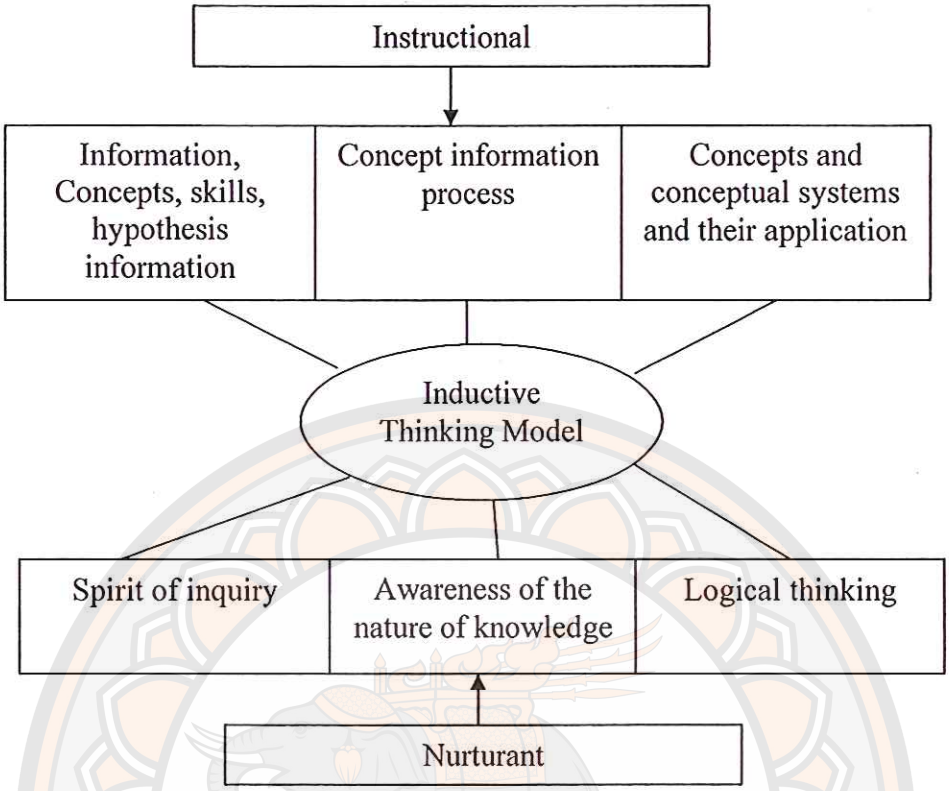


Figure 7 Inductive Thinking Model

Source: Joyce, et al. [94]

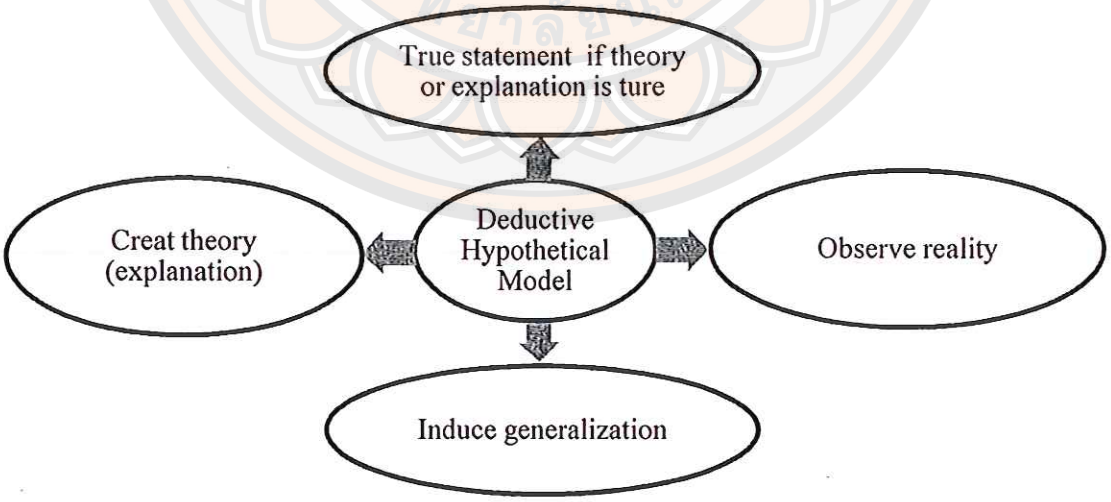


Figure 8 Deductive Hypothetical Model

Source: McIntyre [156]

Noticeably, Dewey [72] views that school should be laboratories for real problem-solving and provides the philosophical underpinning for problem-based learning. Dewey's pedagogy encouraged teachers to engage students in problem-oriented projects and help them inquiry into important social and intellectual problem. Learners' critical thinking skills should be developed by requiring them to follow a series of steps leading from consideration of specific information to formulation of conclusions supported by evidence [148], and then help them to become more sophisticated thinkers.

Learners learn best by doing through examining their beliefs and assumptions and consider their applications, actions that lead to further insights and learning. This fosters the development of open-mindedness, wholeheartedness, and responsibility in facing consequences and attitudes [157], and then promotes students' critical thinking.

Table 5 Summarization of Cognitive Development Theory

Cognitivist	Main Contributions	Characterized by	Description
Piaget	Assimilation and Accommodation	Bloom, et al. [155], Bassham, et al. [153], Smutny [152], Sawyer [150], Hullfish and Smith [149]	1. Learning is involved in social environment and interactions 2. Learning is associated with learners' experiences 3. Learning concerns the stage of learners' development 4. Learning is involved in experimenting, debating, questioning, discussing or problem-solving

Table 5 (cont.)

Cognitivist	Main Contributions	Characterized by	Description
Dewey	Deductive and Inductive	Elkind [147], Fisher and Henke [146], Kolb [145], Graham and Golan [144], Arends [134], Bruner [70], Morrison, et al. [96], Slavin [143], Ausubel [142], Duncan [140], Santrock [138]	1. Learning is involved in reflexive thinking 2. Learning is involved in analyzing, discovering, judging, and drawing conclusions 3. Learning is related to real problem-solving 4. Learning is associated with open-mindedness, collaboration or teamwork 5. Learning focuses on reasoning and beliefs 6. Learning is thinking

4. Social-Cognitive Theory

Social cognitive theory is the concept of human agency in which the individual are proactively engaged in their own development. The individuals possess self-beliefs that enable them to excise a measure of control over their thoughts, feelings, and actions. The individuals are imbued with the capabilities to symbolize, plan alternative strategies, learn through vicarious experience, self-regulate, and self-reflect [73]. The concepts of social cognitive theory are the interaction among behavior, environment, and personal characteristics; beliefs about personal capabilities; learning through observation and models; and guiding own learning through self-regulation [73].

Meichenbaum and Critical Thinking

Self-instruction is defined as "a series of self-statements (or self-questions) which outline stages in effective task performance, including (a) how to approach a task or problem, (b) how to check one's progress in completing the task or solving the

problem, (c) how to reinforce one's sustained effort, and (b) how to evaluate task performance" [158].

The use of self-instruction encompasses a variety of domains such as cognitive skills and affective skills [159], however; an important area of application is academic achievement. Using the self-instructional training of cognitive modeling, followed by overt and covert rehearsal, the learners were taught to use the following self-verbalization 1) questions about the task, 2) answer to the questions in the form of cognitive rehearsal, 3) self-instructions to guide the subject through the task, and 4) self-reinforcement [74].Self-instruction has been used with a variety of tasks and types of students [160], and particularly is useful for students with disabilities [161] and for teaching students to work strategically.

Self-instruction in conjunction with attributed training may produce increased improvement in student performance. Students' attributions are essential to their academic success and failure. Successful and unsuccessful students tend to offer different attributed explanations of their academic successes and failures [162]. Successful students often attribute success to internal and controllable factors and attribute failure to external and uncontrollable factors.

Any success students may experience is usually attributed to external and uncontrollable factors [162]. This belief system leads to a decrease in self-esteem since those students see no way to control changing their pattern of failure into success [163] and also a decrease in future expectations since they see no relation of effort to outcome and they give up trying to succeed [164].

Lack of persistence, lack of exerted effort [165], and belief in an external locus of control [166] all contribute to student experiences of failure in comparison with their peers. Hence, attribution training may help change students' beliefs about success from uncontrollable to controllable and to develop persistence by increasing the effort exerted on such endeavors.

Positive thoughts and behaviors lead to student success in their study, but negative thoughts and behaviors bring them their failures [167]. The main elements of positive thoughts are including self-belief, valuing school, and learning focus, and positive behaviors refers to keeping persistence or challenging, making a clear plan, and having a smooth task management. However, negative thoughts will bother

student success, and these come from many reasons including being uncertain control in learning, feeling anxious and pessimistic, and keeping failure avoidance. Negative behaviors concern student self-handicapping and disengagement [167].

Therefore, these negative thoughts and behaviors should be reduced or eliminated and positive thoughts and behaviors should be enhanced so that students' critical thinking can be fostered.

Meichenbaum [168] hypothesized that self-instructional training could be effective with older persons who often exhibit "production deficits" in reasoning and problem solving, and with college students to increase creativity. Meichanbaum [168] believes that corresponding changes must take place in cognitive structures, inner speech, and behavior before a client can maintain and generalize new behaviors. Goals of training were to provide a procedure by which these students could learn 1) to comprehend demands of a task, 2) spontaneously to produce self-instructions and plans, and 3) to use self-instructions to guide, monitor, and control performance [168].

Self-instructional training has two components including cognitive modeling and rehearsal of self-instructions. Self-instructional training provides a package of self-instructions that is applicable to a variety of cognitive tasks. Research provides evidence that students learn to understand what they have to do, to plan and respond spontaneously to task demands, and to use covert verbal mediation to guide, monitor, and correct their performances [169].

Self-instructional training emphasizes self-instructions leading to efficient task performance. Self-instructional training is extended by rehearsal of self-instructions, coping skills, and problem-solving techniques. Self-instructional training seems best suited to problems that can be defined by concrete task behaviors requiring highly similar cognitive demands [168].

Table 6 Summarization of Social Cognitive Theory

Theorists	Contribution	Characterized by	Summarization
Meichenbaum	Self-instruction	Bandura [73], Asarnow and Meichenbaum [169], Martin [167], Linn and Hodge [166], O'Neill and Douglas [165], Licht [164], Nicholls [163], Weiner [162], Wood, Rosenberg and Carran [161], Fish and Pervan [160], Meichenbaum and Goodman [168], Miller, et al. [158]	1. Model is a root of learning. 2. Learning is related to positive though or behavior 3. Learning is related to positive motivation 4. Learning is related to a clear goal 5. Learning is using problem-solving techniques

5. Cognitive Information Processing Theory

Information processing theory seeks to understand how people acquire new information, how they store information and recall it from memory, and how what they already know guides and determines what and how they will learn. The theory assumes that people process new information in stages that there are limits on how much information can be processed at each stage, and that previously learned information affects how affect how and what students currently learn [170].

Neisser [171] defined cognitive processing theory as the study of how people encode, structure, store, retrieve, use or otherwise learn knowledge. Based on the work of Atkinson and Shiffrin [75], information processing theory is the stage theory model. It views that learning and memory as discontinuous and multi-staged. It is hypothesized that the information in some way was manipulated before it was stored. The stages include sensory memory, short-term or working memory, and long-term memory. Sensory input and working memory enable people to manage the limited amounts of incoming information during initial processing whereas long-term memory serves as a permanent repository for knowledge. When learning occurs, the

information is input from the environment, processed and stored in memory, and output in the form of some learned capabilities [141].

Broadbent and Critical Thinking

Broadbent [76] proposed a filter theory of attention to indicate how much information a person can attend to at any given time. When the information available at any given time exceeds capacity, the person uses an attentional filter to let some information through and block the rest, especially to make a selection of what message to process early in the processing before the meaning of the message identified.

Broadbent [76] indicates the basic framework that people used and still used to the large extent to think about the basic mental processes involved in attention, perception, and memory. In the discussion of perception and attention, it indicates that people encode basic sensory information at a different level than they encode meaning. Attention capabilities are limited, and people can attend to a few things at once. Therefore, attention can be constructed as the process of selecting some of many potential inputs [67].

Attention can refers to a limited human resource expended to accomplish one's goal and to mobilize and maintain cognitive processes [172]. Norman [173] proposed that all inputs are attended to in sufficient fashion to activate a portion of long-term memory. The input was selected for further attention based on the degree of activation, which depends on the context, and then stimuli activate portions of long term memory, but attention involves more complete activation.

Neisser [171] suggested that pre-attentive processes are involved in head and eye movements and in guided movements. Attention is a necessary prerequisite of learning. Students are required to attend to the teacher's voice and ignore other sounds. Differences in the ability to control attention are associated with student age, hyperactivity, intelligence, and learning disabilities [172]. Attentional deficits are associated with learning problems such as excessive motor activity, distractibility, and low academic achievement. Thus, students have difficulties focusing and sustaining attention on academic materials.

Teachers can spot attentive students by noting their eye focus, their ability to begin working on cue, and physical signs indicating that they are engaged in work [174]. Teachers can also promote student attention to relevant materials through the

design of classroom activities. Eye-catching, student involvement, checking on student progress, individual work, group work, voice inflections, gestures, or moving around the classroom helps sustain student attention on the task. Also, various practices help keep classrooms from becoming too predictable and repetitive, which decreases attention. Teachers can vary presentations, materials used, student activities, and personal qualities such as dress and mannerisms.

Some key elements used to maintain student attention are including [67]:

1. Signals: Signals to the students at the start of the lessons or when they are to change activities

2. Movement: Moving while presenting materials to the whole class or moving around the room while students are engaged in seatwork

3. Variety: Using different materials and teaching aids or using gestures and avoid speaking a monotone

4. Interest: Introducing lessons with stimulating materials and appealing to students' interests at other times during the lesson

5. Questions: Asking students to explain a point in their own words or stressing that they are responsible for their own learning

Comprehension suffers when students do not pay adequate attention, and the actual types of processing students engage in must differ to account for subsequent comprehension differences [67]. Learners have some control over the process and may selectively focus attention to meet certain ends [172]. Selective attention refers to the learner's ability to select the process certain information while simultaneously ignoring other information.

Learners themselves may be taught to stay on task and selectively attend to important features of instruction [172], and this appears in two forms 1) learners should be taught to take more time in responding to a learning task and 2) they should be given a strategy for focusing attention and allowed to practice the strategy. Solving the problems require overcoming the effects of past experience on perception. The influences of past experience and context on perception come together in teachers' expectation about students, and it may affect their evaluations of student achievement, as well as their own behavior toward students [174].

Table 7 Summarization of Cognitive Information Processing Theory

Theorist	Contribution	Characterized by	Summarization
Broadbent	Attention	Atkinson and Shiffrin [75], Schunk [67], Grabe [172], Norman [173], Neisser [171], Good and Brophy [174]	1. Learning requires using different techniques and activities 2. Learning is related to students' experience. 3. Learning requires practicing.

6. Adult Learning Theory

Knowles [175] is the theorist who brought the concept of adult learning. He has argued adulthood has arrived when people behave in adult ways.

Adult Learning Theory and Critical Thinking

Adult learning theories provide insight into how adults learn, and can help instructors be more effective in their practice and more responsive to the needs of the learners they serve.

Adult learners are more utilitarian and discerning in what they are willing to learn, but more questioning and resentful of being told what to learn. They need to see more clearly what is being asked to learn will benefit for their learning [32]. Productive learning comes from the analysis of learners' experiences, and that is learning should begin with a topic that addresses the current learners' needs; be motivated from situations in which the learners see a need to learn, and be involved in setting a clear agenda using different techniques, methods, and multidisciplinary rather than subject-oriented [92].

Unlike pedagogical approach that the instructors know best what is to be taught and learned and where students are expected to learn the same things in the same ways or instructors as disseminators of knowledge and students as empty pots to be filled, andragogical approach is that the effective adult learning begins with where the learners are. The adult learners will learn faster if what they are learning has an

immediate effect on their current situations in life, and on the foundation of their interest [77].

Knowles [32] posted a set of assumptions about adult learners including:

1. Moving from dependency to increasing self-directedness as she/he matures and can direct her/his learning

2. Drawing on his/her accumulated reservoir of life experiences to aid learning

3. Being ready to learn when he/she assumes new social or life roles

4. Being problem-centered and wants to apply new learning immediately

5. Being motivated to learn by internal rather than external factors

Knowles [77] also suggested that adult educators should consider the following the implications for practice:

1. Setting a cooperative climate for learning in the classroom

2. Assessing the learner's specific needs and interests

3. Developing learning objectives based on the learner's needs, interests, and skill levels

4. Designing sequential activities to achieve the objectives

5. Working collaboratively with the learners to select methods, materials, and resources for instruction

6. Evaluating the quality of learning experience and making adjustments, as needed, while assessing needs for further learning

According to Knowles [176], adult learning involves six characteristics including:

1. Learning should be motivated: Clear learning activities should be demonstrated to the learners where they would benefit in their learning. The quality of learning is built around the concept of nourishing extrinsic (promotions or bonuses) and intrinsic motivators (self-esteem, broadened responsibilities, power, and achievement). Adults may not be satisfied with what is told unless they perceive needs to learn.

2. Learning should be self-directed: Learning should encourage adults to take freedom of responsibilities and making decisions, not designing adults where they

were told what, where, when, and how to learn. Learning puts the learners in charge of much more and incorporate them as much search and discovery as possible.

3. Learning should be goal-oriented: Learning should be based on the individual needs. The information taught should be included the reasons for learning. The benefits of learning should be authentically indicated, and the activities should be relevant to their real life-based work experiences.

4. Learning should be relevancy-oriented: Learning should be based on task-oriented, problem-solving, or life-centered orientations which are related to adult learners by their virtues of life and experiences. Concerning learning tasks, adult learners are required to do something with information rather than knowing it.

5. Learning should be practical and respected: Dumping the information on the adult learners through telling them that they need to know this information does not encourage them to learn. Adult learners are ready to learn when they experience in their real life situations, and that is a need to know or be able to do in order to perform more effectively and satisfyingly.

Adult learners want something more than fact-laden lectures, assigned reading, drill, quizzes, rote memorizing, and examinations, and then training must prepare them to face a novelty of conditions [77]. Adult learners' learning is learning how to learn, the skills of self-directed inquiry, and emphasizes on 1) experiential techniques such as group discussion, the case method, the critical incident process, simulation exercises, role playing, skill-practice exercises, field projects, action projects, laboratory methods, consultative supervision, demonstration, seminars, work conferences, counseling, group therapy, and community development, 2) practical application including illustrating life experiences drawn from learners, building into design of learning experiences provision for the learners to plan and rehearse how to apply their learning to their day-today lives, and 3) unfreezing and learning to learn from experience through building into the early phases of a course, workshop, conference, institute or other sequential educational activity to look at themselves more objectively and free their minds form preconceptions [77].

Adult learners tend to have a perspective of immediacy of application toward most of their learning and problem-centered in their orientation to learning. Learning should be largely response to pressures they feel from their current life

situation through improving their ability to cope with life problems, using problem-centered or performance-centered frame of mind [77]. Learning should be primarily concerned with the logical development of subject matter and attuned to be existential concerns of the individuals that they are able to develop learning. In this case, education is no longer a process of transmitting what is known but a lifelong process of continuing inquiry [77].

Kolb [145] expressed that four characteristics accounted for adult learning include:

1. Being related to experience
2. Reflecting on experience
3. Analyzing experience
4. Making sense of experience

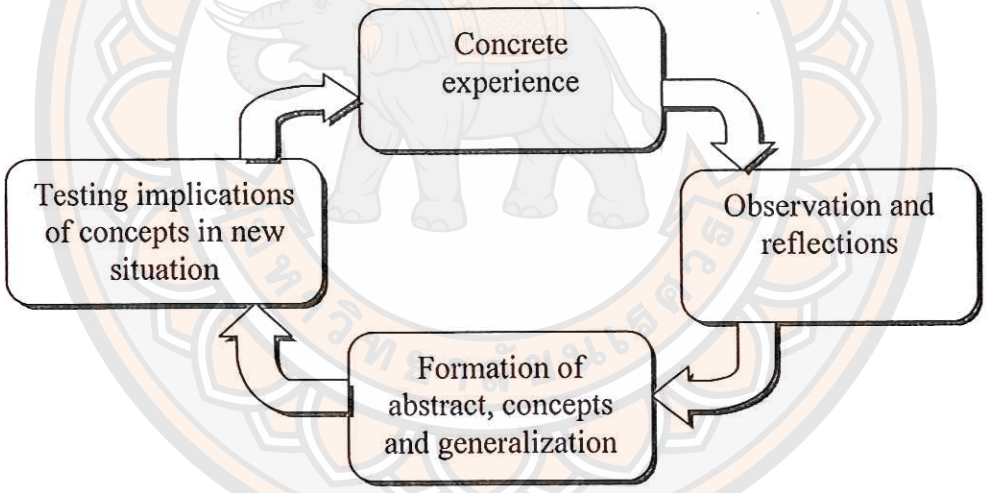


Figure 9 Experiential Learning Circle

Source: Kolb [145]

Adult learners learn in different ways. According to Akin [177], Adult learning is involved in actions-oriented rather than cognitive. The individuals actually learn when they are confronted with a learning situation. There are five characteristics of adult learning [177] including:

1. Social–oriented: Asking other people, sharing ideas and learning together to acquire new knowledge and skills

2. Role-taking oriented: Learning is less personalized, and that is fitting learning to the self, learning from broad, and abstract expectations rather than from another person's perspectives

3. Practical-oriented : Learning is involved in having high confidence in the ability to figure things out, to find out his/her own way, to discover for him/herself, and to try a new way until the problem, learning issue, or situations is solved

4. Anticipatory-oriented: Learning is related to careful and thorough understanding of a situation through planning and searching using deductive and inductive approach.

5. Scientific-oriented: Learning is involved in formulating hypothesis to see how things might work, trying out in a controlled, experimental way, and then carefully reflecting on the results

Adults need to know why they need to learn something and learn by doing, learning should focus on tasks rather than memorization of content, involving real-life problems.

Adults' learning is self-directed learning [178, 179, 180]. Self-directed learning is a process in which individuals take the initiative, without the help of others in planning, carrying out and evaluating their own learning experiences, and taking place outside classrooms [181]. Learners make their own decisions about the content, method, resources, and evaluation of the learning.

Relatively, adult learners learn best when they see:

1. The relevance of the taught concept is related to their experiences.
2. Discovery and exploration rather than the recipients of information.
3. The environment supports learning.
4. Learners are allowed to define their own needs.
5. Learning introduces personal growth opportunities.
6. Materials presented are relevant to learners' needs and experiences
7. Cooperative and individual exercises are actively participated
8. Life experiences of learners are respected.
9. Direction of learning makes explicit at the outset.

10. A variety of teaching methods and media are used.
11. Learners are empowered with their learning skills.
12. Timely feedback on practice activities is required.
13. Learners receive reinforcement for accomplishments.
14. The individuals are met.
15. Content is relevant and in integrated patterns.
16. Learners feel free to question and challenge.
17. Learner's self-esteem and ego-are respected.

According to Zoller and Harrison [182], adult learning appears in a form of student-centered and these are suggested as follows:

1. Adult learning activities such as role plays, scenarios
2. Inquiry-based dialogue
3. Reflecting on experiences
4. Group work, discussion, and problem-solving

The learner has the need and the capacity to assume responsibility for his own continuing learning [183]. Also, Gagné [184] identifies five domains of the learning process including motor skills-develop through practice, verbal information-the major requirement for learning being its presentation within an organized and meaningful context, intellectual skills-the learning of which appears to require prior learning of prerequisite skills, cognitive strategies-the learning of which requires repeated occasions in which challenges to thinking as presented, and attitudes which are learned most effectively through the use of human models and vicarious reinforcement.

Darkenwal and Merriam [185] listed several aspects of learning they considered to be pertinent to adult education. They stated that learning is affected by past learning amounts of the learner, intrinsic motivation of the learner, positive reinforcement by the instructor, an organization of material, repletion of concepts, the perceived meaning of tasks and materials, active participation by the learner, and physical and emotional environment created by the teacher.

Wircenski and Walker [186] stated that one of the most important goals of education is to introduce a sense of appreciation for the range of human experience. They said that the key to effective development of adult education is the relationship

between instructors and learners. The relationship requires an environment that facilitates cooperative planning, instruction, and evaluation.

Knowles [176] identified eight steps to developing a learning contract including:

1. Diagnose learning needs: A learning need is the gap between where we are now and where we want to be in regards to a particular set of competencies.

2. Specify learning objectives: Be sure that the objectives describe what will be learned, not what we do to learn them.

3. Specify learning resources and strategies: When finishing listing objectives, describe how you propose to go about accomplishing each objective. Identify the resources you plan to use in your field experience and the strategies you will employ in making use of them.

4. Specify evidence of accomplishment: After completing, describe what evidence you will collect to indicate the degree to which you have achieved each objective.

5. Specify how the evidence will be validated: After you have specified what evidence you will gather, specify what criteria will vary according to the type of objectives.

6. Review your contract with consultants: After you have completed the first draft of your contract, you will find it useful to review it with two or three friends, supervisors, or other expert resource people to get their reactions and suggestions.

7. Carry out the contract: Simply carry out the contract... as you work on it you may find that your notions about what you want to learn and how you want to learn it may change.

8. Evaluation of learning: When you have completed your contract, you will want to get some assurance that you have in fact learned what you set out to learn.

Table 8 Summarization of Adult Learning Theory

Theorist	Contribution	Characterized by	Summarization
Knowles	Motivated and self-directed, goal-oriented, relevancy-oriented, practical and be respected	Zoller and Harrison [182], Brookfield [178], Cross [179], Tough [180], Akin [177], Kolb [145]	1. Learning should be practiced and respect. 2. Learning is related to student's needs. 3. Learning is related to learner's experience. 4. Learning requires different techniques. 5. Learning is related to real life. 6. Learning should be motivated. 7. Learning should be goal- oriented.

Summarization of Cognitive-Based Approach

Cognitive-based approach refers to thinking using brain. It emphasizes the importance and usefulness of mental processes in learning occurring through the surrounded environment with an active and supportive role of learners' perceptions, thoughts, beliefs, attitudes, and values in constructions, acquisitions, retrieval, or even forgetting. In favor of this research study, constructivist learning theory, cognitive development theory, social-cognitive development theory, cognitive information processing theory, and adult learning theory are considered as main themes under covered by cognitive-based approach and used to foster in learner critical thinking.

Constructivist learning theory is that learner is free to conduct their own knowledge using past experiences, cognitive development theory concludes that learning is associated with learner development, needs, and experiences, social-cognitive development theory underlines that learning concerns social and cultural interaction and particularly based on self-instruction, cognitive information processing theory expresses that learning is analyzing the information, and adult learning theory focuses on freedom of individual learners.

Table 9 Summarization of Cognitive-Based Approach

Cognitive-Based Approach	Main Theorists	Contribution	Description
Constructivist learning theory	Bruner [70]	Discovery learning	1. Learning is involved in learners' experience 2. Learning is associated with learners' development and needs 3. Learning is about problem-solving or project-based
Cognitive development theory	Piaget [71]	Assimilation and Accommodation	1. Learning concerns searching for understanding new things 2. Learning concerns proving consistency with the external reality 3. Learning is involved in analyzing, discovering or judging
	Dewey [157]	Inductive and Deductive	
Social-cognitive theory	Meichenbaum [74]	Self-instructional training	1. Learning requires modeling 2. Learning requires using different techniques and activities 3. Learning is related to social interaction
Cognitive information processing theory	Broadbent [76]	Attention	1. Learning needs practice 2. Learning needs healthy and supportive environment 3. Learners construct and interpret their own learning

Table 9 (cont.)

Cognitive-Based Approach	Main Theorists	Contribution	Description
Adult learning theory	Knowles [77]	Motivated and self-directed, goal-oriented, relevancy-oriented, practical and be respected	1. Learning requires freedom of thoughts 2. Learning requires collaboration 3. Learning answers real life needs of learners 4. Learning requires motivation and encouragement

Critical Thinking

1. Definition of Critical Thinking

The original history of critical thinking was found in Socrates' work (469-399 B.C.). Socrates encouraged the young people who live in Athens to doubt, ask questions and think for themselves. Through well-reasoning thinking, human might see deeper realities in life [187]. Socratic Method which is about dialect inquiry and cross examination through critical questioning has been implemented until today. Plato has continued Socrates' work by advocating critical thinking, and he believed that truth, justice, wisdom, goodness, and honor could be perfectly obtained through interaction, dialogue, and reasoning (427-347 B.C.).

The effort to define critical thinking has received much attention; however, no consensus has been reached in regards to this concept's meaning [188]; Garrison [22]. Critical thinking is fundamental and ideal for education for four reasons including fostering students to think for themselves, preparing them for adulthood, being a core of educational activities and efforts, and involving careful analysis and reasons [189]. Critical thinking is also defined as "reasonable reflexive thinking that is focused on deciding what to believe and do" [19] and judged of good that meets standards or criteria of appropriate reason and acceptability [189].

Similarly, critical thinking is also conceived as the ability to reason well and disposition to value, seek, and determine goodness; govern beliefs and actions based on clear assumptions [190]. Critical thinking is viewed as "strictly analytical and evaluative, selective, an algorithmic process that consists in arriving at the correct evaluations of ideas, arguments or products" [191].

Critical thinking is essential to both public and private organizations, and it concerns the ability to analyze, reason, evaluate, make a decision, interpret information, devise creative solutions, break down the complicated problems, and draw conclusions [192]. Similarly, critical thinking requires persistence of effort and examination of information in light of facts and evidence through the use of information, logical inquiry and reasoning, the ability to interpret data, evaluate arguments, recognize relationships between ideas, draw conclusions, and make generalizations with accuracy, clarity, and discrimination [63].

Dewey [157] defined critical thinking "as active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusion to which it ends." Critical thinking is certainly based on criteria and closely related to critical reflection [148] which is appropriately moved by reasons and acquires reasoning skills, abilities, and dispositions [189] such as development of reflective judgment, complex problem solutions, assumptions regarding certainty, and facilitation of an integration of experience [193].

Critical thinker rejected the beliefs that are lack of reasonable foundations. Reason is a kind of movement that begins with an understanding of certain things naturally known as immutable principle and judgments made on the basis of these principles [194]. Bloom's Taxonomy model has influenced education through encouraging critical thinking. Lower-order thinking consisted of sub-skills including knowledge, comprehension, and application and higher-order thinking including analysis, synthesis, and evaluation require deep thinking and promote the development of critical thinking [195].

"Critical thinking refers to the use of cognitive skills or strategies that increase the probability of a desirable outcome which is purposeful, reasonable, and goal-directed" [196]. Also, "critical thinking is defined as the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing,

and/or evaluating information gathered from, generated from, or generated by observation, experience, reflection, reasoning, or communication, as guided to belief and action" [197].

Dispositions, criteria to make judgments, argument, reasoning, point of view, and procedures for applying criteria and judging are the vital elements of critical thinking [198]. According to Moon [199], critical thinking involves the process of analyzing the arguments introduced, making inferences, drawing logical conclusions, and critically evaluating all the relevant information as well as possible results made.

Critical thinking is defined as a set of skills used by individuals to simply take responsibility and be responsible for thinking [200]. The individuals who lack critical thinking skills are not able to distinguish why they do and why. According to Beyer [201], effective and critical thinking individuals continue to be doubtful about judgments until evidence is found, express a question, problem, or calm in a flawless way; don't act without thinking; and are willing to create thoughtful research and present reasons and evidence supporting the allegations of set forth.

McPeck [31] defined critical thinking as "the skills and propensity to engage in an activity with reflective skepticism". This definition refers to awareness of one's own thinking as well as self-correction. Also, Glaser [63] explained that the ability to think critically involves three things 1) an attitude being disposed to consider in a thoughtful way the problems that come within the range of one's experiences, 2) knowledge of the methods of logical inquiry and reasoning, and 3) skills in applying those methods. His explanation means that critical thinking requires persistent effort and examination of information in the light of facts and evidence. Problems could be solved and solutions discerned through the use of relevant information. The ability to interpret data, evaluated arguments, recognize relationships between ideas, draw conclusions, and make generalization is essential.

Critical thinking was defined as a process of purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference. This definition gives the ideal critical thinker. The ideal critical thinker is habitually inquisitive, well-informed, trustful biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry and persistent in

seeking results which are as precise as the subject and the circumstance of inquiry permit.

Ennis [35] defined critical thinking as reflective thinking that focuses on deciding what to do or what to believe. Bruning, et al. [111] further described reflective thinking as a reflective activity in which the goal is to understand the nature of a problem. The purpose of critical thinking is to evaluate information, enabling us to make informed decisions. Paul and Willsen [202] defined critical thinking as a systematic forming and shaping of one's thinking, "which is responsive to and guided by intellectual standards such as accuracy, relevance, clarity, precision, breadth, and depth". Also, critical thinking is that mode of thinking about any subject, content, or problem in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them [82].

Critical thinking refers to a wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome personal prejudices and biases; to formulate and present convincing reasons in support of conclusions; and make reasonable, intelligent decisions about what to believe and what to do [203]. Critical thinking is disciplined thinking governed by clear intellectual standards. Among the most important of these intellectual standards are clarity, precision, accuracy, relevance, consistency, logical correctness, completeness, and fairness [203].

Critical thinking can also be defined as involving an attitude of being disposed to consider problems and subjects in a thoughtful way, knowledge of methods of logical inquiry and reasoning, and some skills in applying those methods. Critical thinking can also be defined by an individual's ability to "identify central issues and assumptions in an argument, recognize important relationships, make correct inferences from data, deduce conclusions from information or data provided, interpret whether conclusions are warranted on the basis of the data given, and evaluate evidence or authority". Moore [131] defined critical thinking as the careful, deliberate determination of whether one should accept, reject, or suspend judgment about a claim and the degree of confidence with which to accept or reject that claim.

Halpern [48] defined critical thinking as "the use of those cognitive skills or strategies that increase the probability of a desirable outcome." According to Reid [204] critical thinking is also defined as "the conjunction of knowledge, skills, and strategies that promotes improved problem solving, rational decision making and enhanced creativity." Critical thinking is recognized as an essential part of education and a valuable life skill [205].

Bandman and Bandman [206] defined critical thinking as the rational explanation of ideas, inferences, principles, arguments, and assumptions that lead to conclusions, issues, statements, beliefs, and actions. Miller and Malcolm [207] defined critical thinking as a combination of attitude toward inquiry that was supported by discipline-specific knowledge and ultimately enhanced by the skill of application. Also, critical thinking refers to clarifying questions, looking for reasons, using credible sources, considering of the entire situation, keeping relevant information, looking for alternatives, open-mindedness, and drawing conclusions [108].

Critical thinking includes considering multiple viewpoints or taking both sides of an issue into account [208, 209]. One definition of critical thinking is "the ability to analyze facts, generate and organize ideas, defend opinions, make comparisons, draw inferences, evaluate arguments and solve problems" [29]. Nussbaum and Schraw [210] emphasized that effective argumentation includes not only considering counterarguments but also evaluating, weighing, and combining the arguments and counterarguments into support of a final conclusion.

Critical thinking is the art of thinking about thinking while thinking in order to make thinking better. Critical thinking involves three interwoven phases including analyzing thinking, evaluating thinking, and improving thinking [78]. The definition proposes that critical thinking is a complex process that requires the person's introspection and willingness to reflect about the process of thinking and take this process to the highest level. Dewey [87] defined critical thinking as "active, persistent, and careful consideration of a belief or suppose form of knowledge in the light of the grounds which support it and the further conclusions to which it tends.

Dressel [211] suggested that critical thinking involves five steps including 1) recognizing and defining a problem, 2) clarifying the problem by collecting necessary facts or information and recognizing assumptions being made, 3) formulating possible

explanations, 4) selecting one or more possible hypotheses for testing and verification, and 5) making final conclusions. Perkins [212] simply defined critical thinking as better thinking. This perspective suggested that learning to think critically develops our ability to collect, interpret, evaluate, and choose information for the purposes of making knowledgeable choices.

Critical thinking is a process that includes creative thinking [84]. This definition emphasizes that critical thinking enables us to both challenge assumptions and imagine and explore alternatives. McKeachie, et al. [65] attributed the improvement in critical thinking to three instructional variables including 1) student discussion, 2) explicit emphasis on problem solving, and 3) explicit emphasis on methods to encourage development of metacognition.

Dressel and Mayhew [213] identify four salient skills essential for critical thinking, and these are including:

1. Identifying central issues
2. Recognizing underlying assumptions
3. Evaluating evidence or authority by recognizing stereotypes and clichés, recognizing bias and emotional factors in a presentation, distinguishing between verifiable and unverifiable data, distinguishing between relevant and non-relevant, distinguishing between essential and incidental, recognizing the adequacy of data, determining whether facts support a generalization, and checking consistency
4. Drawing warranted conclusions

Ennis [35] elaborates twelve abilities associated with the definition of critical thinking, namely:

1. Focusing on a question
2. Analyzing arguments
3. Asking and answering questions of classification and or challenge
4. Judging the credibility of a source
5. Observing and judging observation reports
6. Deducing and judging deductions
7. Inducing and judging inductions
8. Making and judging value judgments
9. Defining terms and judging definitions

10. Identifying assumptions
11. Deciding on an action
12. Interacting with others

Table 10 Summarization of Definition of Critical Thinking

Descriptions	Theorists
Careful analysis and reason	Beyer [198], Siegel [189], Dewey [157]
Purposeful, reasonable, goal-directed, reasonable reflexive thinking	Facione [214], Halpern [196], Ennis [19], Elder and Paul [200]
Beliefs and clear assumptions	Aquinas [194], Paul [190]
Correct evaluation, accuracy, relevance, clarity, and precision	Blake, et al. [191], Paul [202]
Analyze, evaluate, interpret, synthesize, and draw conclusions	Taylor and Fratto [192], Glaser [63], Bloom [195], Scriven and Paul [197], Moon [199], Bassham, et al. [203]

2. Theories of Critical Thinking

New trends in education nowadays are focusing on developing critical thinking skills. Fisher [11] asserts that "in recent years, critical thinking becomes something of a buzz word in educational circles. For many reasons, educators have become very interested in teaching thinking skills of various kinds in contrast with teaching information and content." Critical thinking also becomes more important in competitive economic environment. It enables students to be flexible, self-directed, accountable, and set their own goals for life [192].

Sternberg [34] emphasizes intelligence which concerned critical thinking skills required in the 21st century. Sternberg's concept of intelligence is divided into three categories including 1) intelligence of solving problem and making decision (analytical/componential intelligence), 2) intelligence of using prior experience to work out the problem (experiential intelligence), and 3) flexibility in adaptation and accommodation (practical/contextual intelligence). In higher education, critical thinking tends to be emphasized on high–order or level of thinking which deals with adaptability, managing complexity, self-direction, curiosity, creativity, risk-taking,

comparing and contrasting ideas, evaluating evidence for claims or beliefs or interpreting information and drawing conclusions [82].

Argument is considered as basic to critical thinking, and it composes of reasons, evidence, accuracy, and conclusions. This argument is divided into 2 dimensions 1) deductive argument-proving from general premises to particular conclusive grounds and 2) inductive argument-moving from particular premises to probable or plausible conclusions [203].

Critical thinking is thought as a process involved in searching for knowledge through reasoning, problem-solving, and decision-making that guides us to accomplish the desired results more effectively and efficiently [56]. Relatively, critical thinking also concerns making meaningful and unbiased decisions or judgment using analysis, evaluation, inferences, interpretation, evidence, and explanation of the arguments [214]. This reveals that critical thinking cannot avoid including the elements of comparing and contrasting ideas, using clear sources of information and experiences, constructing beliefs based on evidence, seeking relationship and pattern, analyzing and interpreting the information, and drawing conclusions [82].

Critical thinking involves thinking reflectively and productively and evaluating the evidence. Thinking critically also means being open-minded and curious on one hand but avoid key mistakes in interpretation on other hand [138]. Thinking involves manipulating and transforming the information in memory done to form concepts, reason, thinking critically, and thinking creatively, make decisions, and solve the problems. Thinking concerns both inductive and deductive reasoning. The inductive reasoning is about drawing conclusions from general nature based on evidence whereas deductive reasoning is about something from general to the specific [138].

Critical thinking involves the process of the arguments occurred, making inferences, drawing logical conclusions, and critically evaluating all the relevant sources of elements and information to reach the possible consequences of each decision making [215]. Using dialogue, debate, and problem-solving, and engaging students in higher-order thinking tasks such as analysis, synthesis, and evaluation are also important to enhance critical thinking [216].

The interactions among students are vital to improve their thinking and learning. These interactions help them deepen their understandings through multiple perspectives while they are working, exploring, discussing, interpreting, and negotiating the ideas with their peers and others [217]. Critical pedagogy suggested that the best way to develop critical and reflective thinking is through curriculum that is oriented around activist approaches to teaching.

Geertsen [218] noted that the disposition of the student/thinker is as important as that of the teacher in developing call attention to critical thinking skills. Geertsen also added that there are three characteristics necessary to foster high-level thinking were open-mindedness, evidence-mindedness, and persistence-mindedness. Open-mindedness refers to respecting for other views; evidence-mindedness refers to withholding judgment until the evidence is reviewed, and persistence-mindedness is about willing to explore all possibilities and change when necessary.

Critical thinking requires a systematic approach that affords students an opportunity to skillfully evaluate information and reach the most favorable solution to a problem based on the known research [219]. Critical thinking is an important part of making judgments and deciding what to believe or do in a certain situation. Critical thinking involves weighing the evidence about a question or claim and using reasoning to make up one's mind about the question. Critical thinking is reflective thinking involved in the evaluation of evidence relevant to a claim so that a sound conclusion can be drawn from the evidence [220].

Generally, a critical thinker is believed to have the following characteristics 1) knowledge of reasoning, 2) cognitive skills involved in reasoning, 3) knowledge that is relevant to the problem that is being thought about, and 4) a set of dispositions to think critically [220]. During the elementary grades, it is reasonable to introduce critical thinking and concepts such as comparing, synthesizing, and reflecting. At the secondary level, it is more feasible and realistic to expand these building blocks to include higher-level thinking, metacognition, media literacy, and global awareness [218].

According to Greenstein [218], critical thinking involves:

1. Using/applying information or experience from past to present/future
2. Seeking and using information and data to strengthen conclusions and analysis
3. Using information and experience across disciplines and in real-world situations
4. Objectively reviewing evidence and data to support statements
5. Applying past experiences and learning to future planning
6. Managing complexity through multiple approaches
7. Proposing additional options
8. Revisiting, reviewing, and reconstructing patterns of beliefs based on new evidence
9. Evaluating a decision, an experiment, an argument, and a product
10. Recognizing and considering multiple perspectives
11. Comparing and contrasting ideas
12. Interpreting information and drawing conclusions
13. Evaluating evidence for claims and beliefs
14. Connecting facts and information to viewpoints and ideas
15. Analyzing a problem, an argument, causes and connections
16. Analyzing how parts interact and produce a whole compilation of knowledge, ideas, and beliefs
16. Seeking relationships and patterns
17. Grasping complex, abstract, and symbolic images, objects, and texts
18. Reasoning and making judgments, drawing conclusion/generalization about an issue or topic
19. Using multiple types of reasoning including inductive and deductive
20. Identifying gaps and deceptions and biases
21. Attending to contradictions and ambiguities
22. Recognizing unstated assumptions
23. Synthesizing knowledge, skills, beliefs, and dispositions
24. Connecting multiple pathways of thinking and learning
25. Combining evidence, arguments, claims, and beliefs

26. Linking together facts and parts into larger understanding
27. Looking for and seeing patterns and relationships among the elements

Table 11 Ordinary Thinking Compared with Critical Thinking

Ordinary Thinking	Critical Thinking
Guessing	Estimating
Preferring	Evaluating
Grouping	Classifying
Believing	Assuming
Inferring	Inferring logically
Associating concepts	Grasping principles
Making judgment without criteria	Making judgment with criteria
Noting relationships	Noting relationships among other relationships
Supposing	Hypothesizing
Offering opinions without reasons	Offering opinions with reasons

Source: Daiek [221]

Thinking is divided into two levels including lower-order thinking and higher-order thinking. Higher-order thinking is considered as essential to critical thinking [155]. Bloom, et al. [155] also stated that learning is divided into three domains including cognitive domain (knowledge), affective domain (attitude), and psychomotor domain (skills). Like Bloom, Watson and Glaser [222] expressed that critical thinking is a combination of attitudes, knowledge, and skills. This conceptualization suggested that critical thinking includes:

1. The ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true
2. Knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined
3. Skills in employing and applying the above attitudes and knowledge

A high level of competency in critical thinking, as measured by the Watson and Glaser [63], may be operationally defined as the ability to correctly perform the domain of tasks represented by the five tests:

1. Inference: Discriminating among degrees of truth or falsity of inferences drawn from given data

2. Recognition of assumptions: Recognizing unstated assumptions or presuppositions in given statements or assertions

3. Deduction: Determining whether certain conclusions necessarily follow from information in given statements or premises

4. Interpretation: Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted

5. Evaluation of arguments: Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular issue

According to Facione and Facione [223], the California Critical Thinking Disposition Inventory (CCTDI) is designed to measure seven aspects of critical thinking including:

1. Truth-seeking: Eager to seek the truth, courageous about asking questions, honest and objective about pursuing inquiry even if the findings do not support one's interest or one's preconceived options

2. Open-mindedness: Open-minded and tolerant of divergent views with sensitivity to the possibility of one's bias and respect the rights of others to hold different opinions

3. Analyticity: Alert to potentially problematic situations, anticipating possible result or consequences, and prizing the application of reason and the use of evidence even if the problem at hand turns out to be challenging and difficult

4. Systematicity: Disposition towards organized, orderly, focused, and diligently inquiry

5. Self-confidence: Level of one's trust one place in one's own reasoning processes

6. Inquisitiveness: One's intellectual curiosity and one's desire for learning even when the application of the knowledge is not readily apparent

7. Maturity: The critical thinking mature person approaches problems, inquiry, and decision-making with a sense that some problems are necessarily ill-structured. Many times judgments must be based on standards, context and evidence which preclude certainty

Critical thinking is the mental restructuring of perception from the five senses to form new ideas or beliefs based on a logical thought process that is objective and sequential. Presseisen [107] refers to four aspects of higher order thinking that interact with one another including:

1. Cognition: Mental acts by which long-term knowledge is acquired and remembered. These are perception, attention, learning, memory, reasoning, language, and emotion

2. Metacognition: The learner's knowledge or awareness of his or her own cognitive processes and products and the ability to regulate them

3. Conation: Motivational striving or attempting to do something directly with a learning experience

4. Epistemology: The different ways knowledge is characterized and the methods associated with defining and generating content

Critical thinking educational goals focus on developing students who are fair-minded, are objective, reach sound conclusions, and are disposed toward seeking clarity and accuracy [12]. The history of critical thinking skills were including sourcing-looking at the source of the document before reading and using that information to help interpret and make inferences about reading, corroboration-making connection between information in different texts and noting similarities and contradictions, and contextualization-imaging the time, place, people, and culture that is the context for the event, with all the political and social forces that might be operating [20].

A good critical thinker analyzes arguments, scrutinizes claims, seeks evidence, makes inferences, and synthesizes all of this prior to making a judgment and taking some action if required. The critical thinking process is reinforced by a disposition to use critical thinking in a variety of different situations. This disposition includes a tendency to reserve judgment, ask questions, and consider alternative possibilities [224].

Critical thinking is associated with 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 [225]. It is clear that critical thinking goes beyond simply recalling certain facts and information. Critical thinking requires individuals to understand and interpret information appropriately. Critical thinking requires individuals to understand and interpret information appropriately.

Critical thinking is "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by, observation, experiences, reflection, reasoning, or communication, as a guide to belief and action" [226]. Critical thinking skills are important because they enable students "to deal effectively with social, scientific, and practical problems" [226].

Critical thinking is an essential component of education, and it is an important life skill that everyone should acquire [205]. Students who are able to think critically are able to solve problems and make effective decisions. However, many teachers continually struggle to engage students in critical thinking activities [227], and students seldom use critical thinking skills to solve complex, real-world problems [228].

Paul [229] construes critical thinking as the ability to reach sound conclusions based on observations and information. For critical thinking to be fostered, it must be explicitly focused on and perpetually present and infused in the curriculum, individual courses, and the basic building block of formal education, the lesson plan [230]. Teachers should not confuse critical thinking with an educational strategy like lecture, small group discussion, experiments, role-play, or debate.

Brookfield [231] contends that critical thinking is a process. The definition included emotional as well as rational components and clearly acknowledges the importance of culture and context. The definition also contains the following common characteristics including identifying and challenging assumptions, challenging the importance of context, and trying to imagine and explore alternatives and reflective skepticism. Ferrett [232] advances the following characteristics of critical thinker:

1. Asks pertinent questions
2. Assesses statements and arguments
3. Be interested in finding new solutions
4. Be able to clearly define a set of criteria for analyzing ideas
5. Be willing to examine beliefs, assumption, and opinions, and weigh them against facts
6. Listens carefully to others and be able to give feedback
7. Sees that critical thinking is a lifelong process of self-assessment
8. Looks for proof
9. Examines problem closely
10. Be able to adjust opinions when new facts are found
11. Be able to reject information that is incorrect or irrelevant

The curricula of educational institutions should provide special system to develop the ability to think critically [233]. Critical thinking is necessary in students' reading, note making, assignment writing, tutorial presentations, and professional practice. Browne and Keeley [234] refer critical thinking as filtering, separating the relevant from the irrelevant. Chaffee [235] expressed that critical thinking is "making sense of our world by carefully examining our thinking and the thinking of others in order to clarify and improve our understanding. Also, critical thinking concerns understanding the argument, recognizing fallacies, distinguishing premises from conclusions, and isolating salient issues from non-relevant information [236].

Table 12 Summarization about Theories and Concepts of Critical Thinking

Theorists	Details of Critical Thinking
Facione [224], Bensley [220], Geertsen [218], Browne and Keeley [234]	Being open-minded, judging, asking questions, considering alternative possibilities, making a decision, drawing a conclusion
Woolfolk [20], Boyles [225], Paul [229], Brookfield [231]	Analyzing of problem, comprehending the consequence, challenging assumptions, exploring alternatives
Marzano, et al. [12], Bonwell and Eison [216], Bloom [155]	Seeking clarity and accuracy, analyzing, evaluating, synthesizing,

Table 12 (cont.)

Theorists	Details of Critical Thinking
Greenstein [82], Jonassen and Land [217], Chaffee [235], Ferrett [232]	Interpreting information, discussing and negotiating the ideas, examining to improve understanding, looking for proof
Thomson [219], King [215], Santrock [138]	Distinguishing between arguments, using deductive and inductive approaches,

3. Benefits of Critical Thinking

Critical thinking helps students to perform better through improving their abilities to discover ideas and issues, support, criticize, and interpret arguments, understand, examine, analyze, construct, and draw conclusions [80]. Two activities are considered central to critical thinking including identifying and challenging assumptions and exploring and imagining alternatives which are essential for adulthood and should be encouraged by asking higher order questions [84]. Critical thinking involves training students to use strategies and procedures and establishing some vital goals to support them in being more independent, open-minded, avoidance of egocentricity, stereotyping, and suspension of judgment until the appropriate evidence is indicated [229]. The main elements of critical thinking that should be taught and learned by students in order to reinforce their existing capacities are including "clarity, precision, accuracy, relevance, consistency, logical correctness, and fairness and understanding the arguments and beliefs of others, critically evaluating those arguments and beliefs, and developing and defending one's own well-supported arguments and beliefs" [17]. Relatively, the possibility to take part in the argument and decision making is complementary to critical thinking [237]. Critical thinking fosters students' abilities when they are treated to think for themselves and to assess the probative strength of reason [189].

Critical thinking actively concerns thinking skills divided into five dimensions including " 1) metacognition helps students to be aware of their own thinking as performing various tasks and operations that enable them to monitor, control their commitment, attitudes, and attention during learning, 2) critical and

creative thinking enables students to become objective, commit to accuracy and clarity, and help them form new combination of ideas that lead to creative output and result, 3) thinking process helps students well manage their mental operations through concept and principle formation, making comprehension, problem-solving, decision making, research, composition, and oral discourse, 4) core thinking skills is significant for students to function the broader dimensions of their thinking, and 5) the relationship of content-area knowledge to thinking identifies important models and modes of instruction in helping students to their academic disciplines and linking them to dimensions of thinking" [238].

With critical thinking, students are asked to evaluate and make critical judgments based on higher-level thinking processes including evaluation involves in giving opinions and making judgments, synthesis refers to drawing a new and original ideas, analysis concerns illustrating cause-and-effect relationships, application refers to implementing what has been learned in real life, comprehension is about depicting main ideas using one's own words, and knowledge is focused on recalling any specific information [155]. Provided with effective reasons using inductive and deductive, hiring system thinking through analyzing the interaction of every part involved, making judgments and decisions based on information, facts, experiences and processes, and holding innovative and various points of view to tackle the problems are considered the focal point of enhancing critical thinking for adult learners [14].

The interaction between learners and interpretation of content with reliable judgments or inference [239] and valid evaluation or adequate and correct judgment in forms of open-mindedness-listening to others and willing to change, objectivity-free of bias-avoiding grasping any unfair and personal opinion, and suspend judgment-getting clear evidence before judgment are essential to sustain critical thinking [240]. Critical and creative thinking go hand in hand. When solving the problems, critical thinking is needed to raise the ideas whereas creative thinking is required to tackle and control what looks the most promising [240]. Critical thinking is mental ability that helps students to think, engage in divergent thinking, to look for relationship among ideas, grapple with real-life issues, explain, add to, validate responses and answers, give reasons, evaluate, and encourages them to question, to analyze and to look beyond the superficial for all possible answers [241, 242]. Thinking skills are considered as key

dimensions to critical thinking, and in particular strengthening students' abilities through clarifying position or idea, analyzing competing views, weighing evidence, gathering new information, restructuring existing view of problem, or identifying and implementing a strategy [243].

Unlike ordinary thinking which is common and lack of having a clear reason and standard, critical thinking is based on objectivity and consistency and generally requires high level of thinking-more evaluation and synthesis than application or analysis [244]. As stated by Lipman [245], to enrich with critical thinking, students must be taught to change their thinking "1) from guessing to estimating, 2) from preferring to evaluating, 3) from grouping to classifying, 4) from believing to assuming, 5) from interring to inferring logically, 6) from associating concepts to grasping principles, 7) from noting relationships to noting relationships among relationships, 8) from supposing to hypothesizing, 9) from offering opinions without reasons to offering opinions with reasons, and (10) from making judgments without criteria to making judgment with criteria"

Critical thinking is valuable in many contexts which occur everywhere in human's life including "self-directed, self-disciplined, self-monitored, and self-corrective thinking in improving the quality of thoughts by skillfully analyzing, assessing, and reconstructing" [78]. The quality of thought is also related to three functions of mind including "1) thinking mind is to create meaning, 2) feeling mind is to monitor or evaluate the meaning created by thinking function, and 3) desiring mind is to allocate energy to action" [78].

Critical thinking involves thinking reflectively and productively and evaluating the evidence through deductive reasoning-conducting valid deduction from premises and inductive reasoning-making conclusion more definitive than evidence using quality and quantity of information available [138]. Critical thinking is "purposeful, reasoned, goal-directed thinking that involves solving problems, formulating inferences, working with probabilities, and making carefully thought-out decisions and useful in distinguishing among facts, opinions, working systematically towards desired goal, generating multiple solutions to problems, or understanding how causation is determined" [246].

Critical thinking is also vital for daily's life. In making any judgment, critical thinking is used to draw ideas from different resources, decide consequences, classify information based on facts and opinions, sequence ideas and events, use chronological order, define concepts, locate relevant data, exercise evidence to state generalizations, make inference based on data, identify cause-and-effect relationships, and adjudicate validity of information [79]. Non-thinking behaviors including "1) impulsiveness-responding before questions completed, 2) overdependence on teachers-asking before reading the instruction, 3) inattentive behavior-having short attention span, 4) restless rusher-finishing work early but lack of accuracy, 5) dogmatic/ assertive behavior-considering only self-perception, 6) rigidity/inflexibility of behavior-being reluctant to give up old strategies, 7) fearful/lack of confidence-sticking with one right answer, and 8) responsibility forfeiture-fear of taking risks negatively impact the development of critical thinking" [247].

Wade and Tavris [248] contend "critical thinking is the ability and willingness to assess claims and make objective judgments on the basis of well-supported reasons and evidence, rather than emotion and anecdote and not only indispensable in ordinary life but also fundamental to other fields implemented with asking questions or being willing to wonder, defining terms, examining the evidence, analyzing assumptions and biases, avoiding emotional reasoning, not oversimplification, considering other interpretations, and tolerating uncertainty". In addition, critical thinking is relevant to being active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of grounds that support it and further conclusions to which it ends [148] and to identify and understand the fundamental issues [249]. Critical thinking is also related to creative thinking which is defined as "grouping together information to reach a new understanding, concepts, or ideas through four stages including preparation-collecting the information and examination, incubation-forming hypothesis, illumination-allowing images from subconscious to surface, and verification-gaining confidence, verifying, and testing the ideas" [244].

4. Barriers to Critical Thinking

According to Bassham, et al. [203], some common barriers to critical thinking are as follows:

1. Lack of relevant background information

2. Poor reading skills
3. Bias, prejudice, superstition
4. Peer pressure, provincialism, narrow-mindedness
5. Close-mindedness, distrust in reason, stereotyping, scapegoating
6. Rationalization, short-term thinking, selective perception
7. Selective memory, overpowering emotions, self-deception
8. Face-saving, fear of change

More importantly, there are other five additional factors which extensively impede critical thinking [203]:

1. Egocentrism: Refers to seeing reality as centered on oneself which is selfish or self-absorbed. Egocentrism appears in two dimensions. Self-interest thinking is considered as a major obstacle to critical thinking in that it benefits oneself and self-reasoning. Self-serving bias refers to seeing oneself better than others and regarded as overconfidence which is resulted in an obstacle to genuine personal and intellectual growth.

2. Sociocentrism refers to group-centered thinking which hinders rational thinking due to focusing excessively on the group. There are two main characteristics of sociocentrism including group bias and conformism. Group bias is the tendency to see one's own group as being better than others, and it lies at a root of lack of critical thinking. Conformism refers to unthinking which follows the crowd, authority or group standards of conducts and belief and it seriously cripples power of critical reasoning and decision making.

3. Unwarranted assumptions and stereotypes refer unreasonable or assumptions taken for granted without good reasons whereas stereotype refers to hasty generalization.

4. Relativism refers to truth is a matter of opinion and appears in a form of subjectivism-truth of individual opinion and cultural relativism-truth for person.

5. Wishful thinking refers to believing something that is wished to be true, and considered as critical hindrances.

Another important constraint for developing students' critical thinking skills is the majority of teaching and learning instructions that were based on memorization of facts from lecture rather than active participation [64]. A review done

by Mckeachie [65], the result indicated that lecturing is less effective for long term knowledge retention, transfer of knowledge to new situations, higher-order thinking, attitude, and motivation for further learning.

Conley [250] stated that in assessing student performance in general education course at the college level, some argue that the nearly 50% failure rate in some courses can be contributed to poor study habits, a lack of understanding of the expectations of college instructors, and deficiencies in content knowledge and thinking skills. The lack of teacher's critical thinking was suggested by Willingham [208]. Teachers refused to incorporate critical thinking into their classroom instruction [251].

A research study "Perceptions of the Use of Critical thinking Teaching Methods" done by Kowalcyk, Hackworth, and Case-Smith [33], obstacles encountered when implementing critical thinking are including:

1. Need to deliver a large amount of information to cover the content
2. Students concern of getting a good grade versus learning
3. Insufficient time to learn new teaching methods
4. Lack of students motivation to become critical thinking
5. Lack of time for preparing and planning critical thinking
6. Students' expectations of lecture format instruction
7. Students' resistance to active learning
8. Lack of appropriate instructional materials
9. Insufficient class time
10. Lack of time in assessing students critical thinking skills
11. Lack of knowledge of how to promote students' critical thinking skills
12. Difficulty is assessing students' work that reflect critical thinking
13. Feeling of unpreparedness to teach critical thinking skills
14. Lack of knowledge of what constitutes critical thinking
15. Large number of students per class
16. Lack of administrative support in developing new teaching methods
17. Fear of negative student evaluation

According to a research study on "Teaching Critical Thinking and Problem Solving Skills" conducted by Snyder and Snyder [252], the result indicated that several barriers can impede critical thinking instruction including lack of training,

limited resources, biased preconceptions, and time constraints. These conspire to negate learning environments that promote critical thinking.

The lack of instructional materials, teaching strategies, and teacher training which are concerned with critical thinking is severely limiting students' abilities in the college classroom [61, 253]. Most instructional materials are more concerned with the quantity of information and not the quality of thinking required making rational decisions with the information [61]. Critical thinking is rarely taught explicitly and systematically at any level of education [254].

In a review of critical thinking in practice, Phillips and Bond [255] concerned that what universities view as critical thinking and what is needed for graduates to be successful may not match. The development of critical thinking can be in traditional settings, and university is asked to provide a proper account. Teaching to the test is another barrier to critical thinking. This method standardizes and inhibits the integration of critical thinking skills into classroom settings [256]. Also, teaching emphasis on remembering through reciting facts and information while students sit passively in the class, absorbing the information [193] does not lay a foundation of knowledge upon which students can think critically [257].

The lack of preparation is also considered as barrier to critical thinking. Most of educational programs do not instill critical thinking skills in the classroom. That is teachers teach what they know [78]. Moreover, there is some disagreement among scholars on which approaches work best to teach critical thinking.

5. Critical Thinking Assessment

More support has been offered in the literature for assessing critical thinking through the use of performance assessment and portfolios [258, 259, 260, 261] suggests that performance assessments allow learners to demonstrate what they can do in real situations rather than articulate how a task or skill should be completed. Brookfield [258] notes "assessment of critical thinking should allow learners to document, demonstrate, and justify their own engagement in critical thinking.

According to Spicer and Hanks [259], "multiple measures of critical thinking should be used in assessment" especially since no one test covers all dimensions of critical thinking. Worth [262] found that "the lack of a universal operational definition for critical thinking has created considerable variability

regarding the construct's measurement" There are a variety of standardized tools used to assess critical thinking, especially portfolio and performance assessment [259].

Several critical thinking assessments rely exclusively on recognition including the Measurement of Academic Proficiency and Progress, the California Critical Disposition Inventory and the Cornell Critical thinking Test. Several other critical thinking assessments rely exclusively on recall including the ICAT Critical Thinking Essay Examination, the Cornell (known as the Ennis-Weir) Critical Thinking Essay, and the Watson-Glaser II Critical Thinking Appraisal.

The Halpern Critical Thinking Assessment [263] is utilized for both recognition and recall. The HCTA is a reliable and well-validated assessment. The assessment has sufficient reliability (Cronbach alpha=.88) and inter-rater reliability (r=.93). This high level of reliability is due to a unique scoring method in which scores respond to simple prompts that are presented by a software system.

The Watson-Glaser Critical Thinking Appraisal (WGCTA)is a multiple-choice test designed for adult students with five main subsets including 1) inference-discriminating among degrees of truth or falsify of inferences drawn from given data, 2) recognition of assumptions-recognizing unstated assumptions or presumptions in given statements or assertions, 3) deduction-determining whether certain conclusions necessarily follow from information in given statements or promises, 4) interpretation-weighing evidence and deciding if generations or conclusions based on the given data are warranted, and 5) evaluation of arguments-distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question at issue [83].

Watson and Glaser [83] estimated internal consistency by calculating split-half coefficients, which resulted in a range of 0.69 to 0.85. The GCTA also yielded a test and retest reliability of 0.73, and alternate-forms reliability 0.75.

The Cornell Critical Thinking Test was first published in 1971, but the most recent version was introduced in 1985 and is based on Ennis' definition of critical thinking. There are two forms of variables, level X intended for elementary and middle school students and level Z intended for advanced or gifted high school students and adults. Both versions consist of multiple-choice items and employ a story format. The split half reliability estimates range from 0.76 to 0.87 for level X and 0.55

to 0.76 for level Z [264]. Although it has a particular concern of lack of evidence of the test's construct validity, this instrument is useful in the evaluation of teaching and/or curriculum development [264].

The California Critical Thinking Skills Test was published in 1992, and it is a multiple-choice test with five sub-scores including 1) analysis, 2) evaluation, 3) inference, 4) deductive reasoning, and 5) inductive reasoning. The total score internal consistency appears to be approximately 0.70.

The WGCT is considered as the major standardized instruments for measuring critical thinking comparing with others [259]. For this crucial reason, this instrument was selected to measure the achievement after the implementation of curriculum based on cognitive-based approach to enhance critical thinking.

Summarization of Critical Thinking

Critical thinking is considered as essential to the educational goal, and it also becomes a compulsory skill in the 21st century. Critical thinking is defined as the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. Moreover, it also concerns clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

Critical thinking entails the examination of elements of thought implicit in all reasoning such as purpose, problem, or question-at-issue, assumptions, concepts, empirical grounding, reasoning leading to conclusions, implications and consequences, objections from alternative viewpoints, and frame of reference. Relatively, critical thinking consists of a set of information and belief generating and processing skills and the habit based on intellectual commitment of using those skills to guide behavior.

Critical thinking is also intended as self-guided, self-disciplined thinking which attempts to reason at the highest level of quality in a fair-minded way. Critical thinking provides a great deal of benefits for daily's life, particularly in classroom and work place. Anyone who thinks critically consistently attempts to live rationally, reasonably, and empathically.

Table 13 Summarization of Critical Thinking Theory

Watson-Glaser [83]	Main Contributions
Inferences: Discriminating among degrees of truth or falsity of inferences drawn from given data	1. Facione, et al. [224]: Tendency to reserve judgment, ask questions, and consider alternative possibilities 2. Bensley [220]: Evaluation of evidence relevant to a claim so that a sound conclusion can be drawn from the evidence 3. Geertsen [218]: Open-mindedness, evidence-mindedness, and persistence-mindedness 4. Browne and Keeley [234]: Filtering, separating the relevant from the irrelevant
Assumptions: Recognizing unstated assumptions or presuppositions in given statements or assertions	1. Woolfolk [20]: Source, corroboration and contextualization 2. Boyles [225]: Using relevant data sources, incorporating varying perspectives into the analysis of the problem, generating viable alternatives, and comprehending the consequences of the suggested solutions 3. Paul [229]: The ability to reach sound conclusions based on observations and information 4. Brookfield [231]: Identifying and challenging assumptions, challenging the importance of context, and trying to imagine and explore alternatives and reflective skepticism
Deductions: Determining whether certain conclusions necessarily follow from information in given statements or premises	1. Marzano, et al. [12]: Fair-minded, objective, reaching sound conclusions, and being disposed toward seeking clarity and accuracy 2. Bonwell and Eison [216]: Analysis, synthesis, and evaluation are also important to enhance critical thinking 3. Bloom, et al. [155]: Analyzing, evaluating, and synthesizing 4. Greenstein [82]: evaluating a decision, recognizing and considering multiple perspectives, comparing and contrasting ideas, interpreting information and drawing conclusions, analyzing a problem…… 5. Scriven and Paul [226]: Applying, analyzing, synthesizing, and/ or evaluating information gathered from or generated by, observation, experiences, reflection, reasoning, or communication...

Table 13 (cont.)

Watson-Glaser [83]	Main Contributions
Interpretation: Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted	1. Greenstein [82]: Comparing and contrasting ideas, evaluating evidence for claims or beliefs or interpreting information and drawing conclusions 2. Jonassen and Land [217]: Working, exploring, discussing, interpreting, and negotiating the ideas with their peers and others 3. Chaffee [235]: Carefully examining our thinking and the thinking of others in order to clarify and improve our understanding 4. Ferrett [232]: Looking for proof, examine problem closely, being able to adjust opinions when new facts are found, being able to reject information that is incorrect or irrelevant…..
Arguments: Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular issue	1. Bassham, et al. [203]: Deductive and inductive arguments are 2. Thomson [219]: Skillfully evaluate information and reach the most favorable solution to a problem based on the known research 3. King [215]: The process of the arguments occurred, making inferences, drawing logical conclusions, and critically evaluating all the relevant sources of elements and information to reach the possible consequences of each decision making 4. Santrock [138]: Open-minded and curious on one hand but avoid key mistakes in interpretation on other hand

Teaching Critical Thinking

1. Definition of Teaching Critical Thinking

The most fundamental role of educators, especially those of adults, is to encourage and develop critical thinking not only because critical thinking is a central component of education, but also it is the one function that many learners find most difficult to perform themselves [22]. Smith [23] discovered that educators have proposed a number of interesting ideas or improving students' critical thinking, but they have reported little experimental research on the effectiveness of instructional

strategies. Also, McMillan [24] observed there is little evidence that critical thinking is shaped by the specific instructional variables.

The development of critical thinking skills is a highly regarded and well substantiated goal among educational researchers and teachers [200], but the actual teaching of critical thinking in college classrooms is a less than frequent occurrence [265]. One reason might be that few have been trained to teach these skills [266].

A survey of 300 US employers reported that 33% of new employees lacked the skills needed for entry level positions, and 31% lacked the critical thinking skills necessary for employment [55]. 81% of employers surveyed requested more critical thinking instruction for their current and prospective workforce. This call for a change in the way students are educated.

Much of educational reform seen in the last few decades has emphasized critical thinking instruction. There is much evidence that critical thinking can be taught and learned [56, 57], and researchers have discovered that explicit critical thinking instruction is more beneficial than implicit instruction [267]. Halpern [56] proposed a four-part model for teaching critical thinking skills that consists of 1) explicit critical thinking skills instruction, 2) encouraging students' disposition or attitude toward effortful thinking and learning, 3) directing learning activities in ways that increase the probability of trans-contextual transfer, and 4) making metacognitive monitoring explicit and overt.

Halpern [28] claimed that "better critical thinking can be improved with appropriate instruction", and good thinking is a skill that can be taught (Chance, 1986) and considered a learnable skill [30]. Also, critical thinking can be taught through drills, exercises, or problem solving [31] and enhanced through teaching and facilitation [32].

Halpern [28] intended that critical thinking skills do not necessarily develop as a by-product of discipline-specific work. It is specially designed course that focuses on generic thinking skills using varied examples. Courses designed specifically to teach critical thinking may be quite helpful in assisting learners and offering opportunities for them to practice which is considered as important to the development of critical thinking [48].There is empirical evidence that skills acquired during critical thinking instruction. Nisbett [21] and his colleagues provide the

strongest evidence for this in a series of studies conducted to determine whether critical thinking skills can be learned.

McMillan [24] reviewed 27 studies that investigated the effects of instructional methods, courses, programs, and general college experiences on changes in students' critical thinking. The results failed to support the use of any specific instructional method, course, or program to enhance critical thinking. Thus, classroom instruction is crucial to enhance critical thinking [24]. This could be assumed that if teachers use appropriate instructional methods and curriculum materials, students will improve their critical thinking skills.

According to Gadzella and Masten [25] found that the previous studies have not found overwhelming evidence that one best way for teaching critical thinking has been discovered. However, these studies identify numerous approaches showing promise in better promoting critical thinking in the classrooms. A previous review of the literature by McKeachie [26] cited seven studies to demonstrate that discussion classes are more effective than lecture classes in promoting retention and higher-level thinking. It was also found that student centered classes rather than instructor-centered classes promoted higher-level cognitive outcomes [26].

Lipman [268] believes that improving critical thinking skills in education will improve education altogether by increasing a student's quantity and quality of meaning from what a student reads, perceives, and in expressing what he or she says and writes. Schwabel's [269] research supports the expectation that formal thinking can be taught and facilitated in high school and college.

In student-centered classes, students are involved in problem-solving, cooperative learning, simulations, debates, and critical reporting sessions [270]. Kurfiss [30] suggests primarily teacher-focused approached, where instructors provided learners with some expert strategy, instead of student-focused approaches where students were encouraged to develop their own strategies for critical thinking.

Students entering college are expected to operate on the most complex level of the intellectual skills, problem solving. However, due to much of educational system is teacher-centered, many students do not operate effectively on the level of problem solving [271, 272]. Problem solving is the ability to thinking critically, to reason, and to base one's view on previously learned rules and concepts. Also, Gagné

[58] stated that as being for problem solving is an absence of any learning guidance, the solution would be discovered by the learner doing the problem solving. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge [273].

According to a research study "Perceptions of the Use of Critical thinking Teaching Methods" done by Kowalcyk, Hackworth, and Case-Smith [33], the classroom activities that support critical thinking include:

1. Team-based learning
2. Collaborative projects
3. Simulation modules
4. Scenarios with alternative methods/solutions
5. Concept mapping
6. Problem-based learning modules
7. Reflective journaling and portfolio development, research reports/critical analysis papers

Relatively, Gagné, et al. [274] also proposes conditions of learning which is recognized as essential to critical thinking and these conditions are including

1. Gaining attention of learner, informing leaders of the objectives of instruction
2. Stimulating recall of prior learning, presenting the stimulus (causing the need to learn)
3. Providing learning guidance, eliciting performance/learning activities
4. Providing feedback/prompts to critical thinking, assessing performance
5. Enhancing retention and transfer

According to Brown and Keelley [234], students' thinking is best supported when the instructors use critical questioning techniques to engage students actively in the learning process. The samples of questions are as follows:

1. What do you think about this?, Why do you think that?
2. What is knowledge based up on?, What does it imply and presuppose?
3. What explains it, connects to it, leads from it?, How are you viewing it?
4. Should it be view differently?

Socratic approach allows and stimulates student to develop their thinking and evaluate their thinking with logical reasoning. Socratic teaching consists of a teacher wondering about truth and meaning while actively continuing to identify clarity. Socratic questions to promote student critical thinking include [202]:

1. Question about clarification: What do you mean by.....?
2. Question about assumption: Why would someone make this assumption?
3. Question about reasons and evidences: What would be an example of .?
4. Question about viewpoints or perspectives: How are.....like...or different?
5. Question about implications and consequences: What is an alternative?
6. Question about question: Why is this question important

Open questions can be used to enhance critical thinking. Blosser [275] identified that open questions draw on students' past experiences and cause them to give and justify their opinions, to infer or identify implications, to formulate hypotheses, and to make judgments based on their own values and standards. During the class session, teachers can circulate the room and ask students to analyze their ideas [275] by using similar questions to the following list of example questions [247].

1. Would you give me an example of that, please?
2. Could you summarize what has been said?
3. What have you heard today that is inconsistent with what you initially thought?
4. Are there alternatives that we could explore?
5. How can we begin to categorize that which we have discovered so far?
6. In the data that we have collected, what are the trends?
7. From your collection of information, where can you identify support for your idea?
8. What are your assumptions about what will happen?

Bloom, Madaus, and Hastings [27] stated that education is a process of change, and that students must be changed in some way through the instruction they receive. A student's change in critical thinking capacity, during the class session, is directly associated with a teacher's delivery of subject matter content. Therefore, a goal in teaching thinking is for teachers to use questions to cognitively engage

students such that their capacity to think critically is sophisticated, and will transfer readily to situations that improve their quality of life.

Table 14 Bloom's Taxonomy

Evaluation	The ability to judge the value of material for a given purpose. The judgments are to the based on definite criteria. It incorporates or contains elements of knowledge, comprehension, application, analysis, and synthesis.
Synthesis	The ability to put parts together to form a new whole. Learning outcomes at this level stress creative behaviors with a major emphasis on the formulation of new patterns or structure.
Analysis	An understanding of both the content and structural form of material
Comprehension	The ability to grasp the meaning of material and goes just beyond the knowledge level. Comprehension is the lowest level of understanding.
Knowledge	The ability to remember previous learned material. It represents the lowest level of learning outcomes in the cognitive domain.

Ennis [276] proposes four approaches to including critical thinking skills in academic settings:

1. The general approach which consists of critical thinking skills that are taught in a course only for learning the associated skills.

2. The infusion approach, when critical thinking skills are taught within a specific subject and students are encouraged to think through the content versus memorization facts.

3. The immersion approach, which is similar to the infusion approach. However, students are not informed they are learning the concepts that characterize critical thinking skills.

4. The mixed approach, when students encounter critical thinking concepts and thinking strategies in a general course and later apply those concepts in their disciplines.

Behar-Horenstein and Niu [277] expressed that the immersion approach is the best method to teach critical thinking skills.

Nosich's [278] model, SEE-I, outlines four steps to critical thinking. The following illustration elaborates the meaning of SEE-I:

1. Sate it
2. Elaborate (Elaborate it more fully in your own words)
3. Exemplify (Give a good example)
4. Illustrate (Provide an illustration: metaphor, simile, analogy

Chaffee [279] provides objectives that guide and develop the strong critical thinking skills of students. Chaffee's objectives are:

1. Establishing and achieving goals
2. Encouraging intelligent and effective decision-making
3. Developing confident and productive creative thinking
4. Becoming an independent, informed, and open-mined critical thinker
5. Learning how to analyze and discuss difficult and controversial ideas in an orderly way
6. Becoming a strong and successful problem-solver
7. Familiarize oneself with perceptual lenses to view the world and understand how these lenses affect one's experience
8. Learning to develop informed, well-supported beliefs and achieve authentic knowledge of important issues
9. Learning to critically analyze information and images presented in the media, internet, and popular culture
10. Developing one' ability to understand and use language effectively with the purpose of expressing ideas with clarity and cohesiveness
11. Learning to develop concepts and apply them in order to understand the world clearly and in a sophisticated manner
12. Developing one' ability to relate and organize concepts in complex thinking patterns
13. Learning to thinking critically about ethical issues and moral beliefs
14. Learning to construct logically valid and compelling arguments to support a point of view

15. Learning to evaluate the logic of deductive and inductive arguments and detect illogical ways of thinking

16. Developing one' ability to make enlightened choices and work toward creating a meaningful and fulfilling life

2. Strategy of Teaching Critical Thinking

As illustrated in literature, there are many strategies and approaches for the enhancement of critical thinking. Critical thinking compromises the mental processes or strategies that students use to analyze and evaluate ideas, choices and concepts. Fogler [280] argues all models have key elements in common that critical thinking requires developing the abilities to

1. Judge the possibility of specific assertions
2. Weigh and validate the evidence
3. Assess the logical soundness of inferences
4. Construct counter arguments and hypotheses
5. Ask insightful and probing questions
6. Clarify and assess an idea's reasonableness

Also, all the models recognize that critical thinking is systematic, purposeful, use a range of mental processes and skills, is driven by standards of performance, and is highly metacognitive, learners reflect on and manage their own thinking through monitoring, evaluating, and revising in order to arrive at more thorough conclusions and decisions. Some examples of critical thinking skills would be [281]:

1. Comparing: Identifying the significance of the similarities and differences among various elements or aspects of a task

2. Classifying: Categorizing items according to their distinguishing characteristics

3. Analyzing: Separating a whole entity into its meaningful parts and understanding the relationships among those parts

4. Causal: Determining the cause/s of an event

5. Predicting: Making inferences about trends, the effects of an event or the consequences of options based on evidence

6. Evaluating: Making judgments about something by measuring it against a standard. This involves identifying appropriate criteria and assessing the extent to which these criteria are met

Shepard [282] stated that learning is an active process of mental construction and sense making. Active learning implies a shift emphasis from teaching to learning [283]. Active learning is the active or student-centered approached, focusing on involving students in the development of knowledge and leading to a deeper understanding of content and retention of learning [284].

The roots of active learning can be traced to the work of Dewey, Piaget, and Vygotsky. These theories posited that learning is based upon experience or active participation of the learner in the learning. As students engage in active learning, they employ critical thinking skills to draw meaning from their experiences. A variety of strategies have been used in the active learning such as (a) inquiry-based learning, (b) cased-based learning, (c) problem-based learning, (d) cooperative learning, (e) Bloom's cognitive taxonomy, and (f) Socratic questioning.

Inquiry-based learning: Dating back to the days of the Greek scholar, Socrates, the techniques of questioning, discovery and inquiry have been essential tools of the educator, reemphasize the work of Bruner [130, 133, 154, 285]. Inquiry-based learning is significant for improving student critical thinking. It is a type of learning achieved through the process of searching for information, knowledge, and truth by questioning. It can be used to solve authentic and challenging problems with combination of small-group collaborative activities and large group discussion [281].

In the process of inquiry, students identify problems, brainstorm solutions, formulate questions, investigate, analyze and interpret results, discuss, reflect, make conclusions, and present results [130]. This process creates inquiry-based learning circle as follows [281]:

1. Ask: Students propose questions or hypothesis
2. Investigate: Students plan and collect the data
3. Create: Analyze the collected data, formulate explanations, and summarize the evidence
4. Discuss: Students discuss findings, share ideas, and make conclusions

5. Reflect: Students reflect on the conclusions and forms the links to explanation

Case-based learning is the use of case method as part of teaching and learning strategy for a group of students. It is an approach used to promote effective student learning outcomes and in particular, the development of skills in thinking, ethical reasoning and interpersonal communication [281]. Cases are written descriptions of problems presented to students for analysis [286]. The use of case studies is as old as storytelling. Ancient storytellers as well as modern ones have used stories to encourage the development of reflective and critical thinking.

Merseth [287] explained that cases are carefully developed to engage students in meaningful discussion and reflective practices within an active learning environment. The goal of case study is for students to transfer the analytic and problem solving skills developed through the study of similar situations that occurs in real life [286]. Case studies engage students in a three-step critical thinking process including problem identification, brainstorming of potential solutions, and consensus concerning resolution [288].

Students often work in collaborative group to respond to questions that follow the case narrative. This process guides students to analyze and develop possible resolutions to the problems and issues presented in the case [289]. In starting the case discussion, a number of approaches can be equally effective. An example of this is as follows [281]:

1. Identifying the key issues
2. Deciding what issues
3. Asking questions to provide issue interaction
4. Relating issues to other situations
5. Evaluating the issues
6. Reflecting for implications

Problem-based learning is an educational process that requires the learner to go through the same activities during learning that are valued in the real world. It represents a constructivist perspective of learning in which learners actively construct knowledge by assembling new information and modifying their understanding in the light of the new data [281].

Problem-based learning is the learner-centered approach that emphasizes the constructivist perspective where learning is active and learners construct new knowledge based on prior knowledge and experiences. Learning is a construction of meaning that must have relevance and applicability to the learner [290], and this learning environment is considered as compulsory to enhance critical thinking. The problem triggers what students need to know from problem identification, articulating the root of problem, hypothesizing the causes and effects, seeking relevant knowledge and finally generating possible solutions [281]. This process could be suggested as follows:

1. Triggering activity
2. Identifying problems
3. Establishing learning issues
4. Evaluating information
5. Finding solutions
6. Presenting solutions
7. Reflecting outcome

Cooperative learning is an approach which allows students to cooperate with one another, lessen competitive behaviors, increasing overall learning and enhance interpersonal relationships [281]. Students work together in small, mixed-ability learning groups to maximize their own and each other's leaning [291]. There are five elements which distinguish cooperative groups from other groups: positive independence, individual accountability, cooperative skills, face-to-face interaction, and group reflection and setting goal [292]. Cooperative learning tasks often require more problem solving and necessitate high level of reasoning and critical thinking.

In developing students' cooperative skills, Johnson, Johnson, and Holubec [292], describe a six-step process for directly teaching cooperative skills:

1. Identify the skill by naming and defining it
2. Explain why it is needed
3. Demonstrate the skill
4. Provide opportunity to use and practice the skill
5. Provide feedback on the skill
6. Reflect on the performance of the skills and set future goals

Johnson, Johnson, and Holubec [292] describe certain standard procedures that are used repeatedly in cooperative lesson. These include:

1. Checking homework
2. Engaging in discussion
3. Drilling and Reviewing
4. Reading (Reading and explaining in pairs, reading comprehension triads, jigsaw)
5. Writing compositions
6. Resolving conflicts
7. Conducting projects

Bloom's cognitive taxonomy identifies six levels of thinking in hierarchical order of complexity including (a) knowledge, (b) comprehension, (c) application, (d) analysis, (e) synthesis, and (f) evaluation. The levels of analysis, synthesis, and evaluation were considered as high-order thinking that requires students to employ critical thinking, but knowledge, comprehension, and application described as low-order thinking [155]. However, the new revision is (a) remember, (b) understand, (c) analyze, (d) evaluate, and (e) create. Accordingly, any teacher who aspires to enhance the critical thinking skills of students will focus planning, instruction and assessment upon the higher order thinking skills of analyzing, evaluating, and creating.

1. Analyzing: Making by exploring and questioning so that its structure and parts can be understood, related, and connected or distinguishing between components
2. Evaluating: Combing, putting ideas together, judging the ideas based on criteria and standards, and testing hypothesis
3. Creating: Generating something new, putting elements into a coherent whole, and reorganizing ideas into new patterns

Socratic questioning is arguably the most popular method of teaching for the purpose of developing critical thinking skills [293]. This technique encourages active interaction between teacher and students as they respond to probing questions. Also, this technique is based upon the ideas that answers should not be the end of inquiry; instead, generating more questions. In this essence, thinking is driven by

questions, and only students who have questions are really thinking and learning [200].

Paul and Elder [78] identified three types of Socratic questioning including:

1. Spontaneous questioning: It can be described as unplanned or ongoing questions asked as a response to statement made by students.

2. Exploratory questioning: It consists of questions that are planned ahead of time for multiple purposes such as examining issues that spark students interest; identifying areas of disagreement between students, analyzing an issue; or evaluating student understanding.

3. Focused questioning: It is used to bring about a deep understanding of a topic of study by engaging students in an extended, ordered, and integrated dialogue.

3. Evaluation of Teaching Critical Thinking

Central to the notion of effective evaluation teaching is the concept of process utilization. Process utilization relates to and is indicated by individual changes in the ways of acting and thinking, as a result of evaluation learning on the part of participants during the process. Process utility evaluation in Patton's [294] perspectives equates with learning how to learn.

Bloom [155] understood the process of evaluation as the most sophisticated of cognitive skills. Bloom's taxonomy [155] enumerates levels of cognitive processing according to an increasing level of sophistication. The taxonomy unfolds through knowledge, comprehension, application, analysis, and synthesis and culminates with evaluation. From Bloom's work with an assembled panel of critical thinking experts, Facione [214] derived an analysis of cognitive skills as central or core facets of critical thinking including analysis, evaluation, and inference.

Ennis [295] also viewed evaluation as playing a prominent part in critical thinking, joining with reasoning, problem solving, and analysis. Interconnection between evaluation and critical thinking suggest evaluation depends on the evaluator's ability to assess all key elements in critical thinking to include identifying problem [296], developing appropriate plans to solve the problems [297], exploring alternative ways of helping clients [298], and evaluating the effectiveness of the evaluation process [197].

Scrivens's [197] analysis of the essential components for excellence in evaluation requires deep reflection and critical thinking. Scriven's evaluation system hinges entirely upon full engagement of highest order critical thinking. This process allows for analysis, structuring, and interpretation of results entirely derived from the intermediate evaluation context through the whole process of evaluation.

Summarization of Teaching Critical Thinking

Critical thinking is considered as a central component of education, but the actual teaching of critical thinking is less the frequent occurrence, and few instructional variables have so far been found. Active or student-centered approach which involves students in construction of knowledge and leading to a profound understanding of content and retention is considered as vital in fostering student critical thinking. The active learning consisted of several strategies including 1) inquiry-based learning, 2) case-based learning, 3) problem-based learning, 4) cooperative learning, 5) Bloom's cognitive domain, and 6) Socratic questioning. Each strategy was critically synthesized into theme and pattern which were used to construct an instructional model to teach critical thinking (See table 15 below).

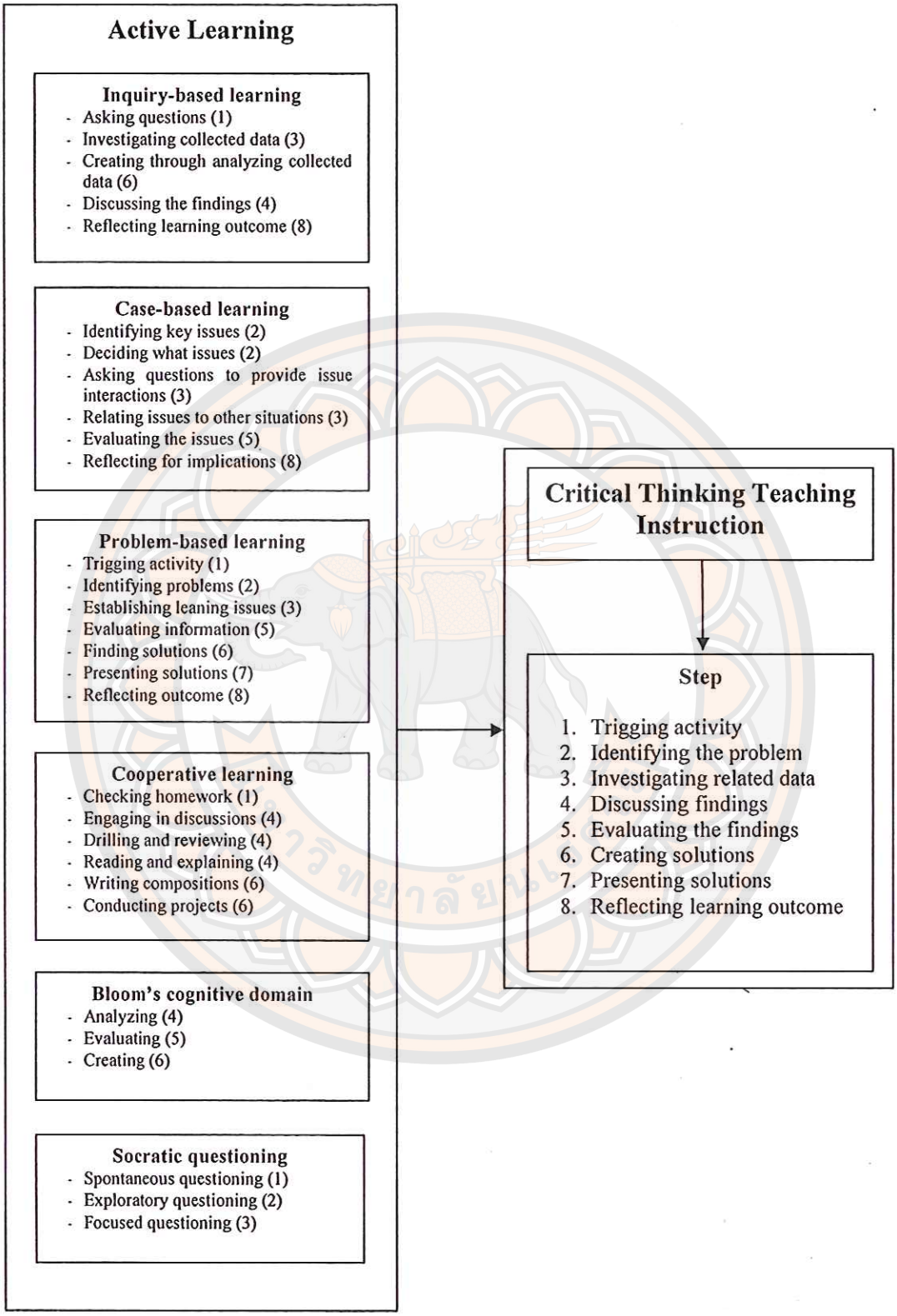


Figure 10 Synthesis of Teaching Critical Thinking

Based on the synthesis of related strategies used to enhance critical thinking, four compulsory components of learning instruction were identified including:

Step 1: Triggering activity: This step alerts learners what is going to come and stimulates their curiosity and anticipation in order to establish learning issues.

Step 2: Identifying problem: This step involves learners in identifying the problem through conducting literature search with an aid of critical articles provided and then explaining in their own words what the problem is about.

Step 3: Investigating related data: This step involves learners in interacting with an authentic learning environment, and they were actively engaged in the collection of data to verify their hypotheses

Step 4: Discussing findings: This step encourages learners to use different platforms to share their ideas and discuss their findings through working individually, in pairs and in groups.

Step 5: Evaluating findings: This step involves learners in analyzing, and evaluating the findings using alternative sources of information collected on the problem.

Step 6: Creating solutions: This step engages learners in constructing new knowledge through presenting possible solutions and options for solving the problem based on their own experience and previously acquired knowledge.

Step 7: Presenting solutions: This step involves learners in presenting their solutions to the class using different methods such as poster, mind map, chart, or demonstration.

Step 8: Reflecting learning outcome: This step involves learners in demonstrating the ability to understand the implications and to refine the existing questions and raise new ones.

Related Researches

Critical thinking demands strategic use of cognitive skills that best suit a particular situation, as well as an active control of one's own thinking processes for well-justified conclusions. Critical thinking is important for daily's life, and thought as a focus of educational purpose. The individuals have confronted unlimited amount of information, complex problems, and rapid technological and social changes. Critical thinkers analyze arguments, recognizing the essentiality of asking for reasons and considering alternative views and developing their own points of view [190]. The ability to participate in sound argument is central to critical thinking and is essential to skilled decision making [237].

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 investigation [66]. Cognitive processing expresses the way that students learn or concerns the development of their thinking abilities such as analysis, inference, induction, and evaluation [68].

Arum and Roksa [43] tracked 2,300 students of traditional college age enrolled in a range of four-year colleges and universities in the United States. Their study indicated that at least 45% of students did not demonstrate significant gains in critical thinking skills during the first two years of college. For students completing four years of college, 36% did not show significant improvement. Therefore, an emphasis on critical and analytical reasoning in the university curriculum should be enhanced.

In higher education, critical thinking can be presented through student's mastery of intellectual skills and abilities, but teaching and evaluation of critical thinking in the current college classrooms and curricula is insufficient [51]. According to the American Association of Colleges for Teacher Education [52], the report indicated that higher education has been criticized for its lacking in preparation of students for lifelong learning and working skills such as problem solving, critical thinking analysis, teamwork, and communication skills considered as essential in today's life and workplace.

Stupinsky, Renaud, Daniels, Haynes, and Perry [36] conducted a research on "critical thinking dispositions and perceived academic control and achievement of pre-service teachers." The findings revealed that college students who resulted in high academic achievements had a strong commitment to think critically. In investigation of discernment of critical thinking, Alazzi [37], in his study, agreed with the recognition of critical thinking in junior high school environment and inferred that more exploration on how critical thinking taught, learned, and judged are required and explicated. Gehrett [38, 39] clarified that any student who 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.

Davidson and Dunham [299] conducted the research on the "impact of a critical thinking skills seminar on Japanese students enrolled in English as second language course. The results found that students who received critical thinking skills scored significantly higher than on the standardized posttest. Relatively, Browne, et al., found that college freshmen enrolled in a special course designed to teach critical thinking skills outperformed college seniors on a standardized posttest.

Ashman and Conway [300] believe that cognitive education approach involves improving critical thinking and problem solving abilities of learners. Students are "rarely provided with instruction or experiences that allow them to learn about learning and learn about problem-solving" [300]. Cognitive education approach focuses on "how to derive maximum information from the learning or problem-solving situation, how to formulate a suitable strategy for dealing with the task at hand, how to enact the strategy, and monitor performance until the goal is achieved" [300].

Paul [202] stated that critical thinking can be defined in a number of ways which are actually consistent with one another and are "at best scaffolding for the mind." This definition illustrates that critical thinking must entail self-improvement and improvement results from using standards to assess thinking. Whether the outcome is problem solving, criticism, or decision making, critical thinking applies intellectual criteria or standards and requires self-regulation and metacognitive awareness [301].

Skills include identifying informational sources, analyzing sources for credibility, reflecting on prior knowledge and making connections, and drawing conclusions are all involved in critical thinking and are based on the constructivist theory, which states that learners need experiences that enable them to construct knowledge and promote thinking [302].

Halpern [56] defined critical thinking as "the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed-the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task."

Critical thinking should foster the importance of students' asking new questions, developing new problems, and seeing new perspectives [253]. This was supported by many critical thinkers in that critical thinking can be taught; it is not necessarily an innate ability or natural ability, but the instruction is required [61, 303] and can be taught separately or required an interplay while students are doing and learning [254, 233, 304].

Dewey [305] believed that the purpose of education is to teacher learners' skills that will be useful to them as individuals, to the community, and to society as a whole. Dewey believed that practical experiences and problem-solving are the conduits of knowledge and values. The goal of education then is to provide proper environment with opportunities to cultivate mental discipline, and introduce methods of inquiry and reasoning that will enable students to reach appropriate conclusions and sound decisions. Siegel [306] voiced that a successfully educated learner is expected to have attained a certain knowledge base, from simple facts to complex theoretical and abstract processes. The ultimate task of education is to teach and develop the critical thinking abilities in students that they need to function in a specific environment.

Conceptual Framework

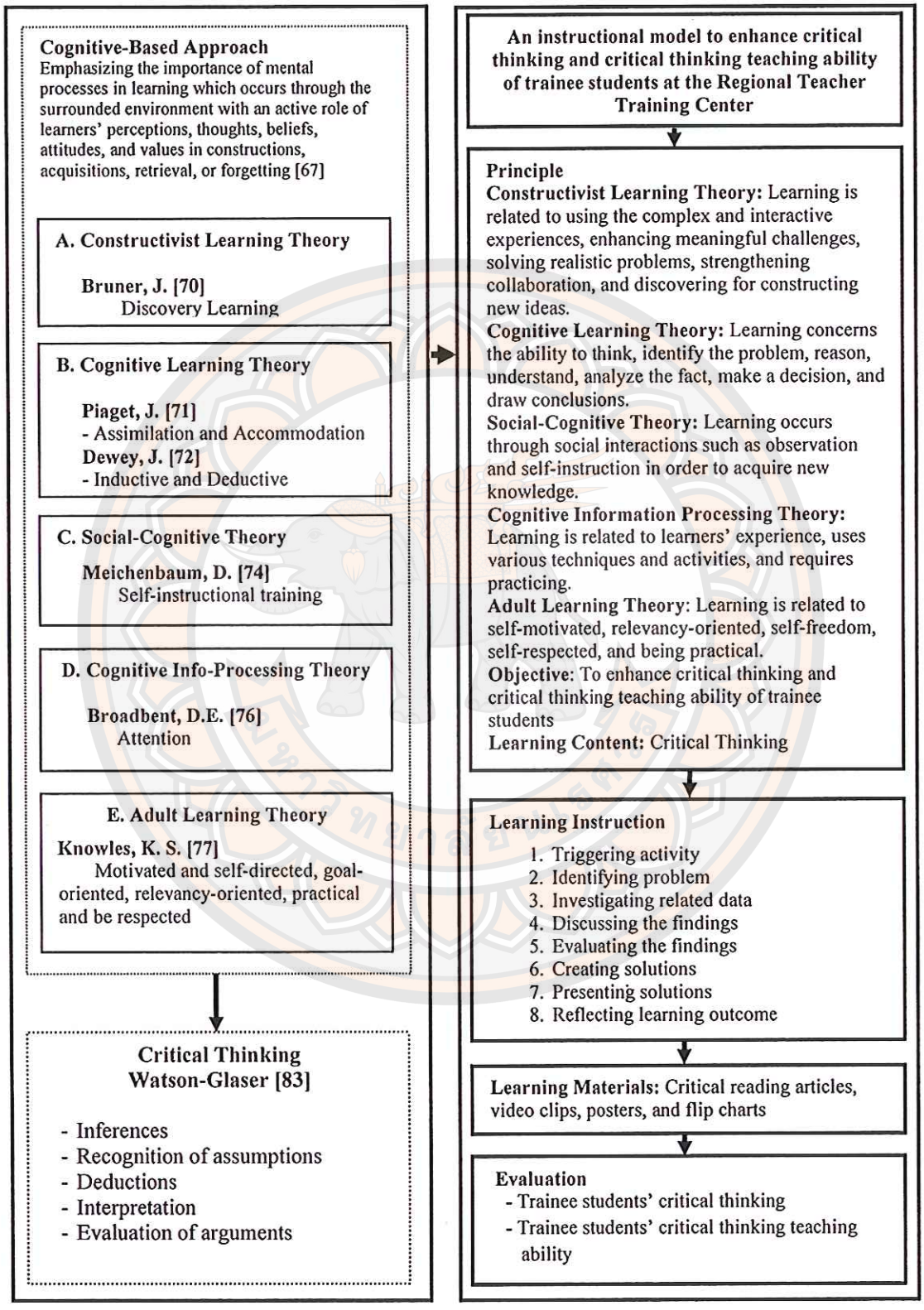


Figure 11 Conceptual Framework

CHAPTER III

RESEARCH METHODOLOGY

The focus of this study was 1) to develop an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability, 2) to implement an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability, and 3) to evaluate an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. This chapter describes and explains the research design and development, implementation, and evaluation of an instructional model development.

1. Research Design and Development
2. Implementation of Instructional Model
3. Evaluation of Instructional Model

The overall of research procedure comprised three compulsory steps including the design and development, implementation, and evaluation. The design and development were identified through what was to be done and how to accomplish the needs; the implementation was involved in activating an instructional design, and the evaluation was the progress of effort towards achievement of the desired goals focusing on validation of progress rather than an evaluation or judgment of results. The research procedure of this study was summarized as follows:

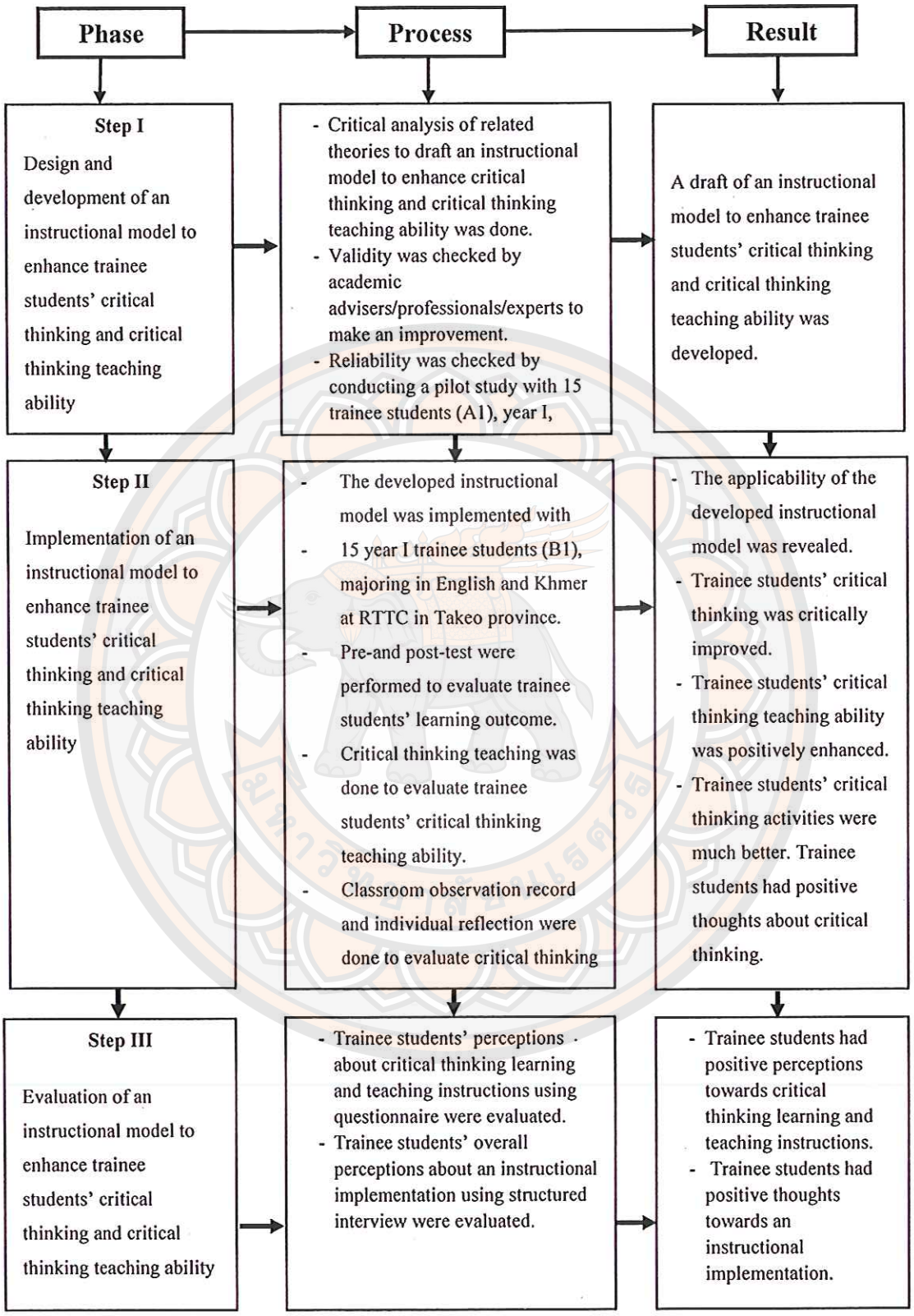


Figure 12 Summarization of Research Procedure

Step I: Research Design and Development

1. Design of Instructional Model

The activation of an instructional design often calls for some sort of management system that takes the basic plan for changing or improving the curriculum and drives it towards completion. Involved in this step are things such as the application of resources and training for those in needs of skills.

The researcher applied deductive and inductive approaches to construct the conceptual framework and to develop an instructional model to enhance trainee students' critical thinking and critical thinking teaching ability. Deductive approach is a form of thinking in which the conclusions are derived from general rules and principles and are used to derive testable hypotheses from a theory [156]. Concerning this matter, the researcher employed the deductive approach to investigate and gather the best findings from the related theories and concepts used as basis for an instructional model development.

The researcher assembled, analyzed, and synthesized the data from the literature about the use of instructional development theory, cognitive-based approach, critical thinking theory, and strategies to teaching critical thinking for the development of an instructional model to enhance trainee students' critical thinking and critical thinking teaching ability. All the data were summarized and grouped into themes which were the explanations of a natural consequence of sense making for an instructional model development.

The inductive approach is a form of thinking in which generalizations result from an accumulation of evidence. At best induction yields generalizations that are more or less likely to be true depending upon the strength of the evidence [156]. The researcher employed this approach in order to check the quality of an instructional model development. After the instructional model was developed, the copy was submitted to the subject matter experts, academic advisers, and professionals so as to comment and evaluate its suitability and applicability.

The design of an instructional model development was divided into four main characteristics involved in the literature review as follows:

1.1 First Literature Review

The first literature review determined how to best design, develop, implement, and evaluate an instructional model. This literature review served as the formative review and introduced the steps and elements considered as compulsory to design and develop an instruction to enhance trainee students' critical thinking and critical thinking teaching ability.

1.2 Second Literature Review

The second literature review was the compilation and confirmation of theoretical support from cognitive-based approach consisting of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information-processing theory, and adult learning theory considered as compulsory to conceptualize and operationalize the conceptual framework.

1.3 Third Literature Review

The third literature review was focused on obtaining an understanding of the perspectives of critical thinking. This review illustrated the importance, assessment, and barriers of using critical thinking and how critical thinking has been implemented in order to build the conceptual framework to solve the research problem.

1.4 Forth Literature Review

The fourth literature review was related to an understanding of the effective strategies used to teach critical thinking. This review indicated the particular approaches including problem-based learning, case-based learning, inquiry-based learning, cooperative learning, Bloom's cognitive domain, and Socratic questioning which are potentially used to shape learning instruction to enhance critical thinking.

2. Draft of Instructional Model Development

Cognitive-based approach, critical thinking theory, and strategies to teaching critical thinking were critically reviewed and the findings were used as theoretical bases to enhance trainee students' critical thinking and critical thinking teaching ability.

2.1 Cognitive-Based Approach

Cognitive-based approach consisted of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive-information processing theory, and adult learning theory, and the findings were summarized as follows:

Constructivist learning theory: Only discovery learning found by Bruner was critically reviewed and used to enhance critical thinking. Basically, the findings found that learning is related to using the complex and interactive experiences, enhancing meaningful challenges, solving realistic problems, strengthening collaboration, and discovering for constructing new ideas.

Cognitive development theory: Both Piaget's theory concerning assimilation and accommodation and Dewey's theory related to inductive and deductive approaches were extensively investigated and employed to foster critical thinking. Relatively, the findings revealed that learning concerns the ability to think, identify the problem, reason, understand, analyze the fact, make a decision, and to draw conclusions.

Social-cognitive theory: Only self-instructional learning found by Meichenbaum was thoroughly reviewed and utilized as theoretical basis to promote critical thinking. Regarding this theory, the findings indicated that learning occurs through social interactions such as observation and self-instruction in order to acquire new knowledge.

Cognitive-information processing theory: Only theory of attention found by Broadbent was sensitively reviewed and used as fundamental rationale to improve critical thinking. The review revealed that learning is related to learners' experience, uses various techniques and activities, and requires practicing.

Adult learning theory: This theory found by Knowles was critically reviewed and used to form the basic principle in order to enhance critical thinking. Concerning this theory, the findings illustrated that learning is related to self-motivated, relevancy-oriented, self-freedom, self-respected, and being practical.

2.1 Theory of Critical Thinking

Critical thinking theories were critically investigated and the findings revealed that five main elements of critical thinking found by Watson-Glaser were considered as pivotal key concepts for an instructional development.

Inference: Referred to discriminating among degrees of truth or falsity of inferences drawn from given data

Assumptions: Referred to recognizing unstated assumptions or presuppositions in given statements or assertions

Deductions: Referred to determining whether certain conclusions necessarily follow from information in given statements or premises

Interpretation: Referred to weighing evidence and deciding if generalizations or conclusions based on the given data are warranted

Arguments: Referred to distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular issue

2.3 Strategy of Teaching Critical Thinking

Active learning was considered as one of the effective approaches used to enhance critical. The active learning consisted of different strategies was extensively investigated and the findings were utilized to fabricate learning instruction to enhance critical thinking.

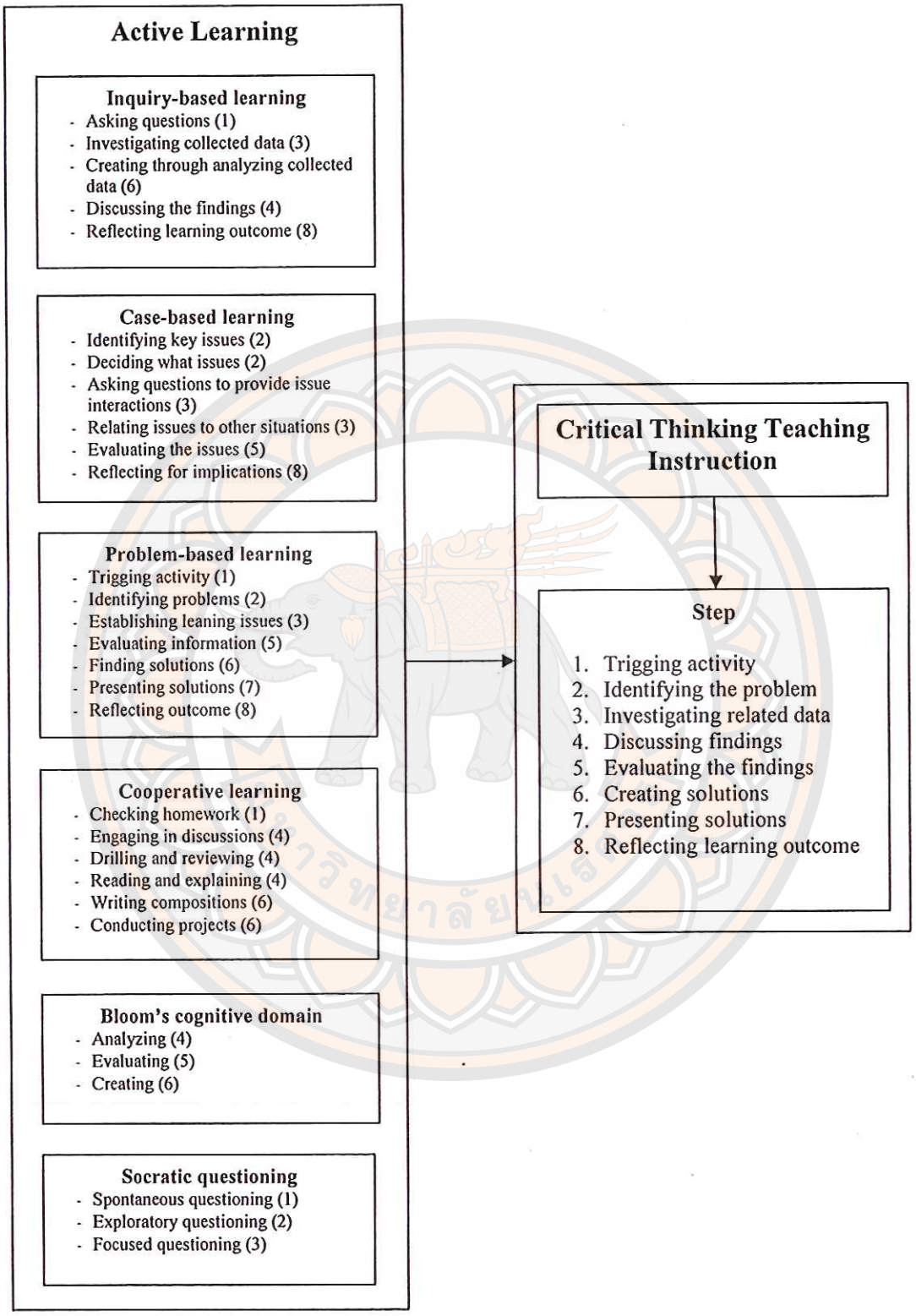


Figure 13 Learning Instruction to Enhance Critical Thinking

Step 1: Triggering activity: This step alerts learners what is going to come and stimulates their curiosity and anticipation in order to establish learning issues.

Step 2: Identifying problem: This step involves learners in identifying the problem through conducting literature search with an aid of critical articles provided and then explaining in their own words what the problem is about.

Step 3: Investigating related data: This step involves learners in interacting with an authentic learning environment, and they were actively engaged in the collection of data to verify their hypotheses

Step 4: Discussing findings: This step encourages learners to use different platforms to share their ideas and discuss their findings through working individually, in pairs and in groups.

Step 5: Evaluating findings: This step involves learners in analyzing, and evaluating the findings using alternative sources of information collected on the problem.

Step 6: Creating solutions: This step engages learners in constructing new knowledge through presenting possible solutions and options for solving the problem based on their own experience and previously acquired knowledge.

Step 7: Presenting solutions: This step involves learners in presenting their solutions to the class using different methods such as poster, mind map, chart, or demonstration.

Step 8: Reflecting learning outcome: This step involves learners in demonstrating the ability to understand the implications and to refine the existing questions and raise new ones.

3. Instructional Model Development

An instructional model to enhance trainee students' critical thinking and critical thinking teaching ability was developed based on models of teaching found by Joyce and Weil [81]. The models consisted of four potential components as follows:

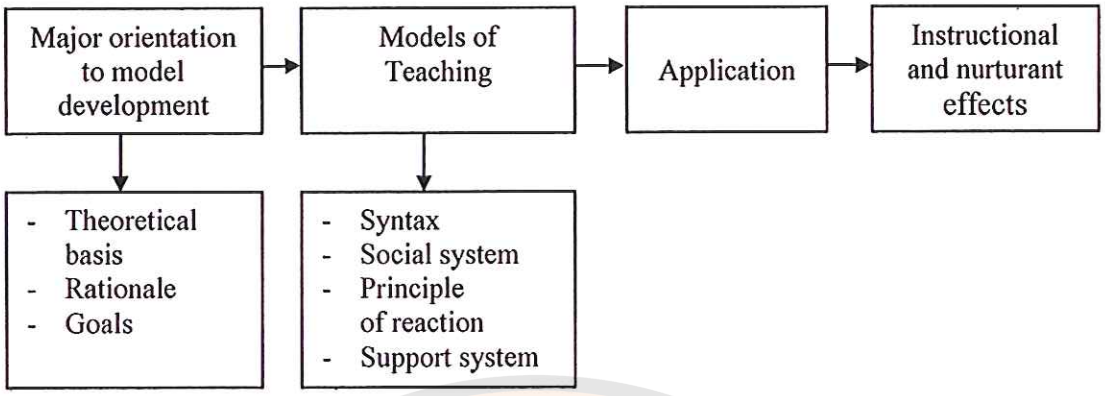


Figure 14 Models of Teaching

Based on the models of teaching found by Joyce and Weil, the following instructional model to enhance trainee students' critical thinking and critical thinking teaching ability was developed.

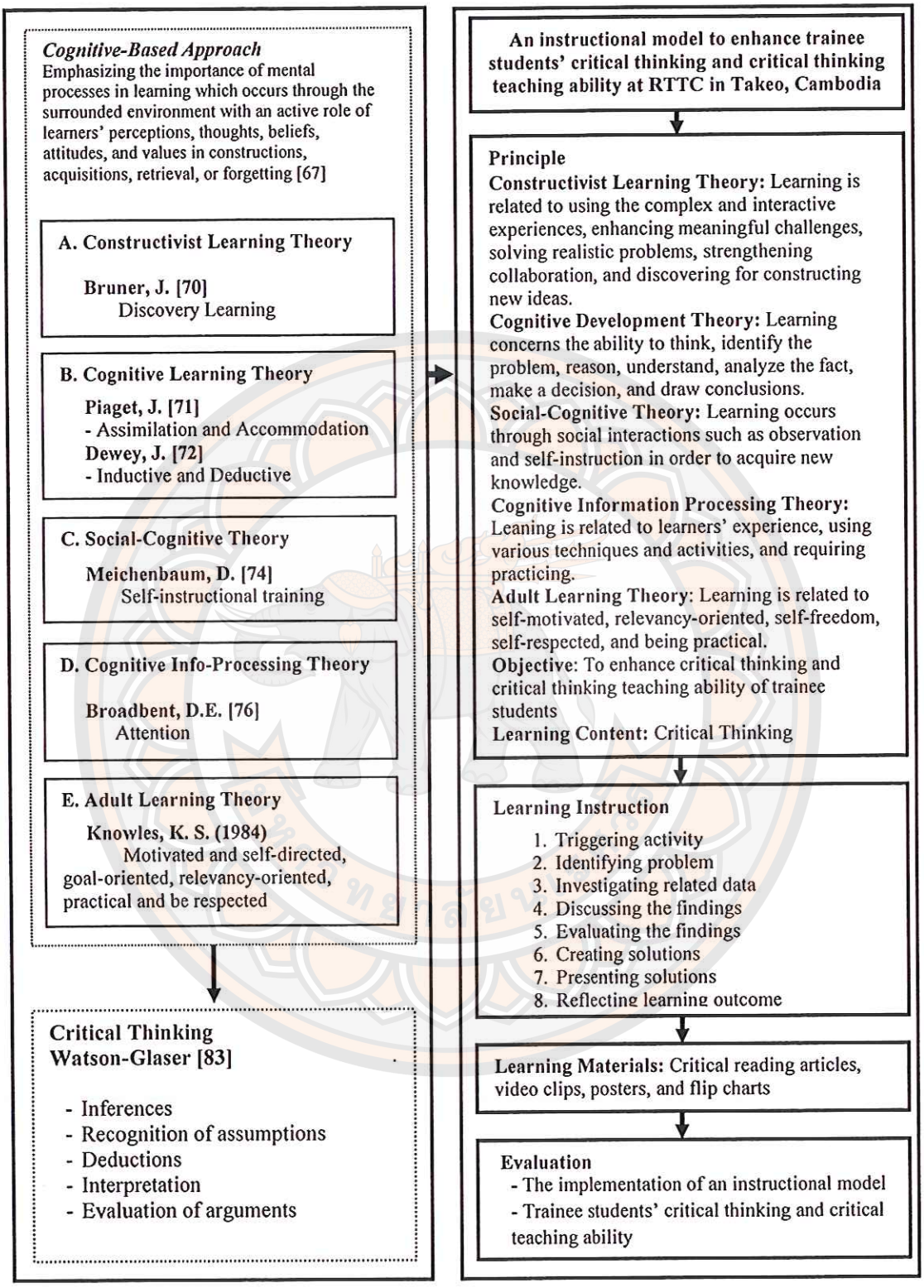


Figure 15 Instructional Model to Enhance Critical Thinking and Critical Thinking Teaching Ability

4. Evaluation of Instructional Model Development

4.1 Validity Check

Validity, checking Index of Congruence (IOC) of this research study yielded the same conclusions from each content analysis. One approach to increasing the validity of this study involves data triangulation which draws on different sources of information. This research study employed methodological triangulation which used multiple qualitative methods to conduct the content analysis of all concepts utilized to improve critical thinking and critical thinking teaching.

The researcher analyzed the results of evaluation and documents from the Department of Teacher Training, Ministry of Education, Youth, and Sport, the Regional Teacher Training Center, and some other relevant theories and concepts about instructional model, cognitive-based approach, critical thinking theory, and strategies to teaching critical thinking. All the content applied to develop an instructional model to enhance trainee students' critical thinking and critical thinking teaching ability was checked and evaluated by subject matter experts, professionals, and the academic advisors.

The criteria used for selecting subject matter experts and professionals were based on some of the essential components applicable to this research. There were 5experts and professionals selected to help review this study, and they had 1) the academic background in curriculum and instruction and 2) at least 5-year experience in teaching and conducting critical thinking assessment. Each of these subject matter experts and professionals and the academic advisers was provided with an introductory letter from the Graduate School, Naresuan University, a copy of chapter 1-3 of this research study, and asked to complete the evaluation form. There are two different evaluation forms including instructional model and instructional handbook.

The instructional model evaluation form was focused on the potential elements used to shape a curriculum, and it included elements of an instructional model development with a rating scale of 1-5 for each question, with 1 as the lowest rating scale and 5 as the high rating scale (See Appendix A). The criteria were including:

Elements of Validity Check	Rating Scale				
	1	2	3	4	5
Principle					
Learning objective					
Learning content					
Learning instruction					
Learning materials					
Evaluation of effectiveness					

The instructional handbook evaluation consisted of ten key elements and it was used to evaluate all supporting materials used to enhance trainee students' critical thinking and critical thinking teaching ability.

Key Elements of Instructional Handbook	Rating Scale				
	1	2	3	4	5
The objective of the instructional handbook is clear and consistent with the current needs of trainee students.					
The introduction of using an instructional model is precise and applicable.					
Learning structure is consistent with the content and timeframe.					
Learning procedure is orderly organized and interrelated with each other.					
Learning activities are consistent with learning content and real practice.					
The duration in each session is long enough for both lesson and practice.					
Learning materials are consistent with the learning content.					
The evaluation is clear and meets with learning content.					
Lesson plan gives the detailed descriptions of the course of instruction.					
The quality of writing is clear and understandable.					

4.1.1 Data Analysis

The results were analyzed using Mean ($\overline{X}$) and Standard Deviation (S.D.). The scoring mean at 3.40 or over was considered that an instructional model development based on cognitive-based approach to enhance critical thinking teaching ability and the instructional handbook were feasible and acceptable.

4.1.2 Data Interpretation

Rating scale was employed in order to interpret the results of data analysis, and it ranks from the highest to the lowest as follows:

5 means = highest level

4 means = high level

3 means = medium level

2 means = low level

1 means = lowest level

4.1.3 Scoring Transformation

According to Best [307], score of validity evaluation was interpreted as follows:

$$\text{The interval from each level} = \frac{\text{The highest score} - \text{The lowest score}}{\text{Level}}$$

$$= \frac{5 - 1}{5} = 0.80$$

4.21-5.00: The highest level of acceptance

3.41-4.20: The high level of acceptance

2.61-3.40: The medium level of acceptance

1.81-2.60: The low level of acceptance

1.00-1.80: The lowest level of acceptance

4.2 Reliability Check

4.2.1 Pilot Study

Reliability of this study refers to the consistency and appropriateness of an instructional development based on cognitive-based approach to enhance critical thinking and critical thinking teaching ability. After an instructional model had been designed and developed, a try-out was conducted with 15 trainee students who are in the semester II, year I, majoring in English and Khmer literature and being trained at the Regional Teacher Training Center in Takeo, Cambodia.

4.2.2 Analysis

The direct observation and trainee students' perceptions towards the implementation of the developed instructional model were critically conducted during the pilot study. The observation includes group work activities, discussion, sharing ideas, identifying problem, analyzing the supporting data, finding the solutions, making conclusions, presenting the results, and or reflecting the learning outcome. Trainee students' perceptions include learning materials, learning activities, and learning instructions. The results of these activities were extensively synthesized by the researcher for making further improvement of the developed model.

4.2.3 Result Interpretation

The result of this pilot study was used to improve an instructional model to enhance critical thinking and critical thinking teaching ability including developmental process, research tool development, and teaching instruction.

Step II: Implementation of Instructional Model

This phase revealed the implementation of the developed instructional model to enhance trainee students' critical thinking and critical thinking teaching ability of trainee students at the Regional Teacher Training Center in Takeo province, Cambodia.

1. Design of Instructional Implementation

A mixed method study was employed, which combines quantitative and qualitative studies. A quantitative method was empirically used 1) to measure trainee students' critical thinking, gained from one group pre- and post-test design and classroom observation record using scoring rubrics, 2) to identify trainee students'

critical thinking teaching ability on the assessment of practice teaching using critical thinking teaching rubrics, and 3) to investigate the individual trainee student perceptions about learning instruction using questionnaire. A qualitative method investigated trainee student learning within the actual context of the classroom, particularly improvement of trainee students' critical thinking while they were working in collaborative activities presented in individual reflection paper and their perceptions for the entire learning instruction presented in structured interview.

The data were collected using participation observations, written document analysis from the assessments, evaluations, and structured interview that were designed to evaluate trainee students' critical thinking and critical thinking teaching ability.

2. Implementation of Instructional Model

2.1 Course Participant

The course participants were trainee students, majoring in English and Khmer who had been being trained in the semester II, year I at the Regional Teacher Training Center in Takeo province, Cambodia for the academic year of 2015. There were only 15 trainee students who were selected, and all of them voluntarily agreed to participate in the study. The participants consisted of four females and eleven males, and they were between 19 and 23 years old. They were from four provinces and municipalities including Takeo and Kampot provinces and Kep municipality and Sihanouk Ville [3].

2.2 Course Procedure

This study was a part of contributing to enhancing trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center in Takeo province, Cambodia. The scope of research context was involved in developing an instructional model based on cognitive-based approach. The course context was "Enhancing Critical Thinking and Critical Thinking Teaching Ability" The researcher chose this particular course subject because of its emphasis on students' critical thinking and critical thinking teaching development. Trainee students were required to be involved in a series of small group activities, class discussion, and collaborative problem-solving activities through working with real-life experience, and practice teaching.

This course was integrated with methodology syllabus, unit 19, related to lesson planning used by the current lower secondary teacher of English training program at RTTC [308]. This unit consisted of three sessions including 1) Session 1: Learning about lesson planning, 2) Session 2: Analyzing lessons and lesson plans, and 3) Session: Preparing lesson plans (Includes peer teaching).

The course mainly focused on improving trainee students' critical thinking and teaching critical thinking ability in association with using academic texts, articles, journals, portfolios concerning trainee students' real life and experience. In-class activities required trainee students to solve real-life problems related to how to use critical thinking and organize critical thinking teaching while working with data, charts, posters, and video clips. Trainee students were asked to think critically about the correspondence of content of the lesson and to engage it in a collaborative problem-solving and then leading to practice teaching activities.

A teaching course lasted for 40 hours consisted of 2 hours per session. The course was conducted during the fall of semester II, year I for the academic year of 2015. At the end of the semester II, this course was introduced to trainee students. The researcher met with the trainee students, explained the purposes of the study, and requested participation for the study. Trainee students were informed that they were being asked to participate in an ongoing study to enhance critical thinking and critical thinking teaching ability, and that they would participate in in-class activities that took place as a part of the course.

The pre-test was administered at the second session of the course. Trainee students were given 60 minutes to complete the pre-test during the course, the first learning module about "Critical Thinking" which was implemented as part of trainee students' learning activities. The instructional materials and associated handouts were distributed at the appropriate point in the course. Students were randomly arranged into groups of three or four, varied depending on the characteristic of the activities. The individual participation in each activity and critical thinking practice teaching was observed and evaluated.

The post-test was administered to the participants at the last session after all activities were completed. A self-report questionnaire on trainee students' perceptions about their learning was administered after trainee students took the post-

test at the last session of the course and all learning activities were completed. Trainee students were given 60 minutes to complete the post-test and 20 more minutes for filling out a perception questionnaire.

For further study that included a structured interview with trainee students, the researcher asked for 5-10 volunteer students. The interviews were conducted with the convenience of each individual student. Each interview lasted about 20 minutes.

2.3 Course Context

This course on "Enhancing Critical Thinking and Critical Thinking Teaching Ability" used for this study shares the following design elements:

2.3.1 Using current events and situations that trainee students might encounter in daily lives as a context for the activities

2.3.2 Providing visible supports and scaffolds for fostering trainee student critical thinking and critical thinking teaching ability

2.3.3 Providing opportunities in which trainee students engage in peer discussion, collaborative activities, and critical thinking lesson plan

2.3.4 Providing opportunities for writing individual reflective paper after small group activities

2.3.5 Guiding trainee students to the development of lesson plan to teach critical thinking

The course content is a real-life complex problem related to "Enhancing Critical Thinking and Critical Thinking Teaching Ability" chosen, organized, and composed by the researcher as well as checked by the academic advisors, experts, and professionals. The learning module was designed using established research in the area of pedagogy dealing with complex thinking and reasoning, and structured problems. The authentic events and genuinely complex problems were employed in the learning activities to elicit students' justification for the answers.

2.4 Learning Module

The content of this learning module is a real-life complex problem related to "Critical Thinking and Teaching Critical Thinking" composed and developed by the researcher. The learning module was divided into five parts and

designed using the established research in the area of pedagogy dealing with critical thinking. The authentic events and genuinely complex problems were employed in learning activities which required trainee students' critical thinking and elicited trainee their justification for answers. The learning module asked trainee students to engage in 1) critical thinking followed by 2) critical thinking evaluation, 3) critical thinking teaching, 4) critical thinking teaching plan, and 5) teaching practice critical thinking lesson (See Appendix B).

No.	Learning Module	Content	Session/Hour
1	Critical Thinking	1. Critical Thinking Introduction 2. Critical thinking definition 3. Components of critical thinking 4. Barriers to critical thinking 5. Benefits of critical thinking	4 sessions/ 8 hours
2	Critical Thinking Evaluation	1. Critical Thinking Assessment Tool 2. How to Assess Critical Thinking	2 sessions/ 4 hours
3	Critical Thinking Teaching	1. Teaching Critical Thinking 2. Strategy of teaching critical thinking	4 sessions/ 8 hours
4	Critical Thinking Teaching Plan	1. Critical thinking teaching content 2. Critical thinking teaching materials 3. Critical thinking teaching activities 4. Critical thinking teaching instruction 5. Critical thinking teaching evaluation 6. Organizing critical thinking lesson plan	6 sessions/ 12hours
5	Practice Teaching Critical Thinking Lesson	Practice teaching	4 sessions/ 8 hours
Total			**20 sessions/ 2 hours**

2.5 Learning Activity

Learning activity to enhance trainee students' critical thinking and critical thinking teaching ability was divided into small group activity and teaching practice critical thinking lesson.

2.5.1 Small Group Activity

The group activity consisted of a group discussion. The instructional materials designed for this learning module included (a) video clip, (b) handouts, and (c) newspaper puzzle. Before engaged in team work activities, trainee students were asked to watch video clips and were provided with an individual worksheet to help them understand and prepare for the group activities. The worksheet includes 3-5 questions that asked students to think about and list what was important and why they made the decisions. The activity was composed of 4 parts. The first part, it required trainee students to consider questions presented and to come up with a set of information about the subject matter. The second part of the activity asked trainee students to create a poster for the documentary. The third part of activity asked trainee students to present the results of their discussions. The fourth part of the activity asked trainee students to conduct lesson plan and to do practice teaching critical thinking lessons.

2.5.2 Practice Teaching Critical Thinking Lesson

Due to the large number of trainee students, they were divided into small groups of 4-5 members and were asked to find out any critical topic in order to organize the lesson plan to teach critical thinking to the rest of the class. Each group was given 1 hour and a half for their practice teaching. During practice teaching the lesson to enhance critical thinking, each group was carefully observed and evaluated by the researcher using critical thinking teaching evaluation form (See Appendix F).

2.6 Data Collection

The data was collected using 1) Pre and Post-Test, 2) Critical Thinking Teaching Evaluation, 3) Class Observation Record, and 4) Individual Reflection Report

2.6.1 Pre-and Post-Test

A set of questions for pre-and post-test was conducted by the researcher. With the target of using cognitive-based approach to enhance critical thinking and critical thinking teaching ability, the content of the questions for pre-and

post-test was extracted in association with the assessment criteria of critical thinking developed by Watson-Glaser [83]. According to Watson-Glaser [83], the assessment criteria for critical thinking were composed of 5 elements including inference, recognition of assumptions, deduction, interpretation, and evaluation of argument. There were a total of 86 items which were composed and developed by the author. The content of each item was related to critical scenarios identified as key factors employing critical thinking for all its solutions (See Appendix G).

Pre-and Post-Test Design

0_1	x	0_2

0_1 = Refers to the score tested before the implementation the developed model

0_2 = Refers to the score tested after the implementation the developed model

x = Refers to the implementation of the developed model

No.	Assessment Criteria for Critical Thinking	Items
1	Inference	14 (1-14)
2	Recognition of assumptions	14 (15-28)
3	Deduction	20 (29-49)
4	Interpretation	11 (50-61)
5	Evaluation of argument	24 62-86)

.2.6.2 Critical Thinking Teaching Evaluation

Critical thinking teaching evaluation was performed while each group was doing teaching practice the lesson to enhance critical thinking. The evaluation provided the details of information about trainee student capacity in managing the learning instruction to teach critical thinking lesson (See Appendix F). The evaluation was done based on the scoring rubric developed by the researcher using the scoring weigh found by Greenstein [82].

2.6.3 Class Observation Record

Several key components of observation were used. Participants and their in-class activities were observed as trainee students engaged in their learning activities. Observation provided information on how subjects interact with other trainee students in group activities and with the instructional materials provided for their activities. Based on Class Observation Record (See Appendix D), the researcher observed class and trainee student activities derived from discussion points. Scoring rubric was conducted using and was weighed using four rating scales found by Greenstein [82].

2.6.4 Individual Reflection Report

After group activity was completed, each trainee student was asked to write an individual reflection report in order to provide their own proposed decisions and address the situation and their reasoning. The report should be based on the findings, analysis, decisions, and suggestions about the subject matter (See Appendix C).

2.7 Validity Check

Concerning checking Index of Congruence (IOC), a set of copies including learning module, class observation record, critical thinking teaching evaluation, pre-and post-test, and scoring rubrics was submitted to 5 experts, academic advisers and professionals. Each item was individually examined and only the items that were approved by experts/professionals/academic advisers were selected. Other suggestions including rewording of some items were revised and reordered based on the suggestions.

2.8 Reliability Check

All items of the pre-and post-test were pilot-tested with 15 (A1 class) trainee students who were in semester II, year I, majoring in English and Khmer, being trained at the Regional Teacher Training Center in Takeo, Cambodia. The items that failed to elicit clear understanding and targeted critical thinking were reworded. The internal consistency reliability was estimated for the pre-and post-test questions using the Cronbach α coefficient. The internal consistency reliability coefficients, Cronbach's alpha for this instrument that included 86 items was 0.63, thus meeting supervisor's recommendation of more than >0.5 as the acceptable reliability level.

2.9 Data Analysis

During this step, the researcher applied two methods of analysis including 1) quantitative method and 2) qualitative method.

2.9.1 Quantitative Method

Analysis of Pre-and Post-Test: A dataset collected from trainee students' pre-and post-test was analyzed using Wilcoxon and was compared to gauge trainee students' learning gains. Trainee students' learning was defined as changes in their performance on critical thinking under the concepts of study.

Analysis of Critical Thinking Teaching: A set of scoring rubrics for evaluating critical thinking teaching was developed. These rubrics rated the level and quality of trainee students' critical thinking teaching. An analytical rubric which was modified based on the guide to rate critical thinking teaching was developed by the researcher (See Appendix F). The data collected was analyzed using Descriptive Statistics (Mean and Standard Deviation).

No.	Critical Thinking Teaching Evaluation	0	1	2	3
1	Lesson plan				
2	Teaching activities				
3	Learning outcome				

Rating Scale

1 = Novice

2 = Basic

3 = Proficient

4 = Exemplary

Scoring Transformation

According to Greenstein [82], critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

18.00-24.00: The high level of critical thinking teaching ability

12.00-17.99: The medium level of critical thinking teaching ability

06.00-11.99: The low level of critical thinking teaching ability

00.00-05.99: The lowest level of critical thinking teaching ability

The scoring mean at 17.99 or over was considered that trainee students' critical thinking teaching ability was acceptable.

Analysis of Classroom Observation Record: A set of scoring rubrics for each learning activity students engaged in class was developed. These rubrics rated the level and quality of the subjects' critical thinking. An analytical rubric which was modified based on the guide to rate critical thinking for group work activities and oral and written presentation developed by Nitko. The rubric was used to score the result of trainee students' critical thinking retrieved from the activities (See Appendix E), and the data was analyzed using descriptive statistics (Mean and Standard Deviation).

No.	Elements of Critical Thinking Rubric	0	1	2	3
1	Consider different points of view				
2	Treat other's points of view				
3	Communicate well with others who had less knowledge or ability				
4	Sensitive to the feelings of others with less knowledge or ability				
5	Clearly stated the thesis or mains points				
6	Defined the key terms when necessary to do so				
7	Use sound reasoning to support the main point or thesis				
8	Used relevant facts in appropriate ways to support the thesis				
9	Portrayed and Evaluated alternative positions clearly				
10	Rebutted the alternative positions well				
11	Presented a well-organized argument				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75-33.00: Exemplary

16.51-24.74: Proficient

08.26-16.50: Basic

00.00-08.25: Novice

The scoring mean at 16.51 or over was considered that trainee students' activities were highly concerned using critical thinking processes.

2.9.2 Qualitative analysis

Qualitative analysis included the analysis of fundamental data collected from individual class activity reflection. This concerned the interactions and the dynamic of group work on problem-solving activities in the whole class, which were used to ascertain contextual information about trainee students' critical thinking and critical thinking teaching through engaging in the learning activities and practice teaching. The content analysis was used and summarized to provide further information about the effectiveness of an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability.

Step III: Evaluation of Instructional Model

1. Design of Evaluation

The evaluation of an instruction model development monitors the progress of the efforts towards achievement of the desired goals. This stage is validation of progress, rather than an evaluation or judgment of results, to make sure that changes are occurring as desired, that the improvement is directional, and that the results are as anticipated by the improvement design. The design of evaluation was divided into two types distinctively conducted in order to get an understanding of trainee students' student perceptions towards an instructional implementation.

2. Implementation of Evaluation

Questionnaire about trainee students' perceptions and structured interview were distributed and interviewed at the end of the course.

2.1 Trainee Student Perception Questionnaire

A Student Perception Questionnaire of their experiences in a course of improving critical thinking and critical thinking teaching ability was conducted by the

researcher. It was designed to investigate how trainee students experienced in using cognitive-based approach to improve their critical thinking and critical thinking teaching ability. The questionnaire was composed of 5main sections with a total of 40 items. Trainee students were asked to rate their personal perceptions using Likert rating scale ranged from 1-5, starting from strongly disagree to strongly agree (See Appendix H).

No.	Section	Items
1	General course instruction	6 (1-6)
2	Small group work activities	6 (7-12)
3	Interpersonal/team skills	4 (13-16)
4	Critical thinking skills	18 (17-32)
5	Critical Thinking Teaching	4(33-36)

2.2 Structured Interview Question

Structured interview questions were conducted by the researcher. This interview process will give an additional data to clarify the effect of an instructional implementation based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. The structured interview allowed the researcher to discover contextual information about the trainee students' engagement in their learning and practice teaching. The questions are about what components of an instruction that trainee students think supported their learning, teaching, and reasoning developments throughout the course. The interview processes consisted of 5 sections with a total of 17 questions (See Appendix I).

No.	Section	Items
1	Background of Information Questions	3 questions
2	General Characteristics of Learning Activities	8 questions
3	Small Group Activities	2 questions
4	Teaching Activity	1 question
4	Learning Processes	3 questions

2.3 Validity Check

The validity check, Index of Congruence (IOC) for student perception questionnaire and structured interview questions were also conducted. All questions for questionnaire and interview were academically reviewed by 5 experts/academic advisors/professionals whose backgrounds were related to curriculum and instruction and had at least 5-year experience in teaching critical thinking or being involved in critical thinking assessment. Each item was individually examined and only the items which were approved by the academic advisors/experts/professionals were selected as survey questions. Other suggestions included rewording of some items were revised and reordered based on the suggestions.

2.4 Reliability Check

All items of student perception questionnaire were pilot-tested with 15 trainee students (A1) who were in the semester II, year I, majoring in English and Khmer, being trained at the Regional Teacher Training Center in Takeo, Cambodia. The items that failed to elicit clear understanding and targeted critical thinking were reworded. The internal consistency reliability was estimated for Student Perception Questionnaire using the Cronbach α coefficient. The internal consistency reliability coefficients, Cronbach's alpha for this instrument that included 34 items was 0.75, thus meeting supervisor's recommendation of more than >0.5 as the acceptable reliability level.

3. Data Collection

3.1 Perception Questionnaire

Concerning perception questionnaire, the data was collected from all the trainee students who attended the learning course. Those trainee students were asked to fill out the questionnaire with 20-minute allocation.

3.2 Structured Interview

Regarding the interview, only 5-10 trainee students were needed to participate in a follow-up interview at the end of the course. These trainee students voluntarily joined the interview, and they were also informed of the general procedures of the interview in advance.

4. Data Analysis

Descriptive statistics and content analysis were used.

4.1 Analysis of Trainee Student Perception

Descriptive statistics (Mean and Standard Deviation) were used to analyze the data related to trainee students' perceptions in order to find out their views about an instructional implementation to enhance critical thinking and critical thinking teaching.

4.2 Analysis of Trainee Student Interview

Content analysis was used to analyze the data related to structured interview to get more understanding of trainee students' ideas about relevant learning processes and environment.

5. Data Interpretation

According to Best [307], score of validity evaluation was interpreted as follows:

4.21-5.00: The highest level of satisfaction

3.41-4.20: The high level of satisfaction

2.61-3.40: The medium level of satisfaction

1.81-2.60: The low level of satisfaction

1.00-1.80: The lowest level of satisfaction

The scoring mean at 3.41 or over was considered that trainee students' perceptions about learning instruction to enhance critical thinking and critical thinking teaching ability is highly satisfied.

CHAPTER IV

RESULTS OF DATA ANALYSIS

Chapter four is to present the results from data analysis that addresses the main purposes of this research study including 1) to develop an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center, 2) to implement an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center, and 3) to evaluate an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. The sections presenting the results responding to each research purpose.

Section 1: The development of an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center

Section 2: The implementation of an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center

Section 3: The evaluation of an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability at the Regional Teacher Training Center

List of Abbreviation

$\bar{X}$ = Mean
S.D. = Standard Deviation
Sig. = Significance
RTTC = Regional Teacher Training Center
CT = Critical Thinking
CTT = Critical Thinking Teaching

IM = Instructional Model

S = Session

T = Trainee Student

Section 1: The Result of an Instructional Model Development based on Cognitive-based Approach to Enhance Trainee Students' Critical Thinking and Critical Thinking Teaching Ability

An instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability was developed using the findings from constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive-information processing theory, and adult learning theory derived from cognitive-based approach, critical thinking theory, and strategies to teaching critical thinking. The findings were critically analyzed and synthesized to construct an instructional model which then was evaluated by the academic advisers, professionals, and experts. The results of evaluation were divided into two parts including the results of instructional model development and applicability of an instructional model and instructional handbook.

Table 15 The Process and Result of Instructional Development

Process	Result
1. Critical analysis and integration of related theories to develop an instructional model to enhance trainee students' critical thinking and critical thinking teaching ability 2. Validity checked, commented, and evaluated by academic advisers, professionals and experts to make an improvement of the developed instruction 3. Reliability checked by conducting a pilot study with 15 trainee students (Class A1), year II, majoring in English and Khmer at the Regional Teacher Training Center in Takeo province	An instructional model based on cognitive-based approach to enhance trainee student's critical thinking and critical thinking teaching ability

1. The Results of Instructional Model Development

The results of findings retrieved from constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive-information processing theory, and adult learning theory derived from cognitive-based approach, critical thinking theory, and strategies to teaching critical thinking were extensively investigated, analyzed, and synthesized using triangulation analysis. Then these findings were used to develop an instructional model which was evaluated by the academic advisers, experts, and professionals. Consequently, the instructional model was developed composing of six potential elements including 1) Principle, 2) Objective, 3) Learning Content, 4) Learning Instruction, 5) Learning Material, and 6) Evaluation of Effectiveness. The details of each element were as follows:

1.1 Principle

An instructional model based on cognitive-based approach to enhance trainee student critical thinking teaching ability was developed using the findings retrieved from constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive-information processing theory, and adult learning theory derived from cognitive-based approach. These findings were used as compulsory principles to foster in trainee students' critical thinking and critical thinking teaching ability. The principles include:

1.1.1 Constructivist Learning Theory: Learning is related to using the complex and interactive experiences, enhancing meaningful challenges, solving realistic problems, strengthening collaboration, and discovering for constructing new ideas.

1.1.2 Cognitive Development Theory: Learning concerns the ability to think, identify the problem, reason, understand, analyze the fact, make a decision, and draw conclusions.

1.1.3 Social-Cognitive Theory: Learning occurs through social interactions such as observation and self-instruction in order to acquire new knowledge.

1.1.4 Cognitive Information Processing Theory: Leaning is related to learners' experience, using various techniques and activities, and requiring practicing.

1.1.5 Adult Learning Theory: Learning is related to self-motivated, relevancy-oriented, self-freedom, self-respected, and being practical.

1.2 Objective

The main purpose of this instructional model development is to enhance trainee students' critical thinking and critical thinking teaching ability.

1.3 Learning Content

The content extensively concerns critical thinking using situational analysis. This critical thinking is divided into five modules including

1.3.1 Critical Thinking (Introduction and Definition of Critical Thinking, Components of Critical Thinking, Barriers to Critical Thinking, and Benefits of Critical Thinking)

1.3.2 Critical Thinking Evaluation (Critical Thinking Assessment Tool and Critical Thinking Assessment)

1.3.3 Critical Thinking Teaching (Critical Thinking Teaching and Strategy of Teaching Critical Thinking)

1.3.4 Critical Thinking Teaching Plan (Critical Thinking Teaching Content, Critical Thinking Teaching Materials, Critical Thinking Teaching Activities, Critical Thinking Instruction, Critical Thinking Teaching Evaluation, and Organizing Critical Thinking Lesson Plan)

1.3.5 Practice Teaching Critical Thinking

Table 16 The Results of Instructional Model Development: Learning Content

No.	Learning Module	Content	Session/Hour
1	Critical Thinking	1. Critical Thinking Introduction 2. Critical thinking definition 3. Components of critical thinking 4. Barriers to critical thinking 5. Benefits of critical thinking	4 sessions/ 8 hours

Table 16 (cont.)

No.	Learning Module	Content	Session/Hour
2	Critical Thinking Evaluation	1. Critical Thinking Assessment Tool 2. Assessment of Critical Thinking	1 sessions/ 4 hours
3	Critical Thinking Teaching	1. Teaching Critical Thinking 2. Strategy of teaching critical thinking	4 sessions/ 8 hours
4	Critical Thinking Teaching Plan	1. Critical thinking teaching content 2. Critical thinking teaching materials 3. Critical thinking teaching activities 4. Critical thinking teaching instruction 5. Critical thinking teaching evaluation 6. Organizing critical thinking lesson plan	6 sessions/ 12 hours
5	Practice Teaching Critical Thinking Lesson	Practice teaching	4 sessions/ 8 hours
		Total	**20 sessions/ 40 hours**

Table 17 The Results of Instructional Model Development: Teaching Outline

No.	Content	Description	Learning Activity	Session
1	Critical Thinking	Introduction and Definition of Critical Thinking	- Students watch clip video and read handouts (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students identify and present result of group discussion - Students reflect learning outcome	Session 1/ 2 hours

Table 17 (cont.)

No.	Content	Description	Learning Activity	Session
1	Critical Thinking	Components of Critical Thinking	- Students do pre-test - Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session 2/ 2 hours
		Barriers to Critical Thinking	- Students watch clip video and read handouts (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students identify and present results of group discussion - Students reflect learning outcome	Session 3/ 2 hours
		Benefits of Critical Thinking	- Students watch clip video and read handouts (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students identify and present results of group discussion - Students reflect the learning outcome	Session 4/ 2 hours
2	Critical Thinking Evaluation	Critical Thinking Assessment Tool	- Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect the learning outcome	Session 5/ 2 hours
		Assessment of Critical Thinking	- Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect the learning outcome	Session 6/ 2 Hours

Table 17 (cont.)

No.	Content	Description	Learning Activity	Session
3	Critical Thinking Teaching	Critical Thinking Teaching	- Students watch 2 videos and read the articles (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect the learning outcome	Session 7/ 2 hours
		Strategy of Teaching Critical Thinking	- Students watch clip video and read the articles - Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session 8/ 2 hours
		Strategy of Teaching Critical Thinking (Cont-)	- Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session 9/ 2 hours
		Strategy of Teaching Critical Thinking (Cont-)	- Students read the handouts (situation given) - Students work in small groups - Students discuss and share the ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session 10/ 2 hours
4	Critical Thinking Teaching Plan	Critical Thinking Teaching Content	- Students read handout (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session11/ 2 hours

Table 17 (cont.)

No.	Content	Description	Learning Activity	Session
4	Critical Thinking Teaching Plan	Critical Thinking Teaching materials	- Students read the handouts (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session12/ 2 hours
		Critical Thinking Teaching Activities	- Students read the handouts (situation given) - Students work in small groups - Students work on EFC books - Students select the activities - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session13/ 2 hours
		Critical Thinking Teaching Instruction	- Students watch clip video and read handout (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session14/ 2 hours
		Critical Thinking Teaching Evaluation	- Students read handout (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students present the findings - Students reflect learning outcome	Session15/ 2 hours
		Organizing Critical Thinking Lesson Plan	- Students do post-test - Students read handouts (situation given) - Students work in small groups - Students discuss and share ideas - Students identify the findings using different sources of information and clear data - Students organize lesson plan - Students present the findings - Students reflect learning outcome	Session16/ 2 hours

Table 17 (cont.)

No.	Content	Description	Learning Activity	Session
5	Practice Teaching Critical Thinking Lesson	Practice Teaching Critical Thinking	- Students practice teaching	Session17/ 2 hours
		Practice Teaching Critical Thinking	- Students practice teaching	Session18/ 2 hours
		Practice Teaching Critical Thinking	- Students practice teaching	Session19/ 2 hours
		Practice Teaching Critical Thinking	- Students practice teaching	Session20/ 2 hours

Learning Activity

Learning activity which is extensively used to improve trainee students' critical thinking and teaching critical thinking ability is in association with using academic texts, articles, journals, portfolios concerning trainee students' real life and experience. In-class activities require students to solve real-life problems related to how to use critical thinking and organizing critical thinking teaching while working with data, charts, posters, and video clips. Trainee students were asked to think critically about the correspondence of content of the lesson and engage in a collaborative problem-solving and then leading to practice teaching activities.

1.4 Learning Instruction

Critical thinking theories and strategies to teach critical thinking were extensively investigated, and the findings were used to develop learning instruction to enhance trainee students' critical thinking and critical thinking teaching ability. The learning instruction is divided into 8 steps as follows:

Step 1: Triggering activity: This step alerts learners what is going to come and stimulates their curiosity and anticipation in order to establish learning issues.

Step 2: Identifying problem: This step involves learners in identifying the problem through conducting literature search with an aid of critical articles provided and then explaining in their own words what the problem is about.

Step 3: Investigating related data: This step involves learners in interacting with an authentic learning environment, and they were actively engaged in the collection of data to verify their hypotheses

Step 4: Discussing findings: This step encourages learners to use different platforms to share their ideas and discuss their findings through working individually, in pairs and in groups.

Step 5: Evaluating findings: This step involves learners in analyzing, and evaluating the findings using alternative sources of information collected on the problem.

Step 6: Creating solutions: This step engages learners in constructing new knowledge through presenting possible solutions and options for solving the problem based on their own experience and previously acquired knowledge.

Step 7: Presenting solutions: This step involves learners in presenting their solutions to the class using different methods such as poster, mind map, chart, or demonstration.

Step 8: Reflecting learning outcome: This step involves learners in demonstrating the ability to understand the implications and to refine the existing questions and raise new ones.

1.5 Learning Materials

Learning materials which are used to enhance trainee student critical thinking and critical thinking ability include:

1.5.1 Instructional handbook

1.5.2 Lesson plans (20 sets)

1.5.3 Articles and journals about critical thinking and critical thinking teaching

1.5.4 EFC, English for Cambodia

1.5.5 Clip video about critical thinking and non-critical thinking activities

1.5.6 Posters and flip charts

1.6 Evaluation of Effectiveness

The evaluation is divided into two parts including:

1.6.1 Critical thinking and critical thinking teaching evaluation

1.6.2 Critical thinking learning instruction

1.7 Evaluation Tool

1.7.1 Pre-and-Post test

1.7.2 Critical thinking teaching rubrics to evaluate critical thinking teaching

1.7.3 Class observation record to evaluate critical thinking activities

1.7.4 Individual reflection, perception questionnaire, and structured interview to evaluation learning instruction

1.8 Evaluation Criterion

The evaluation criterion is divided into 6 parts including:

1.8.1 Comparison of results between pre-and post-test using Wilcoxon

1.8.2 Critical thinking teaching evaluation using scoring rubrics

18.00-24.00: The high level of critical thinking teaching ability

12.00-17.99: The medium level of critical thinking teaching ability

06.00-11.99: The low level of critical thinking teaching ability

00.00-5.99: The lowest level of critical thinking teaching ability

1.8.3 Classroom observation record using scoring rubrics

24.75-33.00: Exemplary

16.51-24.74: Proficient

08.26-16.50: Basic

00.00-8.25: Novice

1.8.4 Individual reflection using content analysis

1.8.5 Perception questionnaire using Likert scale

4.21-5.00: The highest level of satisfaction

3.41-4.20: The high level of satisfaction

2.61-3.40: The medium level of satisfaction

1.81-2.60: The low level of satisfaction

1.00-1.80: The lowest level of satisfaction

1.8.6 Structured interview using content analysis

2. The Applicability of Instructional Model and Instructional Handbook

The developed instructional model and instructional handbook were carefully checked by the academic advisers, professionals, and experts. The results of evaluation were divided three parts as follows:

2.1 The Results of Instructional Model Evaluation

All the components of the instructional model were checked by the academic advisers, experts, and professionals and the results were as follows:

Table 18 Analysis of Instructional Model Using Descriptive Statistics

Components of Instructional Model	$\overline{X}$	S.D.	Level of Applicability
Principle			
All theoretical bases are clear and rationale.	3.80	0.83	High applicability
All theoretical bases support critical thinking perspectives.	3.80	0.44	High applicability
All theoretical bases clearly explain what is expected to be achieved.	4.00	0.00	High applicability
Total	**3.86**	**0.38**	**High applicability**
Learning Objective			
Objective is clear and reasonable.	4.60	0.54	Highest applicability
Objective answers the current needs of trainee students.	4.40	0.54	Highest applicability
Objective is consistent with the incumbent social needs.	4.60	0.54	Highest applicability
Total	**4.53**	**0.54**	**Highest applicability**
Learning Content			
Learning content concerns trainee students' needs and experiences.	4.40	0.54	Highest applicability
Learning content is consistent with social needs.	4.20	0.44	High applicability
Learning content enhances trainee students' critical thinking and their teaching ability on critical thinking.	4.20	0.44	High applicability
Total	**4.26**	**0.43**	**Highest applicability**
Learning Instruction			
Learning instruction is simple and clear.	4.00	0.70	High applicability
Learning instruction fosters trainee students in improving critical thinking and critical thinking teaching ability.	4.00	0.00	High applicability

Table 18 (cont.)

Components of Instructional Model	$\overline{X}$	S.D.	Level of Applicability
Learning instruction engages trainee students in working in groups, sharing ideas, and analyzing to reach conclusions.	4.60	0.54	Highest applicability
Total	**4.20**	**0.18**	**High applicability**
Learning Material			
Learning materials are sufficient and practical oriented for enhancing critical thinking and critical thinking teaching ability.	4.00	0.00	High applicability
Learning materials help trainee students to enhance their critical thinking and critical thinking teaching ability.	4.00	0.00	High applicability
Learning materials are consistent with each critical thinking learning activity.	4.20	0.44	High applicability
Total	**4.06**	**0.14**	**High applicability**
Learning Evaluation			
The evaluation is clear and measurable.	4.20	0.83	High applicability
The evaluation is consistent with learning objective.	4.00	0.54	High applicability
The evaluation reflects the effectiveness of an instructional model.	4.40	0.54	Highest applicability
Total	**4.33**	**0.62**	**Highest applicability**
Total mean score of instructional model evaluation	**4.21**	**0.23**	**Highest applicability**

Table 18 indicated that all the components of an instructional model were generally at the highest level of applicability ($\overline{X}$= 4.21). Considering of each component, the results revealed that learning objective ($\overline{X}$= 4.53), learning content ($\overline{X}$= 4.26), and learning evaluation ($\overline{X}$= 4.33) were at the highest level of applicability, but learning instruction ($\overline{X}$= 4.20) and learning materials ($\overline{X}$= 4.06) were at highlevel of applicability.

2.2 The Result of Instructional Handbook Evaluation

The instructional handbook was critically checked by the academic advisers, experts, and professionals and the results of evaluation were as follows:

Table 19 Analysis of Instructional Handbook Using Descriptive Statistics

Components of Instructional Handbook	$\overline{X}$	S.D.	Level of Applicability
The objective of the instructional handbook is clear and consistent with the current needs of trainee students.	4.40	0.54	Highest applicability
The introduction of using an instructional model is precise and applicable.	4.40	0.89	Highest applicability
Learning structure is consistent with the content and timeframe.	4.60	0.54	Highest applicability
Learning procedure is orderly organized and interrelated with each other.	4.40	0.54	Highest applicability
Learning activities are consistent with learning content and real practice.	4.40	0.54	Highest applicability
The duration in each session is long enough for both lesson and practice.	4.20	0.83	High applicability
Learning materials are consistent with the learning content.	4.20	0.83	High applicability
The evaluation is clear and meets with learning content.	4.20	0.83	High applicability
Lesson plan gives the detailed descriptions of the course of instruction.	4.80	0.83	Highest applicability
The quality of writing is clear and understandable.	4.00	1.00	High applicability
Total	**4.26**	**0.61**	**Highest applicability**

Table 19 indicated that all the components of the instructional handbook were generally at the highest level of applicability ($\overline{X}$ = 4.26). Considering of each element, the results revealed that the objective of the instructional handbook is clear and consistent with the current needs of trainee students ($\overline{X}$ = 4.40), the introduction of using an instructional handbook is precise and applicable ($\overline{X}$ = 4.40), learning structure is consistent with the content and timeframe ($\overline{X}$ = 4.60), learning procedure is orderly organized and interrelated with each other ($\overline{X}$ = 4.40), learning activities are consistent with learning content and real practice ($\overline{X}$ = 4.40), and lesson plan gives the detailed descriptions of the course of instruction ($\overline{X}$ = 4.80) were at the highest level of applicability, but the duration in each session is long enough for both lesson and practice ($\overline{X}$ = 4.20), learning materials are consistent with the learning

content ($\overline{X}$ = 4.20), the evaluation is clear and meets with learning content ($\overline{X}$ = 4.20), and the quality of writing is clear and understandable ($\overline{X}$ = 4.00) were at high level of applicability.

2.3 The Result of Pilot Study

The developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability was tried out with 15 trainee students being trained at the Regional Teacher Training Center in Takeo province. The results of pilot study collected using observation record, individual trainee student reflection, and some other tests indicated that 1) learning content, 2) learning activity, 3) learning materials, and 4) timeframe were highly applicable. However, few barriers were also found during the implementation of pilot study.

Table 20 Results of Pilot Study Using Content Analysis and Percentage

Key Components	Classroom Observation Record	Individual Reflection
Learning Content	- Trainee students clearly understand the content of the lesson. - Trainee students are able to apply the content to the real-life situation. - Trainee students can share the ideas about learning content with their friends. - Trainee students can find other sources to support learning content.	80% of trainee students reflected that learning content is precise, easy to understand, full of critical analysis, related to their current needs, and especially clearly introduces them to be able to organize lesson plan to teach critical thinking.
Learning Activity	- Trainee students are happy to join a variety of activities including watching video clips, visiting authentic field, doing critical analysis of provided handouts, and search for other related documents	87% of trainee students reflected that they enjoyed with a variety of learning activities such as working in small groups, sharing ideas, searching for clear sources of

Table 20 (cont.)

Key Components	Classroom Observation Record	Individual Reflection
Learning Activity	- Trainee students are happy to join a variety of activities including watching video clips, visiting authentic field, doing critical analysis of provided handouts, and search for other related documents - Trainee students work harmoniously with each other analyze the matter, share ideas, discuss the findings and present to solutions - Trainee students use their own experience to work on the identified matter and make their own decisions and conclusions	87% of trainee students reflected that they enjoyed with a variety of learning activities such as working in small groups, sharing ideas, searching for clear sources of information, presenting the results and especially using their own decision and reflection.
Learning Material	- Training materials are sufficiently offered to trainee students. - Trainee students enjoyed using a variety of training materials including video clips, EFC books, posters, flip charts, and critical papers, articles, and journals - Trainee students can use all the learning materials to solve the identified problem.	70% of trainee students reflected that learning materials met learning content and learning activities. Learning materials help them to easily acquire the content and make them feel comfortable with all learning processes.
Timeframe	- The duration is long enough for each activity and session.	90% of trainee students reflected that the duration is long enough for all activities, discussion, and presentation.

Table 20 (cont.)

Key Components	Classroom Observation Record	Individual Reflection
Barrier	The main barrier which was found during trying out was that handouts should be distributed in advance.	60% of trainee students suggested that critical handouts should be distributed in advance so that they can read before coming to class.

The results of content analysis in table 20 indicated that learning content, learning activity, learning materials, and timeframe were highly applicable and satisfied by trainee students. All the components of teaching and learning instructions used during the tryout were clear, easy to understand, related to the current needs of trainee students, and full of critical analysis and productive activities. Also, a majority of trainee students reflected that these teaching and learning instructions helped them to get more involved in self-learning and in particular constructing new knowledge. However, some trainee students suggested that handouts should be given to them earlier so that they could be well prepared before entering the classroom.

Section 2: The Implementation of an Instructional Model based on Cognitive-based Approach to Enhance Trainee Students' Critical Thinking and Critical Thinking Teaching Ability at the Regional Teacher Training Center

The developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability was implemented with 15 year II trainee student (Class B1), majoring in English and Khmer, and being trained at the Regional Teacher Training Center in Takeo Province, Cambodia in the academic year of 2015.

Table 21 The Process and Result of Implementation of Instructional Model

Process	Result
- The developed instructional model was implemented with 15 trainee students, year II, majoring in English and Khmer at the Regional Teacher Training Center in Takeo Province, Cambodia. - Pre- and post-test was performed to evaluate trainee students' critical thinking learning outcome. - Trainee students' abilities to teach critical thinking were evaluated by conducting practice teaching. - Classroom observation record was done to evaluate critical thinking activities practiced by trainee students. - Individual reflection about critical thinking teaching and learning instructions was shared by trainee students.	- The applicability of the developed instructional model was revealed. - Trainee students' critical thinking was critically improved. - Trainee students' critical thinking teaching ability was positively enhanced. - Trainee students showed their positive engagement and commitment in doing all critical thinking activities. - Trainee students reflected positive thoughts about critical thinking teaching and learning instructions.

1. Pre-and Post-Test

Pre-and Post-test was conducted at the beginning and the end of the implementation process in order to find out the improvement of trainee students' critical thinking. Wilcoxon was performed and the results were as follows:

Table 22 The Results of Comparison between Pre and Post Critical Thinking Implementation Using Wilcoxon

		N	Mean Rank	Sum of Ranks	Z	p
Post - Pre	Negative Ranks	0	.00	.00	-3.410	.001
	Positive Ranks	15	8.00	120.00		
	Ties	0				
	Total	15				

Table 22 indicated that trainee student's post-critical thinking is higher than pre-critical thinking implementation at the statistical significance of .01.

2. The Results of Critical Thinking Teaching Ability

Trainee students were asked to organize lesson plans and teach critical thinking lessons at the end of the implementation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. The practicum takes for three days, and it has been done with year I primary trainee students being trained at Takeo Teacher Training College (Training College for Primary School Teacher). The results of trainee students' critical thinking teaching ability were evaluated using scoring rubrics.

Table 23 The Results of CT Teaching Ability Using Scoring Rubric

	Trainee Student CTT Ability (Module V: Organizing and Practicing Teaching CT, Session 17-20)								
T	Lesson Plan	Level of CTT	Teaching Activity	Level of CTT	Learning Outcome	Level of CTT	Total $\bar{X}$	S.D.	Level of CTT
1	20	Exemplary	22	Exemplary	20	Exemplary	20.67	1.15	Exemplary
2	20	Exemplary	22	Exemplary	20	Exemplary	20.67	1.15	Exemplary
3	20	Exemplary	22	Exemplary	20	Exemplary	20.67	1.15	Exemplary
4	20	Exemplary	22	Exemplary	20	Exemplary	20.67	1.15	Exemplary
5	20	Exemplary	22	Exemplary	22	Exemplary	21.33	1.15	Exemplary
6	20	Exemplary	20	Exemplary	22	Exemplary	20.67	1.15	Exemplary
7	20	Exemplary	20	Exemplary	22	Exemplary	20.67	1.15	Exemplary
8	20	Exemplary	20	Exemplary	22	Exemplary	20.67	1.15	Exemplary
9	20	Exemplary	20	Exemplary	20	Exemplary	20.00	0.00	Exemplary
10	20	Exemplary	21	Exemplary	20	Exemplary	20.33	0.58	Exemplary
11	20	Exemplary	21	Exemplary	20	Exemplary	20.33	0.58	Exemplary
12	20	Exemplary	21	Exemplary	20	Exemplary	20.33	1.00	Exemplary
13	22	Exemplary	21	Exemplary	20	Exemplary	21.00	1.15	Exemplary
14	22	Exemplary	20	Exemplary	20	Exemplary	20.67	1.15	Exemplary
15	22	Exemplary	20	Exemplary	20	Exemplary	20.67	1.15	Exemplary
To-	20.40	Exemplary	20.93	Exemplary	20.53	Exemplary	20.62	0.28	Exemplary

Table 23 revealed that trainee students' critical thinking teaching ability was generally at the exemplary level ($\bar{X}$= 20.62). Considering of each element practiced by trainee students, the findings indicated that lesson plan ($\bar{X}$= 20.40), teaching activity ($\bar{X}$= 20.93), and learning outcome ($\bar{X}$= 20.53) were also at the exemplary level.

3. Classroom Observation Record on Critical Thinking Activity

Classroom observation record was conducted during the implementation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability using scoring rubrics. The collected data was analyzed using Scoring Rubrics, and the results were as follows:

Table 24 Analysis of Critical Thinking Activity Using Scoring Rubric

T	Trainee Student Critical Thinking Activity (Module I: Critical Thinking, Session 1 – 4)										
	S1	CT Level	S2	CT Level	S3	CT Level	S4	CT Level	$\overline{X}$	S.D.	CT Level
1	16	Basic	17	Proficient	18	Proficient	21	Proficient	18.00	2.16	Proficient
2	16	Basic	16	Basic	19	Proficient	20	Proficient	17.75	2.06	Proficient
3	17	Proficient	18	Proficient	18	Proficient	16	Basic	17.25	0.96	Proficient
4	16	Basic	16	Basic	16	Basic	18	Proficient	16.50	1.00	Basic
5	16	Basic	16	Basic	19	Proficient	20	Proficient	17.75	2.06	Proficient
6	17	Proficient	18	Proficient	18	Proficient	16	Basic	17.25	0.96	Proficient
7	16	Basic	16	Basic	16	Basic	18	Proficient	16.50	2.22	Basic
8	15	Basic	16	Basic	16	Basic	20	Proficient	16.75	2.08	Proficient
9	17	Proficient	15	Basic	18	Proficient	20	Proficient	17.50	2.22	Proficient
10	16	Basic	17	Proficient	19	Proficient	21	Proficient	18.25	0.00	Proficient
11	16	Basic	16	Basic	16	Basic	16	Basic	16.00	0.96	Proficient
12	17	Proficient	17	Proficient	18	Proficient	19	Proficient	17.75	2.50	Proficient

Table 24 (cont.)

T	Trainee Student Critical Thinking Activity (Module I: Critical Thinking, Session 1 – 4)										
	S1	CT Level	S2	CT Level	S3	CT Level	S4	CT Level	$\overline{X}$	S.D.	CT Level
13	16	Basic	16	Basic	16	Basic	21	Proficient	17.25	1.91	Proficient
14	16	Basic	16	Basic	18	Proficient	20	Proficient	17.50	1.26	Proficient
15	15	Basic	16	Basic	16	Basic	18	Proficient	16.25	2.16	Basic
				Total					17.21	1.27	Proficient

Table 24 indicated that trainee students' critical thinking activities was generally at the proficient level ($\overline{X}$ = 17.21) during the first module consisting of four sessions including critical thinking introduction, critical thinking definition, components of critical thinking, barriers to critical thinking, and benefits of critical thinking.

Table 25 Analysis of Critical Thinking Evaluation Activity Using Scoring Rubric

T	Trainee Student Critical Thinking Evaluation Activity (Module II: CT Evaluation, Session 5– 6)						
	S5	CT Level	S6	CT Level	$\overline{X}$	S.D.	CT Level
1	22	Proficient	21	Proficient	21.50	0.71	Proficient
2	22	Proficient	25	Exemplary	23.50	2.12	Proficient
3	22	Proficient	22	Proficient	22.00	0.00	Proficient

Table 25 (cont.)

T	Trainee Student Critical Thinking Evaluation Activity (Module II: CT Evaluation, Session 5– 6)						
	S5	CT Level	S6	CT Level	$\overline{X}$	S.D.	CT Level
4	23	Proficient	22	Proficient	22.50	0.71	Proficient
5	25	Exemplary	25	Exemplary	25.00	0.00	Exemplary
6	21	Proficient	22	Proficient	21.50	0.71	Proficient
7	23	Proficient	22	Proficient	22.50	0.71	Proficient
8	21	Proficient	21	Proficient	21.00	0.00	Proficient
9	23	Proficient	22	Proficient	22.50	0.71	Proficient
10	20	Proficient	21	Proficient	20.50	0.71	Proficient
11	20	Proficient	23	Proficient	21.50	2.12	Proficient
12	25	Exemplary	25	Exemplary	25.00	0.00	Exemplary
13	25	Proficient	25	Exemplary	25.00	1.41	Exemplary
14	20	Proficient	22	Proficient	21.00	4.95	Proficient
15	18	Proficient	25	Exemplary	21.50	0.71	Proficient
		Total			22.43	0.61	Proficient

Table 25 revealed that trainee students' critical thinking evaluation activities was generally at the proficient level ($\overline{X} = 22.43$) during the second module consisting of two sessions including critical thinking assessment tool and how to assess critical thinking.

Table 26 Analysis of Critical Thinking Teaching Activity Using Scoring Rubric

T	Trainee Student Critical Thinking Teaching Activity (Module III: CTT Activity, Session 7 – 10)										
	S7	CT Level	S8	CT Level	S9	CT Level	S10	CT Level	$\overline{X}$	S.D.	CT Level
1	26	Exemplary	26	Exemplary	23	Proficient	25	Exemplary	25.00	1.41	Exemplary
2	25	Exemplary	25	Exemplary	24	Proficient	25	Exemplary	24.75	0.50	Proficient
3	25	Exemplary	24	Proficient	25	Exemplary	25	Exemplary	24.75	0.50	Proficient
4	25	Exemplary	24	Proficient	25	Exemplary	24	Proficient	24.50	0.58	Proficient
5	23	Proficient	25	Exemplary	25	Exemplary	26	Exemplary	24.75	1.26	Proficient
6	22	Proficient	26	Exemplary	26	Exemplary	27	Exemplary	25.25	2.22	Exemplary
7	25	Proficient	25	Exemplary	23	Proficient	23	Proficient	24.00	1.15	Proficient
8	25	Exemplary	22	Proficient	24	Proficient	25	Exemplary	24.00	1.41	Proficient
9	25	Exemplary	25	Exemplary	27	Exemplary	27	Exemplary	26.00	1.15	Exemplary
10	22	Proficient	25	Exemplary	23	Proficient	24	Proficient	23.50	1.29	Proficient
11	23	Proficient	24	Proficient	26	Exemplary	27	Exemplary	25.00	1.83	Exemplary
12	23	Proficient	23	Proficient	23	Proficient	25	Exemplary	23.50	1.00	Proficient
13	24	Proficient	24	Proficient	28	Exemplary	28	Exemplary	26.00	2.31	Exemplary
14	22	Proficient	23	Proficient	23	Proficient	24	Proficient	23.00	0.82	Proficient
15	25	Exemplary	25	Exemplary	25	Exemplary	26	Exemplary	25.25	0.50	Exemplary
				Total					24.62	0.59	Proficient

Table 26 illustrated that trainee students' critical thinking teaching activities was generally at the proficient level ($\overline{X} = 24.62$) during the third module consisting of two sessions including strategies to teach critical thinking and how to teach critical thinking.

Table 27 Analysis of CT Teaching Plan Activity Using Scoring Rubric

T	Trainee Student Critical Thinking Teaching Plan Activity (Module IV: CTT Plan, Session 11 – 16)														
	S11	CT Level	S12	CT Level	S13	CT Level	S14	CT Level	S15	CT Level	S16	CT Level	$\overline{X}$	S.D.	CT Level
1	25	Exemplary	25	Exemplary	27	Exemplary	27	Exemplary	27	Exemplary	28	Exemplary	26.50	1.22	Exemplary
2	24	Proficient	25	Exemplary	25	Exemplary	25	Exemplary	28	Exemplary	29	Exemplary	26.00	2.00	Exemplary
3	25	Exemplary	26	Exemplary	26	Exemplary	26	Exemplary	27	Exemplary	28	Exemplary	26.33	1.03	Exemplary
4	24	Proficient	24	Proficient	27	Proficient	27	Exemplary	29	Exemplary	29	Exemplary	26.67	2.25	Exemplary
5	26	Exemplary	26	Exemplary	29	Exemplary	30	Exemplary	30	Exemplary	31	Exemplary	28.67	2.16	Exemplary
6	27	Exemplary	28	Exemplary	28	Exemplary	28	Exemplary	29	Exemplary	28	Exemplary	28.00	0.63	Exemplary
7	25	Exemplary	25	Exemplary	25	Exemplary	27	Exemplary	27	Exemplary	27	Exemplary	26.00	1.10	Exemplary
8	26	Exemplary	26	Exemplary	26	Exemplary	26	Exemplary	26	Exemplary	26	Exemplary	26.00	0.00	Exemplary
9	27	Exemplary	28	Exemplary	31	Exemplary	31	Exemplary	31	Exemplary	31	Exemplary	29.83	1.83	Exemplary
10	25	Exemplary	24	Proficient	24	Proficient	25	Exemplary	28	Exemplary	28	Exemplary	25.67	1.86	Exemplary
11	27	Exemplary	27	Exemplary	27	Exemplary	29	Exemplary	29	Exemplary	29	Exemplary	28.00	1.10	Exemplary
12	25	Exemplary	27	Exemplary	27	Exemplary	27	Exemplary	28	Exemplary	28	Exemplary	27.00	1.10	Exemplary
13	28	Exemplary	28	Exemplary	28	Exemplary	28	Exemplary	29	Exemplary	29	Exemplary	28.33	0.52	Exemplary
14	25	Exemplary	26	Exemplary	24	Proficient	24	Proficient	26	Exemplary	27	Exemplary	25.33	1.21	Exemplary
15	24	Proficient	25	Exemplary	27	Exemplary	27	Exemplary	27	Exemplary	28	Exemplary	26.33	1.51	Exemplary
						Total							26.98	1.12	Exemplary

Table 27 revealed that trainee students' critical thinking teaching plan activities was generally at the exemplary level ($\overline{X}$= 26.98) during the fourth module consisting of six sessions including critical thinking teaching content, critical thinking teaching materials, critical thinking teaching activities, critical thinking instructions, critical thinking teaching evaluation, and organizing critical thinking teaching lesson plan.

Table 28 Summarization of Overall Trainee Student Critical Thinking Activity

T	Total Mean Score of Overall Trainee Student Critical Thinking Activity										
	$\overline{X}$ CT Activity	CT Level	$\overline{X}$ CT Eval-Activity	CT Level	$\overline{X}$ CTT Activity	CT Level	$\overline{X}$ CTT Plan Activity	CT Level	$\overline{X}$ Total	S.D.	CT Level
1	18.00	Proficient	21.50	Proficient	25.00	Exemplary	26.50	Exemplary	22.75	3.80	Proficient
2	17.75	Proficient	23.50	Proficient	24.75	Proficient	26.00	Exemplary	23.00	3.65	Proficient
3	17.25	Proficient	22.00	Proficient	24.75	Proficient	26.33	Exemplary	22.58	3.98	Proficient
4	16.50	Basic	22.50	Proficient	24.50	Proficient	26.67	Exemplary	22.54	4.37	Proficient
5	17.75	Proficient	25.00	Exemplary	24.75	Proficient	28.67	Exemplary	24.04	4.56	Proficient
6	17.25	Proficient	21.50	Proficient	25.25	Exemplary	28.00	Exemplary	23.00	4.57	Proficient
7	16.50	Basic	22.50	Proficient	24.00	Proficient	26.00	Exemplary	22.25	4.09	Proficient
8	16.75	Proficient	21.00	Proficient	24.00	Proficient	26.00	Exemplary	21.94	4.02	Proficient
9	17.50	Proficient	22.50	Proficient	26.00	Exemplary	29.83	Exemplary	23.96	5.24	Proficient
10	18.25	Proficient	20.50	Proficient	23.50	Proficient	25.67	Exemplary	21.98	3.27	Proficient
11	16.00	Proficient	21.50	Proficient	25.00	Exemplary	28.00	Exemplary	22.63	5.15	Proficient
12	17.75	Proficient	25.00	Exemplary	23.50	Proficient	27.00	Exemplary	23.31	3.98	Proficient
13	17.25	Proficient	25.00	Exemplary	26.00	Exemplary	28.33	Exemplary	24.15	4.8	Proficient
14	17.50	Proficient	21.00	Proficient	23.00	Proficient	25.33	Exemplary	21.71	3.32	Proficient
15	16.25	Basic	21.50	Proficient	25.25	Exemplary	26.33	Exemplary	22.33	4.55	Proficient
Total	17.21	Proficient	22.43	Proficient	24.61	Proficient	26.97	Exemplary	22.81	4.17	Proficient

Table 28 illustrated that trainee students' critical thinking activities was generally at the proficient level ($\overline{X}$ = 22.81). Considering of each activity, the results indicated that critical thinking ($\overline{X}$ = 17.21), critical thinking evaluation ($\overline{X}$ = 22.43), and critical thinking teaching ($\overline{X}$ = 24.61) were at the proficient level, but critical thinking teaching plan was the exemplary level ($\overline{X}$ = 26.97).

4. Individual Reflection about CT Learning and Teaching Instruction

The individual reflection about critical thinking and learning instruction was also performed by the individual trainee student during each session. The individual reflection was analyzed using the content analysis and the results were as follows:

Table 29 The Result of Individual Reflection on CT Learning and Teaching Instruction Using Content Analysis

S	Summarization of Individual Reflection on CT Teaching and Learning Instruction	Number	Percentage
1	Most of trainee students reflected that this lesson was very important for them because they have never learned it all. Critical thinking helped them think thoroughly based on collecting and analyzing the data, using clear reasons and sources, identifying solutions, and then making informed decisions.	12	80.00%
2	Most of trainee students reflected that they clearly acquired the main components of critical thinking which were good for them to use in their daily's daily life. Also, they enjoyed working in groups, sharing ideas, identifying problem and solutions, and presenting the findings.	14	93.33%
3	Most of trainee students reflected that they clearly understood the barriers to critical thinking. They also said that these barriers helped them change the ways of their thoughts, especially how to work together to reach sound conclusions.	13	86.66%

Table 29 (cont.)

S	Summarization of Individual Reflection on CT Teaching and Learning Instruction	Number	Percentage
4	All of trainee students reflected that they clearly understood the importance of critical thinking. Critical thinking guided them how to deal with problems such as sharing ideas, using different sources of information, doing searches with a variety of critical papers, working together, or accepting each other's ideas.	15	100%
5	Most of trainee students reflected that they learned different assessment tools used to evaluate critical thinking. Also, they enjoyed the class which was full of interesting activities including searching for information, exposing to the authentic environment, or working in collaboration to draw conclusions.	14	93.33%
6	All of trainee students reflected that they learned a lot about strategies to teach critical thinking. They also reflected these strategies were new to them, and they were very interesting to use when they finished their training.	14	93.33%
7	Most of trainee students reflected that they clearly understood the processes of teaching critical thinking. They knew what critical thinking teaching was, and they also knew how to manage critical thinking teaching.	10	66.66%
8	Most of trainee students reflected that they enjoyed working together. They had good chances to share ideas, to learn from each other, and to be close together. Also, they said that they really like the way that they could use their own ideas to make decisions and presentation.	15	100%
9	Most of trainee students reflected that they really enjoyed the lessons because these lessons taught them the particular strategies such as problem-based learning, project-based learning, or case-based learning which they have never known at all.	14	93.33%

Table 29 (cont.)

S	Summarization of Individual Reflection on CT Teaching and Learning Instruction	Number	Percentage
10	Most of trainee students reflected that they clearly understood each strategy used to teach critical thinking. These strategies were very important for them because they enlightened them a variety of new ways to teach students, not just only student-centered.	12	80.00%
11	All of trainee students reflected that they clearly understood the content used to teach critical thinking. Also, they said that they were very happy with this learning environment that they used and shared their own experiences in constructing new knowledge.	15	100%
12	Most of trainee students reflected that they enjoyed learning environment of identifying materials used to teach critical thinking. They said that they worked in groups, identified data, search for information, shared ideas, make a conclusion, do presentation and especially reflected their own ideas	13	86.66%
13	Most of trainee students reflected that they got new ideas about organizing activities to teach critical thinking. From video clips, critical documents as well as working together in groups, they found a lot interesting activities which are useful for learning instruction.	11	73.33%
14	Most of trainee students reflected that they enjoyed working in groups to identify learning instruction. They clearly understood the procedures how to teach critical thinking.	14	93.33%
15	Most of trainee students reflected that they learned different critical thinking evaluations which were useful for them to use when they go and teach students in the future. Also, they knew the processes how to conduct evaluations for critical thinking lessons.	12	80.00%

Table 29 (cont.)

S	Summarization of Individual Reflection on CT Teaching and Learning Instruction	Number	Percentage
16	All of trainee students reflected that they enjoyed learning very much. They understood how to conduct lesson plans to teach critical thinking, especially the ways of sharing ideas and working together.	15	100%
17	All of trainee students reflected that they enjoyed this practice teaching lesson. They could participate and test their abilities to teach critical thinking lessons.	15	100%
18	All of trainee students reflected that they loved this learning environment. They could share ideas and especially practice teaching critical thinking lessons.	15	100%
19	Most of trainee students reflected that this practice teaching was very important for them because it was only the opportunity that they could test their ability to teach critical thinking.	11	73.33%
20	Most of trainee students reflected that they enjoyed this practice teaching and they strongly hoped that they could be able to use these to teach their students.	14	93.33%

Table 29 revealed that a majority of trainee students really enjoyed this critical thinking class. They reflected that they enjoyed learning environment including learning activities, learning content, learning materials, learning evaluation, and especially organizing lesson plan. They had done a variety of activities and critical analysis such as working in groups, sharing ideas, identifying the problem, finding the solutions, search for information, doing authentic search, making a conclusion, presenting the findings, and reflecting the learning outcome.

Section 3: The Evaluation of an Instructional Model based on Cognitive-based Approach to Enhance Trainee Students' Critical Thinking and Critical Thinking Teaching Ability at the Regional Teacher Training Center

The results of the evaluation of the instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability were divided into two parts including 1) the results of perception evaluation and 2) structured interview.

1. Perceptions of Instructional Implementation

Trainee students' perceptions about the instructional implementation to enhance critical thinking and critical thinking teaching ability were investigated. The perceptions were divided into 5 sections including general course instruction, group work activities, interpersonal/team skills, critical thinking skills, and critical thinking teaching with a total of 36 subsets. The results of analysis were as follows:

Table 30 Analysis of Trainee Student Perceptions about Instructional Implementation Using Descriptive Statistics

Key Components of Trainee Students' Perceptions	$\overline{X}$	S.D	Level of Satisfaction
General Course Instruction			
I enjoyed learning about the topic of this class.	4.40	0.50	Highest level
The learning materials used in this class were helpful for learning.	4.40	0.50	Highest level
I am satisfied with overall structure of the course.	4.20	0.41	High level
I enjoyed the class activities.	4.27	0.70	Highest level
I found the class activities useful to my understanding of critical thinking.	4.53	0.51	Highest level
I found that the emphasis on the group activities and participation encouraged me to be active in learning.	4.40	0.63	Highest level
Total	**4.36**	**0.14**	**Highest level**

Table 30 (cont.)

Key Components of Trainee Students' Perceptions	$\overline{X}$	S.D	Level of Satisfaction
Group Work Activities			
I enjoyed working with others in classroom (solving problems and working on the activities together).	4.27	1.03	Highest level
I actively engaged with in-class exercises.	3.73	0.88	High level
I found working with others to be less stressful than doing similar tasks alone.	4.20	0.41	High level
I feel that my teammates collaborated in solving the in-class exercises.	3.87	0.51	Highest level
I found that working with others improved my understanding of the course material.	4.47	0.51	Highest level
I was able to help my teammates learn the course content.	3.87	0.64	High level
Total	**4.06**	**0.39**	**High level**
Interpersonal/Team Skills			
Orally present and support personal view	4.20	0.41	High level
Handle conflicts, negotiate agreements, and accept compromises	4.07	0.25	High level
Engage in discussion with an open mind	4.53	0.64	Highest level
Feel comfortable asking questions to clarify facts, concepts, and relationships.	4.27	0.70	Highest level
Total	**4.26**	**0.25**	**Highest level**
Critical Thinking Skills			
Identify what information is needed to solve a problem	4.53	0.64	Highest level
Plan my work	3.93	0.96	High level
Set goals	4.27	0.45	Highest level
Stay on task while working on a problem	4.07	0.45	High level
Organize information	4.40	0.50	Highest level
Apply scientific concepts/ideas to real-world problems	4.27	0.59	Highest level
Divide complex problems into manageable components	3.93	0.45	High level

Table 30 (cont.)

Key Components of Trainee Students' Perceptions	$\overline{X}$	S.D	Level of Satisfaction
Consider other people's perspectives while making decisions	4.07	0.79	High level
Approach the problem from various perspectives (economic, social, and cultural, etc.)	4.07	0.79	High level
Recognize contractions/ inconsistencies in ideas, data etc.	4.00	0.92	High level
Use established criteria to evaluate solutions	4.20	0.77	High level
Recognize mistakes in my own thinking	4.47	0.51	Highest level
Understand the impact of real-life cause of problems	4.13	0.83	High level
Express my thinking clearly in writing and speaking	3.33	1.29	High level
Evaluate arguments and evidence so that strengths and weakness of competing alternatives can be judged	4.00	0.65	High level
Use discussion strategies to analyze and solve a problem	4.47	0.64	Highest level
Total	**4.13**	**0.35**	**High level**
Teaching Critical Thinking			
1. Be able to identify topics for critical thinking lessons	4.40	0.50	High level
2. Understand how to manage critical thinking activities	4.40	0.50	High level
3. Understand how to evaluate critical thinking results	3.93	1.03	Highest level
4. Feel comfortable in continuous teaching critical thinking	4.40	0.50	High level
Total	**4.28**	**0.37**	**High level**
Total mean score of trainee students' perceptions	**4.28**	**0.19**	**Highest level**

Table 30 revealed that trainee students' perceptions on instructional implementation were generally at the highest level ($\overline{X}$= 4.28). Concerning each element, the findings revealed that general course instruction ($\overline{X}$= 4.36), critical thinking teaching ($\overline{X}$= 4.28), interpersonal/team skills ($\overline{X}$= 4.26) were at the highest level, but critical thinking skills ($\overline{X}$= 4.13) and group work activities ($\overline{X}$= 4.06) were at high level.

2. The Result of Structure Interview

Structured interview was conducted with 10 volunteer trainee students in order to find out their own ideas about the critical thinking and critical thinking teaching activities constructed and implemented during learning instruction using the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. Content analysis was used to analyze the retrieved information and the results were as follows:

Table 31 Results of Structured Interview on Trainee Student Critical Thinking and Critical Thinking Teaching Using Content Analysis

Structured Interview	Trainee Students' Opinions
A. Overall - Would you describe how you experienced from this course? - What were the characteristics that helped you be more active and engaged in your learning? - What is the most helpful feature that supported your learning?	This training course is very interesting because it provides a lot of new experiences, especially how to improve critical thinking. Critical thinking is very important for daily's life. This critical thinking helps us how to thoroughly and critically think before making any decision. It is required us to find out all relevant data, look for different sources of information, link together facts, compare and contrast ideas, seek relationships and patterns, apply past experiences, evaluate, analyze, and synthesize assumptions and bias, interpret information, and draw conclusions. What really makes us like this course includes working together in small groups, sharing ideas, giving each other respect, learning by our own, and especially contents related to our own needs.
B. In-Class Activities - Can you describe your in-class activities you experienced from this course?	All the activities are interesting and help us quickly understand the content of the lesson. These activities include working in small groups, discussion, site visit, and especially critical article analysis. What we thought the most active in this course is the ways of sharing ideas to

Table 31 (cont.)

Structured Interview	Trainee Students' Opinions
- Which type you were the most active? - What would be different characteristics from other courses you have attended? - You worked on real problems in society. How did this help your learning?	reach conclusions and decisions. We share ideas, discuss, make decisions, do presentation, and reflect our own ideas about learning outcome. Both content and activities made us have a sense of healthy learning, had strong friendships, learned from different perspectives, and arrived at the best possible solutions.
C. Assignment - You were asked to do several assignments such as pre-and post-test, teaching practice etc.. You liked or dislike them? How did they help you improve your critical thinking?	We were asked do the assignments and these assignments help us use critical thinking. We try to identify the matter using different sources of information, employing clear data, recognizing the unstated assumptions, combing evidence, arguments, claims, and beliefs, and especially making judgments and drawing conclusions based on sound reasoning.
D. Small Group Work Activities - What experience have you had in terms of small group work? - In what way did the small group activity help you to make a decision?	A majority of trainee students expressed that video clips and group work were the most interesting parts of all the activities because they could learn from the real experiences in alignment with their needs, share views and opinions openly without fear of ridicule and criticism, and made them more sociable and out-going.
E. Teaching Activity - As you engaged in teaching activity, how did it help you to improve critical thinking teaching?	Teaching practice is an interesting activity. This teaching practice makes us clearly understand our own abilities to both organize lesson plans and teach critical thinking lessons. This teaching practice also motivates us to use different approaches to teach, not just only student-centered.

Table 31 (cont.)

Structured Interview	Trainee Students' Opinions
F. Teaching Process - How did instructional materials help you make the decisions? (Example, you were asked to list some facts or reasoning to help you make decisions.) - As you engaged in the activities, how did this process help you deal with the complexity of the real-life problem? How did you consider different perspectives? - Overall, did the course help you improve your critical thinking?	The instructional materials are important because they help us to easily understand the lessons, and especially reduce the time. For example, videos, critical papers or articles make clearly understand the content of the lessons, and we can see the activities clearly. Based on the processes used during the class, they are very important to use in daily's life. We learn how to judge, evaluate, analyze, and synthesize the information, and make conclusions with sound reasons. Overall, we love this training course very much because it teaches us to clearly understand critical thinking and critical thinking teaching which are very important for daily's life and especially for our careers.

Table 31 indicated that trainee students really enjoyed this critical thinking course. This critical thinking course enlightened them new knowledge, especially critical thinking and critical thinking teaching. Regarding critical thinking, trainee students learned how to seek and interpret information, to compare and contrast ideas, link together facts, combine evidence, identify the matter, evaluate, analyze, and synthesize the data, use clear reasons and sources for making judgment, and make their own decisions and conclusions retrieved from discussion and team work. Also, trainee students liked practice teaching critical thinking lessons. They learned to organize the lessons plans and then practice teaching. This practice teaching reflected their abilities of both theories and practice.

CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATION

The main purposes of this study were 1) to develop an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability 2) to implement an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability, and 3) to evaluate an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability. The findings are mainly based on three approaches: cognitive-based approach, critical thinking theory and strategies to teaching critical thinking. The cognitive-based approach primarily consists of constructivist learning theory, cognitive learning theory, social-cognitive learning theory, cognitive information-processing theory, and adult learning theory. These findings are used as key elements in the development of an instructional model. An instructional model to enhance trainee students' critical thinking and critical thinking teaching ability is designed for the purpose of fostering the capacity of trainee students' critical thinking and introducing them how to teach critical thinking.

This chapter described a brief summary of the results, and then the findings were addressed with regards to the discussions, conclusions, policy implication for educators, and finally concluded with implications for further research.

Brief Summary of the Results

The results of an instructional development based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability are as follows:

Part 1: The results of an instructional development based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability

1. The findings from constructivist leaning theory, cognitive development theory, social-cognitive development theory, cognitive information processing theory, and adult learning theory derived from cognitive-based approach basically laid a bridge for an instructional model development.

Constructivist Learning Theory: Learning is related to using the complex and interactive experiences, enhancing meaningful challenges, solving realistic problems, strengthening collaboration, and discovering for constructing new ideas.

Cognitive Development Theory: Learning concerns the ability to think, identify the problem, reason, understand, analyze the fact, make a decision, and draw conclusions.

Social-Cognitive Theory: Learning occurs through social interactions such as observation and self-instruction in order to acquire new knowledge.

Cognitive Information Processing Theory: Learning is related to learners' experience, uses various techniques and activities, and requires practicing.

Adult Learning Theory: Learning is related to self-motivated, relevancy-oriented, self-freedom, self-respected, and being practical.

2. The developed instructional model consisted of 6 potential components including fundamental principle, learning objective, learning content, learning instruction, learning material, and evaluation of effectiveness.

3. Critical thinking theories and strategies to teaching critical thinking were extensively investigated, and the findings were used to develop learning instruction to enhance trainee students' critical thinking and critical thinking teaching ability. The learning instruction is divided into 8 steps as follows:

Step 1: Triggering activity: This step alerts learners what is going to come and stimulates their curiosity and anticipation in order to establish learning issues.

Step 2: Identifying problem: This step involves learners in identifying the problem through conducting literature search with an aid of critical articles provided and then explaining in their own words what the problem is about.

Step 3: Investigating related data: This step involves learners in interacting with an authentic learning environment, and they were actively engaged in the collection of data to verify their hypotheses.

Step 4: Discussing findings: This step encourages learners to use different platforms to share their ideas and discuss their findings through working individually, in pairs and in groups.

Step 5: Evaluating findings: This step involves learners in analyzing and evaluating the findings using alternative sources of information collected on the problem.

Step 6: Creating solutions: This step engages learners in constructing new knowledge through presenting possible solutions and options for solving the problem based on their own experience and previously acquired knowledge.

Step 7: Presenting solutions: This step involves learners in presenting their solutions to the class using different methods such as poster, mind map, chart, or demonstration.

Step 8: Reflecting learning outcome: This step involves learners in demonstrating the ability to understand the implications and to refine the existing questions and raise new ones.

4. Learning activity used to improve trainee students' critical thinking and teaching critical thinking ability is in association with using academic texts, articles, journals, portfolios concerning trainee students' real life and experience. Trainee students require to solve real-life problems related to how to use critical thinking and organizing critical thinking teaching while working with data, charts, posters, and video clips. Also, they were asked to think critically about the correspondence of content of the lesson and engage in a collaborative problem-solving and then leading to practice teaching activities.

5. The results of evaluation revealed that the validity of the developed instructional model was generally at the highest level of applicability ($\overline{X}$ = 4.21), meeting the required criteria. Regarding each element, the results also indicated that learning objective ($\overline{X}$ = 4.53), evaluation of effectiveness ($\overline{X}$ = 4.33), and learning content ($\overline{X}$ = 4.26) were at the highest level of applicability, but learning instruction ($\overline{X}$ = 4.20), learning material ($\overline{X}$ = 4.06), and fundamental principle ($\overline{X}$ = 3.86) were at high level of applicability.

6. The results of the evaluation illustrated that the validity of the instructional handbook was, in general, at the highest level of applicability ($\overline{X}$ = 4.26), meeting the required criteria. Considering of each element, the results also revealed that the objective of instructional handbook ($\overline{X}$ = 4.40), the introduction of using an instructional handbook ($\overline{X}$ = 4.40), learning structure ($\overline{X}$ = 4.60), learning procedure ($\overline{X}$ = 4.40), learning activities ($\overline{X}$ = 4.40), and lesson plan ($\overline{X}$ = 4.80) ere at the highest level of applicability, but the duration of each session ($\overline{X}$ = 4.20), learning materials ($\overline{X}$ = 4.20), the evaluation ($\overline{X}$ = 4.20), and the quality of writing ($\overline{X}$ = 4.00) were at high level of applicability.

7. Concerning the reliability check, the pilot study was conducted and the results yielded the high possibility of suitability and acceptability of learning and teaching instructions including learning content, learning activity, learning materials, and timeframe. However, quite few barriers were faced, and especially handouts should be given in advance.

Part 2: The result of an implementation of the developed instructional mode based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability

1. The results of comparison between pre-and post-test critical thinking revealed that trainee students' post-critical thinking was higher than pre-critical thinking implementation.

2. Trainee students' critical thinking teaching ability was at the exemplary level ($\overline{X}$ = 20.62)

3. Trainee student's critical thinking activities were at the proficient level ($\overline{X}$ = 22.81). Considering of each activity, the results indicated that critical thinking ($\overline{X}$ = 17.21), critical thinking evaluation ($\overline{X}$ = 22.43), and critical thinking teaching ($\overline{X}$ = 24.61) were at the proficient level, but critical thinking teaching plan was the exemplary level ($\overline{X}$ = 26.97).

4. Trainee students reflected their positive thoughts towards critical thinking and critical thinking teaching ability.

Part 3: The result of the evaluation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability

1. Trainee students' perceptions about critical thinking learning and teaching instruction were at the highest level ($\overline{X}$= 4.28). Considering of each component, the results also indicated that general course instruction ($\overline{X}$= 4.36), interpersonal and team skills ($\overline{X}$= 4.26), and critical thinking teaching ($\overline{X}$= 4.28) were at the highest level, but group work activities ($\overline{X}$= 4.06) and critical thinking skills ($\overline{X}$= 4.13) were at high level.

2. The results of structured interview illustrated that all trainee students emanated positive thoughts about the instructional implementation, especially overall views about critical thinking activities, in-class activities, assignments, small group activities, teaching activities, and teaching processes.

Discussion

The Regional Teacher Training Center (RTTC) in Takeo province is one of the six Regional Teacher Training Centers in Cambodia. RTTC in Takeo province was found in 1981, and it is situated in the southern part of the country, about 100 kilometers from Phnom Penh capital. This state-owned center annually trains more than 300 trainee students who officially become government secondary school teachers after successful completion of a two-year training course. The training center offered 7 majors that could be selected by each individual trainee when applying for examination, and these majors are including Khmer-Morality, English-Khmer, Physics-Chemistry, Biology-Earth Science, Mathematics-Physics, Home economy-Khmer, and History-Geography. The students who are admitted to take this entrance exam are only from four provinces and municipalities including Takeo and Kampot provinces and Kep municipality and Sihanouk Ville [3]. After completion of the course, trainee students will be deployed to teach students at the secondary schools in the provinces where they had applied earlier.

There are 30 trainee students, majoring in English and Khmer being trained at the Regional Teacher Training Center, Cambodia, and a number of these trainee students is divided into two classes (15 for A1 and 15 for B1). However, only one

class with 15 trainee students (B1) attended this training course, and a majority of them is male.

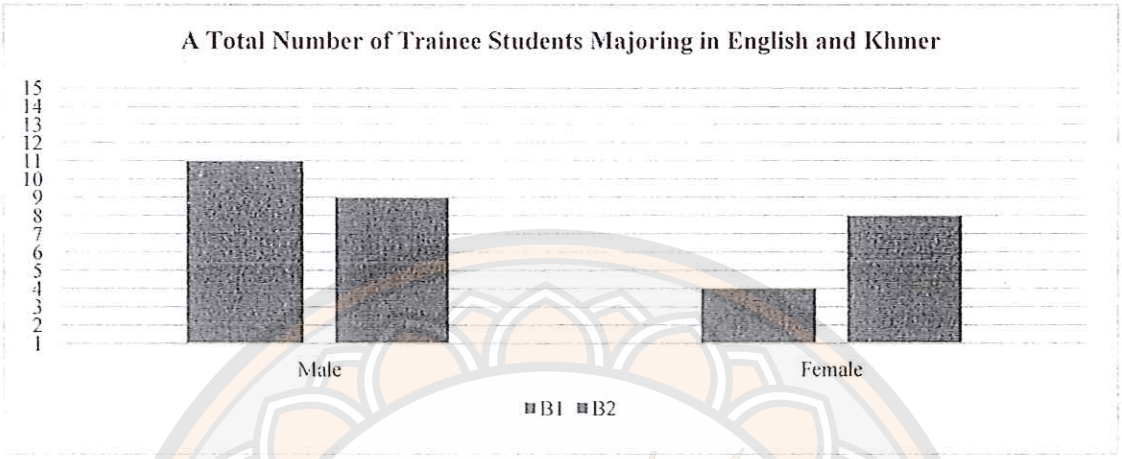


Figure 16 A Total Number of Trainee Students Majoring in English and Khmer

1. The Effect of the Developed Instructional Model

Instruction refers to teaching approaches that are used to help learners to achieve the overall progresses that are outlined in the curriculum [91], involves students as active participants in their own learning, Fisher and Frey [92], and especially facilitates learners' attainment of intended, specific learning goals or the conduct of activities that are focused on learners learning specific things. Instruction includes all teaching and other learning experiences in which instruction is conveyed by other forms of media [93].

Concerning an instructional model development based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability, it consisted of six components including fundamental principle, learning objective, learning content, learning instruction, learning material, and evaluation of effectiveness. Also, learning instruction is designed into eight steps including triggering activity, identifying problem, investigating related data, discussing findings, creating solutions, presenting solutions, and reflecting solutions.

Each element was carefully examined and evaluated by the academic advisers/experts/professionals. The results of evaluation revealed that all the components employed to develop an instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability were highly acceptable and consistent with the criteria of an instructional model development.

1.1 Quality of Instructional Model

The main goal of an instructional model is to make learning more efficient and effective and less difficult by defining the problem and determining what knowledge and skills needed to solve the instructional problem and focusing on what learner needs to know and avoids [96]. Concerning this research, the components of the developed instructional model included fundamental principle, learning objective, learning content, learning instruction, learning material, and evaluation of effectiveness, and these components were carefully checked and evaluated by the academic advisers/experts/professionals.

The results of the evaluation revealed that the components of an instructional model, in general, were at high level of applicability ($\overline{X}$= 4.21). 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 is in line with some other previous researches. The results of 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 [309] indicated that the validity of the developed model including principle, objectives, structure and content, activity arrangement, and evaluation was at high possibility and applicability.

Gadzella and Masten [25], in their studies, identified numerous approaches showing promise in better promoting critical thinking in the classrooms. Halpern [28] claimed that "better critical thinking can be improved with an appropriate instruction. Also, Chapman [64] explained that the majority of teaching and learning instructions were based on memorization of facts from lecturers rather than active participation. This could be assumed that if teachers use appropriate instructional

methods and curriculum materials, students will improve their critical thinking skills [24].

Considering of each component, the results indicated that fundamental principle was at high level of applicability ($\overline{X}$= 3.86), learning objective was at the highest level of applicability ($\overline{X}$= 4.53), learning content was at the highest level of applicability ($\overline{X}$= 4.26), learning instruction was at high applicability ($\overline{X}$= 4.20), learning material was at high level of applicability ($\overline{X}$= 4.06) and evaluation of effectiveness was at the highest level of applicability ($\overline{X}$= 4.33).

Fundamental principle was at high level of applicability ($\overline{X}$= 3.86). This reflected that all the theoretical bases used to support the instructional model development were clear and rationale. Also, the findings retrieved from all supporting theories promoted critical thinking and critical thinking teaching perspectives, and especially explained what is expected to be achieved. The same results were also explained by some other scholars and theorists. A previous review of the literature by McKeachie [26] cited seven studies to demonstrate that discussion classes are more effective than lecture classes in promoting retention and higher-level thinking. Moreover, critical thinking needs to be intentionally and thoroughly instructed with precise explanation in every subject content area [21].

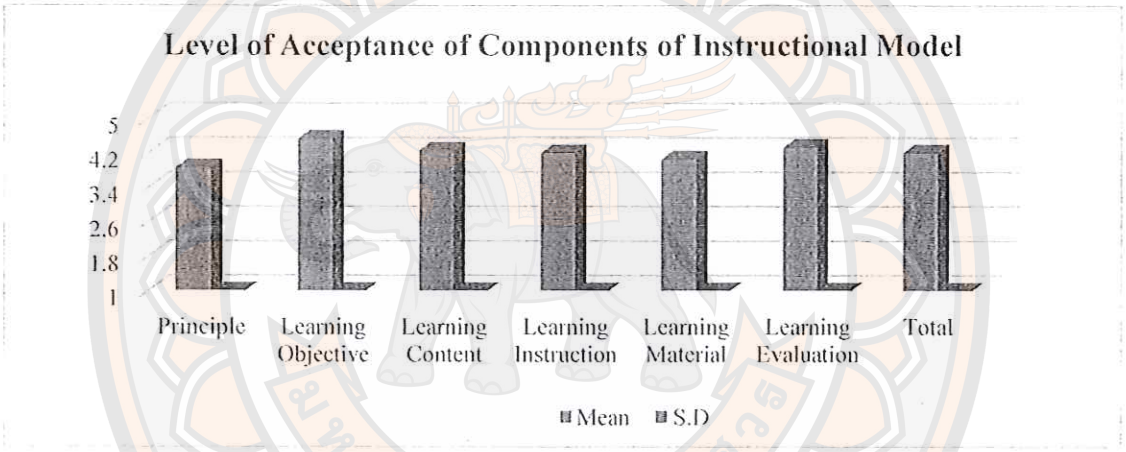
Learning objective was at the highest level of applicability ($\overline{X}$= 4.53). This meant learning objective constructed was clear and reasonable, answered the current needs of trainee students, and especially consistent with the incumbent needs of society. The finding is also in conjunction with some other preceding researches. Developing student competency is to deal with complex problems in real-life contexts [310] and the needs to support students to effectively function in complex problem-solving environment [311] require students to be involved in critical thinking which underlies a process of purposeful, reasonable, and goal-directed higher-order thinking [196]. Also, the delivery of information and activities must facilitate learners' attainment of intended, specific learning goals or the conduct of activities focused on learners learning specific things [93].

Learning content was at the highest level of applicability ($\overline{X}$ = 4.26). There are several reasons leading to this level. Learning content concerns trainee student's needs and experiences, enhance their critical thinking and critical thinking teaching ability, and above all is consistent with social and industrial requirements. The same finding is also shared by some other theories. Halpern [28] intended that critical thinking focuses on generic thinking skills using varied examples. Courses designed specifically to teach critical thinking may be quite helpful in assisting learners and offering opportunities for them to practice which is considered as important to the development of critical thinking [48]. Also, the key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge [273].

Learning instruction was at high level of applicability ($\overline{X}$ = 4.20). This reflected that learning instruction is simple and clear, fosters trainee students in improving critical thinking and critical thinking teaching ability, and particularly engages them in working in groups, sharing ideas, and analyzing to reach conclusions. This finding is strongly supported by some researches and theories. In a series of studies conducted by Nisbett and his colleagues [21], the findings indicated that there is empirical evidence that skills acquired during critical thinking instruction. Also, classroom instruction is crucial to enhance critical thinking [24], and a good learning instruction demands that every teaching event involves students as active participants in their own learning, which also allows the teacher to plan subsequent lessons based on student's understanding and misunderstanding [92].

Learning material was at high level of applicability ($\overline{X}$ = 4.06). This reflected that learning materials are sufficient and practical-oriented for enhancing trainee students' critical thinking and critical thinking teaching ability, help them promote their critical thinking, and all are consistent with each learning activity and content. In lieu of this finding, Paul and Elder [78] explored that materials can be used to promote the active learning and those material should be useful immediately, rather than at some time in the future [145]. Also, Darkenwal and Merriam [185] explained that learning is affected by an organization of material, the perceived meaning of tasks and materials by the learner.

Evaluation of an effectiveness was at the highest level of applicability ($\overline{X}$ = 4.33). This was found that the evaluation is clear and measurable, reflects the effectiveness of the instructional model, and consistent with learning objectives. Similarly, Ennis [295] also viewed evaluation as playing a prominent part in critical thinking, joining with reasoning, problem solving, and analysis. Interconnection between evaluation and critical thinking suggest evaluation depends on the evaluator's ability to assess all key elements in critical thinking to include identifying problem [296], developing appropriate plans to solve the problems [297], and exploring alternative ways of helping clients [298].



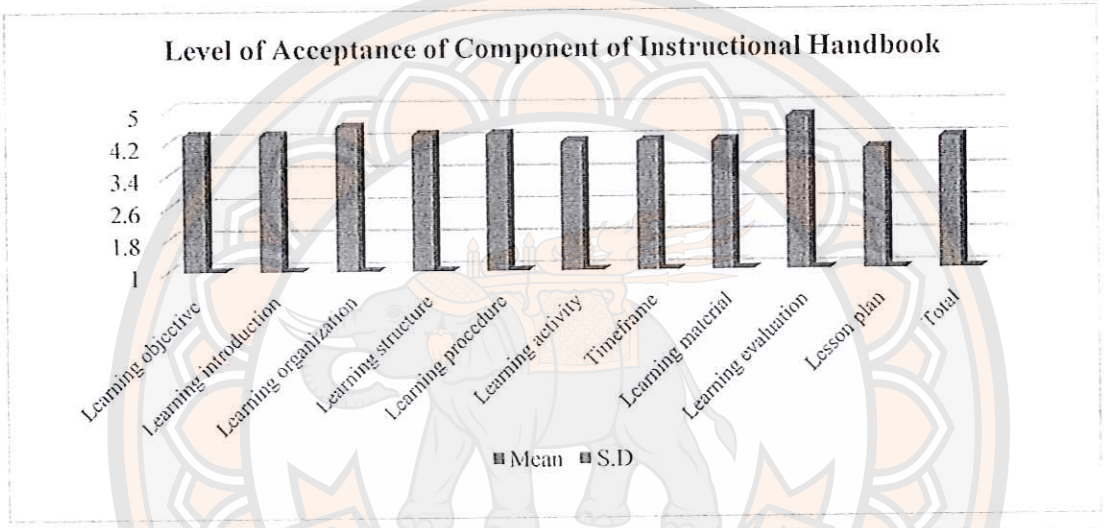
Note: 1.00-1.80 = lowest level, 1.81-2.60 = low level, 2.61-3.40 = medium level, 3.41-4.20 = high level, 4.21-5.00 = highest level

Figure 17 Summarization of Quality of Components of Instructional Model

1.2 Quality of Instructional Handbook

The instructional handbook was invented in order to provide the details of information about how to use the developed instructional model. The main components of the instructional handbook included learning objective, learning introduction, learning organization, learning content and structure, learning procedure, learning activity, timeframe, learning material, learning evaluation, and lesson plan, and these components were checked and evaluated by the academic advisers, experts, and professionals. The results of this evaluation revealed that all the components of the instructional handbook were generally at the highest level of applicability ($\overline{X}$ = 4.26).

Considering of each element of an instructional handbook, the results indicated that learning objective ($\overline{X}$ = 4.40), learning introduction ($\overline{X}$ = 4.40), learning organization ($\overline{X}$ = 4.60), learning content and structure ($\overline{X}$ = 4.40), learning procedure ($\overline{X}$ = 4.40), and learning evaluation ($\overline{X}$ = 4.80) were at the highest level of applicability. However, learning activity ($\overline{X}$ = 4.20), timeframe ($\overline{X}$ = 4.20), learning material ($\overline{X}$ = 4.20), and lesson plan ($\overline{X}$ = 4.00) were at high level of applicability.



Note: 1.00-1.80 = lowest level, 1.81-2.60 = low level, 2.61-3.40 = medium level, 3.41-4.20 = high level, 4.21-5.00 = highest level

Figure 18 Summarization of Result of Instructional Handbook

1.3 The Effect of Pilot Study

The results of pilot study indicated that learning content, learning activity, learning materials, and timeframe are all suitable and in conjunction with the expectation of enhancement of trainee students' critical thinking and critical thinking teaching ability.

Learning content is clear, understandable, and related to the current needs of trainee students and society. Also, learning content is full of critical analysis using a variety of portfolios such as clip video, critical report, critical reflection paper, and critical articles. Particularly, the content concerned the existing issues faced by training centers and trainee students. Relatively, Howe and Warren [270] expressed that problem-solving, cooperative learning, simulations, debates, and critical reporting

sessions are crucial to enhance critical thinking, and learners must be given an opportunity to learn and perform with their acquired knowledge which is thought as the key to successful learning [273].

Learning activity involved trainee students in building up their critical thinking skills and critical thinking teaching abilities. Different kinds of activities related to enhancement of critical thinking and critical thinking teaching were utilized during tryout. These activities including working in small group, discussions, debates, personal search, and presentation motivate trainee students to enjoy the class, and especially help them to conveniently understand the content. Supportably, the research done by Kowalcyk, Hackworth, and Case-Smith [33] on "Perceptions of the Use of Critical thinking Teaching Methods" indicated that the classroom activities which support critical thinking include, team-based learning, collaborative projects, simulation modules, scenarios with alternative methods/solutions, concept mapping, problem-based learning modules, and reflective journaling and portfolio development, research reports or critical analysis papers.

Learning materials included clip videos, posters, critical papers, and particularly doing the authentic search on site. These learning materials were sufficient for trainee students to identify the content of critical thinking and critical thinking teaching. Also, These materials ease them searching for the answers, profoundly understanding the lessons, and above all encouraging them to work together in groups and using critical analysis with different sources of information and data. Similarly, Knowles [77] found that appropriate environment for developing learner participation and sharing of information and perspectives have widely assumed to be the basis of critical thinking pedagogy, and the appropriate environment encourages the values emanating from conducive to critical thinking.

Timeframe was long enough for each session. Trainee students had enough time for learning the lessons and doing the practices. Moreover, trainee students had enough time to work in groups, to identify the answers for the proposed questions, to discuss about the matter, to search for relevant information and data, and especially for presenting the findings and reflecting the learning outcome. Correspondingly, the interactions among students are vital to improve their thinking and learning; however, it takes time. These interactions deepen students'

understandings through multiple perspectives while working, exploring, discussing, interpreting, and negotiating the ideas with their peers and others [217].

At the same time, there appeared some challenges, particularly handout distribution. Some trainee students suggested that handouts should have distributed in advance so that they could be well-prepared before entering the class. These challenges gave prior clues which then they will be well organized during the implementation of the developed instructional model.

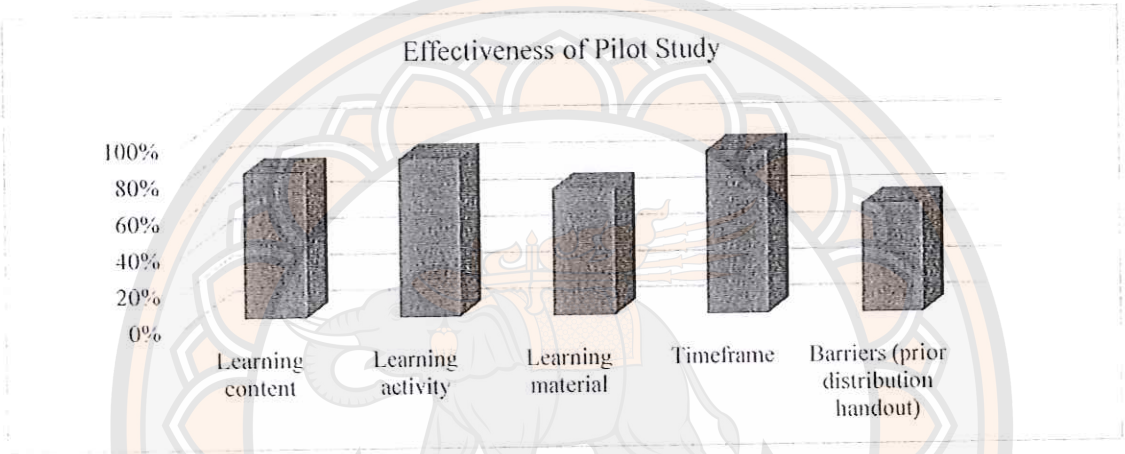


Figure 19 Summarization of Effect of Pilot Study

2. The Effect of Critical Thinking and Critical Thinking Teaching

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 cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability is placed on 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. Particularly, trainee students construct new knowledge using their own experiences.

2.1 Critical Thinking

The results of analysis using Wilcoxon indicated there was a huge gain in mean scores of trainee students' critical thinking between pretest and posttest. This reflected that critical thinking of trainee students could be improved when an appropriate instruction was used. Of course, an instructional model development based on cognitive-based 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 a research "Exploring Undergraduate Students' Active Learning for Enhancing Their Critical Thinking and Learning in a Large Class" conducted by Kim [312]. The results found that active learning strategies were useful in enhancing students' critical thinking as well as engaging their critical thinking process.

Any learning instruction which nurtures critical thinking is to avoid the ignorance of the needs, interests, and backgrounds of students. This means that student's personal choice, randomness, individuality, and freedom are paramount and the most characteristics to the enhancement of critical thinking, and they must take center stage. Thus, students will never become fully cognitive human unless they choose their studies for themselves. Also, learning instruction should focus on students' motivation to learn, stages of development, and reaction to new and different ideas and situations. This elastic view is consistent with some theories. For example, critical thinking is a learnable skill [31], good thinking is a skill that can be taught [29], and better critical thinking can be improved with appropriate instruction [28].

Students are viewed as bundles of potentiality that are shaped powerfully by their senses of touching, feeling, hearing, smelling, and tasting. Therefore, learning instruction is to create activities and establish environment that stimulates all five of these senses which help cultivate critical thinking. Furthermore, students should be actively engaged in pursuing projects that interest them and encouraged to express themselves in any way they choose, including through role playing, drama, debate, or discussion. Teachers should be guides who direct student learning, not lecturers who tell student what to know or propel students toward right answers. Malamitsa, et al. [313] conducted a research study to explore the development

of sixth grade students' critical thinking skills in science teaching. The research focused on dilemmas, debates, and active participation by teamwork, developing argument, problem-solving, and on engaging students in practical work. The result was that it helped in promoting students' critical thinking skills, which marked in identifying and evaluating arguments, assessing claim, forming conclusions, and justifying procedures.

Selecting or improvising suitable instructional materials help facilitate and motivate student learning. Such materials make learning and teaching easy, lively, and concrete and especially improve their cognitive ability. Creative use of a variety of instructional materials will increase the probability that students learn more, retain better, and bring about the skills that they are expected to perform. Students learn material best when they use it to do something that interests them, when they have chosen the activity for themselves, and when the project engages their full range of desires. It was also found that instructional materials which are properly used in teaching and learning situations can accomplish unlimited amounts of complex tasks. For instance, instructional materials offer real experiences in giving concrete basis for thinking, understanding, breaking language barriers, easing difficulties, reducing meaningless responses, and in the end, making learning more meaningful. As stated by Scriven and Paul [226] that insufficient instructional materials hinder critical thinking resources.

The improvement of critical thinking geared to the needs of learners required of the teachers an enormous amount of flexibility, a high tolerance of unpredictability and a willingness to give up absolute control of the classroom. The role of teacher is to build upon students' innate desires and make a personal communication with them. Learning activities must impact students in emotional and effective, not just intellectual, way. Students are motivated to share experiences with others, and they should not be pressed to do somewhat beyond their ken; otherwise, they reply confusedly and at random. A previous review of the studies by McKeachie [26] found that student-centered classes which involved students in cooperative learning settings, simulations, freedom and responsibility, and critical reporting sessions [270] promoted higher-level cognitive outcomes.

2.2 Critical Thinking Teaching Ability

Critical thinking teaching ability was also checked by the researcher. At the end of the implementation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability, trainee students were asked to organize critical thinking lesson plans and then perform practice teaching. The trainee students' practice teaching critical thinking lessons reflected their abilities to select the topics, content, learning activities, learning materials, and learning evaluation which are all used to promote critical thinking and critical thinking teaching ability. Trainee students' critical thinking teaching ability was evaluated using scoring rubrics composed of three main components including lesson plan, teaching activity, and learning outcome.

The results of critical thinking teaching evaluation indicated that trainee students' critical thinking teaching ability was generally at the exemplary level ($\overline{X}$ = 20.62). The results also illustrated that all key components including lesson plan ($\overline{X}$ = 20.40), teaching activity ($\overline{X}$ = 20.93), and learning outcome ($\overline{X}$ = 20.53) practiced by trainee students were also at the exemplary level. There are some challenges that make trainee students' critical thinking teaching ability be at the exemplary level, and these are including:

Lesson plan: Lesson plan is a vital component of teaching and learning processes. Proper classroom planning keeps teachers and students organized and on track while teaching and learning, thus allowing them to teach and learn more, and especially help students reach objectives more easily and manage less. Lesson plan also provides a coherent framework for smooth efficient teaching, and particularly, gives a sense of direction in relation to learning outcome. The better well-organized the teacher is, the more likely she/he will be able to handle whatever unexpectedly happens in the lesson. Before practice teaching critical thinking lessons, trainee students were asked to prepare lesson planning by themselves. The results of their group work and discussion to organize the lesson planning reflected that they could conduct the productive lesson plans to teach critical thinking.

The lesson plans included clear topics which concerned problem of the current situations and students' experiences. Also, the purposes of all lesson plans are clear and foster in critical thinking, content concerns critical analysis of real-life

problem, learning materials include critical articles, posters, reports etc., learning instruction engages in small group discussion, collaborative activities, debate, simulation etc., learning instruction involved approaches to teaching critical thinking including Bloom's cognitive domain, project-based approach, problem-based approach etc., and assessment of learning outcome engages students in developing new knowledge.

Similar ideas were also proposed by some scholars. Halpern [56] proposed a four-part model for teaching critical thinking one of those is directing learning activities in ways that increase the probability of trans-contextual transfer. Also, Halpern [28] claimed that "better critical thinking can be improved with appropriate instruction", and critical thinking can be taught through drills, exercises, or problem solving [31].

Teaching activity: The main aims of organizing a variety of activities are to achieve the learning outcome which mainly based on clear focus, clear structure, progressive levels of thinking, or opportunity for feedback. When planning classroom activity, it is need to be clear what the learning activity will enable the students to achieve, presentation, practice, performance, or purpose. Successful learning activities lie at the heart of effective classroom management. It is required to carefully think about the nature of activities that students will engage with, and understand the importance of the link between effective learning activities and the quality of the learning output such activities can generate. The more students can engage with the learning the fewer problems with behavior management. This should be clearly known what the focus of classroom learning activity is, and more importantly communicate with students, when they know where they are going with their learning they perform better.

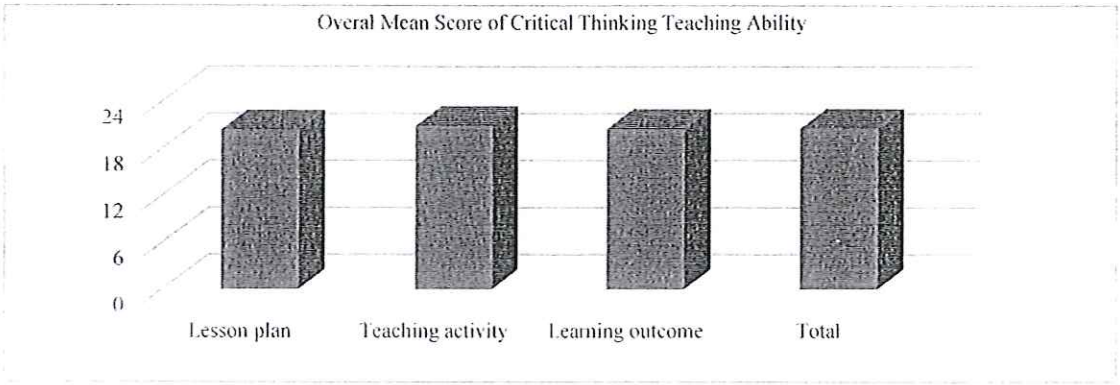
Teaching activities which were organized and implemented by the trainee students during their practice to teach critical thinking stimulated trainee students for their curiosity and participation to establish learning issues. Moreover, these activities involve trainee students in identifying problem through using critical articles, portfolio etc., engage students in authentic learning environment through data collection and verification hypothesis, involve students to work in groups, share ideas, or discuss findings, engage students in analyzing, evaluating using alternative sources

of information collected on the problem, encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience, keep students to present findings using different methods such as posters, mind maps etc., and involves students in demonstrating the implication, refining the existing questions, and raising new ones.

Relatively, the same ideas revealed by some scholars. Critical thinking is related to applying cognitive skills such as hypothesizing, designing, performing, and analyzing a series of investigation [66]. Critical thinking process is reinforced by disposition which includes a tendency to reserve judgment, ask questions, and consider alternative possibilities [224]. Also, critical thinking is associated with 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 [225].

Learning outcome: Learning outcomes focus on the application and integration of the knowledge and skills acquired in a particular unit of instruction and emerges from a process of reflection on the essential contents of a course. They help students connect learning in various contexts, and help guide assessment and evaluation. Also, learning outcome describes the knowledge or skills that students should acquire by the end of a particular assignment, class, course, or program, and help students understand why that knowledge and those skills are useful to them.

As a result, students could seek the statements of the main points or questions, they could look for explanation, reasons, and alternatives, and they could use, cite credible sources, change position on an issue with good reasons, and particularly suggested new ideas. In line with these ideas, Paul [229] construed critical thinking as the ability to reach sound conclusions based on observations and information. Also, critical thinking concerns making meaningful and unbiased decisions or judgment using analysis, evaluation, inferences, interpretation, evidence, and explanation of the arguments [214].



Note: 00.00 – 6.00=Novice, 6.01 – 11.99=Basic, 12.00– 17.99=Proficient, 18.00 – 24.00=Exemplary

Figure 20 Summarization of Result of Critical Thinking Teaching Evaluation

2.3 Critical Thinking Learning Activity

Classroom observation record was performed by the researcher himself, and it has been done for inspection to collect baseline data and judge learning and teaching practices and social problems that inhibit the participation and achievement of the trainee students. Particularly, classroom observation record helps teacher on his own practice in order to identify effective teaching strategies, to revitalize his development, to promote equitable participation, to explore how trainee students' beliefs and roles impact on their expectations, and to address the diverse needs of all the trainee students.

The results of classroom observation indicated trainee students' learning participation for all critical thinking activities was generally at the proficient level ($\overline{X}$= 22.81). Considering of each activity, the results indicated that critical thinking ($\overline{X}$= 17.21), critical thinking evaluation ($\overline{X}$= 22.43), and critical thinking teaching ($\overline{X}$= 24.61) were at the proficient level, but critical thinking teaching plan was the exemplary level ($\overline{X}$= 26.97). There are several reasons that lead to this proficient level.

Interactions among trainee students: Learning environment that offers opportunities for students to communicate with each other helps them effectively construct their knowledge as well as maximize their critical thinking ability. By emphasizing the collaborative and cooperative nature of tasks, students share

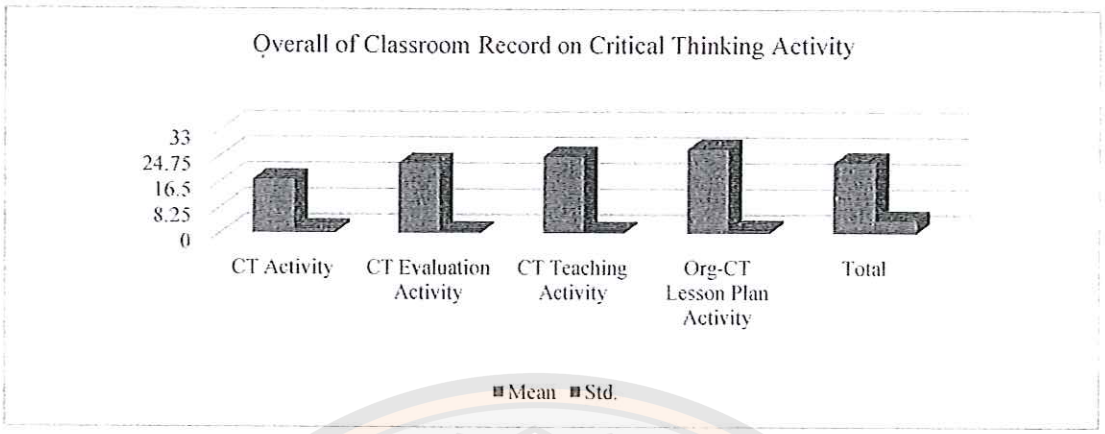
responsibility for learning with each other, discuss divergent understandings, and shape the direction of the class. Additionally, teach less learn more, a more student-focused interaction provides multiple opportunities for students to discuss ideas in small groups and supports a whole class discussion, the proportion of the class dedicated to students talking to one another. Some particular scenarios which are considered encouraging the interactions between students and students include jigsaw activities, think-pair share, theme discussion, open-ended questions, in-class debates, or controversial issues.

Similarly, the quality of discussion is also important. Successful discussions are characterized by small group conversations that seek to give voice to all students and provide sufficient time and opportunity to listen and consider the ideas of others. Likewise, the notion of cognitive coaching [314] 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, more lecture-focused or well-organized material environment will minimize student-student interactions and also stagnate their critical thinking.

Interactions between trainee students and trainer: The effective interactions between teacher and trainee students are essential for promoting learning success. The interactions create emotional support, productive classroom organization, and ongoing instructional support. With an aim at improving trainee students' critical thinking and critical thinking teaching, the interactions were characterized by providing students with frequent and engaging learning activities, motivating and supporting them to think for meaningful challenges, facilitating language barriers, and recognizing their needs for a sense of autonomy and an active role in learning. All are associated with higher relative trainee student gains in achievement for academic and social progress, especially promoting cognitive ability. These ideas were also reflected in some previous researches. Cooper [315], 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.

Some potential comments: Noticeably, there are a few factors that impede success of learning environment while implementing an instructional model to enhance trainee students' critical thinking and critical thinking teaching ability. At first, most of trainee students remain in a state of reaction and rarely think primarily because they have never experienced a critical thinking class. However, this behavior was reduced and then turned trainee students into free thinkers who can draw upon many fields of knowledge, solve problem, carefully develop their viewpoints, learn to base their judgments on reasons and well-conceived view of purpose, pursue broader virtues of faith, hope, wisdom, truth, and friendliness, get on well with each other, and thereby avoid surrendering to their passions. Also, Scriven and Paul [226] expressed that critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, or evaluating information gathered from and generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

Another drawback is social conditioning that also affects the ability to think critically. Admittedly, socio-economic, sociological, cultural, and psychological factors and beliefs all contributed substantially to the gender differences and restricted development in critical thinking ability. Social connection among girl trainee students influences their participation and recognition in learning activities. For example, girls were found more anxious and less active and confidential during the debates or discussion which prevented them from having a meaningful and conducive learning environment. Relatively, Chang [316] found that students who reported socializing with other students from different racial/ethnic groups or discussing diversity-related issues accrued numerous educational benefits. Also, Vygotsky [69] wrote extensively about the development of higher psychological functions and the importance of self-talk and the social construction of knowledge in that development.



Note: 00.00 – 8.25=Novice, 8.26 – 16.50=Basic, 16.51 – 24.74=Proficient, 24.75 – 33.00=Exemplary

Figure 21 Summarization of Classroom Record on Critical Thinking Activity

2.4 Critical Thinking Learning and Teaching Participation

Individual trainee student was asked to reflect his/her opinions about learning and teaching activities. The results indicated that most of trainee students highly enjoyed learning environment (See figure 22 below).

Concerning the content of critical thinking, trainee students reflected that the content was very clear and easy to understand. Trainee students understood the meaning of critical thinking, the main components of critical thinking, the barriers to critical thinking, and benefits of critical thinking. This is revealed that critical thinking is very important for daily life, and especially it is a common expectation in the workplace. The ability to analyze, interpret, explain, evaluate, and create new ideas from existing information is the main components of critical thinking. Moreover, lack of appropriate instructional materials, insufficient class time, lack of students' motivation, large number of students per class or irrelevant content to learners' background etc. were considered as potential barriers to critical thinking.

In compliance with this opinion, critical thinking is valuable in many contexts includes self-directed, self-disciplined, self-monitored, and self-corrective thinking in improving the quality of thoughts by skillfully analyzing, assessing, and reconstructing" [78], vital for daily life in making, drawing ideas from different resources, deciding consequences, classifying information based on facts and opinions, sequencing ideas and events, using chronological order, defining concepts, locating

relevant data, exercising evidence to state generalizations, making inference based on data, identifying cause-and-effect relationships, and adjudicating validity of information [79].

Regarding critical thinking evaluation, trainee students reflected that it enlightened them with valuable and useful ideas of different sorts of critical thinking evaluation forms, and particularly how to develop and use each evaluation. Critical thinking evaluation forms including Bloom's taxonomy, Socratic's questioning, or Watson-Glaser were very important to use when teaching students. Relatively, the lessons taught them how to use critical thinking questions, critical thinking assessment components, and especially evaluation rate and interpretation. Also, learning environment helped learners enjoy working together through having good chances to share ideas, to learn from each other, and to be close together. More importantly, classroom activities highly focus on eliciting learners' sources and encourage them to make their own decisions which then lead to achieving the productive improvement of critical thinking.

As indicated by some scholars and researchers, performance assessment and portfolios have been used to evaluate critical thinking [258, 260]. Performance assessments allow learners to demonstrate what they can do in real situations rather than articulate how a task or skill should be completed, Wiggins [261]. Also, assessment should allow learners to document, demonstrate, and justify their own engagement in critical thinking [258].

In relation to critical thinking teaching, trainee students reflected that critical thinking teaching lessons provided them a great deal of helpful ideas, above all strategies to teach critical thinking. Trainee students learned that strategies including project-based approach, case-based approach, inquiry-based approach, cooperative approaches, and problem-based approach were very useful. These approaches are full of motivating and involving learners in learning and constructing new knowledge using their own experiences. Noticeably, trainee students did their own practices using these approaches while learning, reflecting effective results of learning outcomes.

Similarly, Chapman [64] stated that learning based on memorization rather than active participation inevitably interrupts the enhancement of critical thinking, also less effective for long term knowledge retention, transfer of knowledge

to new situations, higher order thinking, attitude, and motivation for further learning [65]. However, if appropriate instructional methods and curriculum materials were used, students will improve their critical thinking skills [24].

On the subject of critical thinking teaching plan, trainee students reflected that learning to organize lesson plans to teach critical thinking not only helps them to get new knowledge but also gives them opportunity to practice conducting lesson plans by themselves. Trainee students intended that they worked in small groups, shared ideas, looked for different data and information, and analyzed, evaluated, and synthesized data in which in return, led them to create very useful lesson plans to teach critical thinking.

Relatively, teaching critical thinking skills concern using explicit critical thinking skills instruction, encouraging students' disposition or attitude toward effortful thinking and learning, directing learning activities in ways that increase the probability of trans-contextual transfer, and making metacognitive monitoring explicit and overt, Halpern [56]. Also, involving in problem-solving, cooperative learning, simulations, debates, and critical reporting sessions enhances students' critical thinking [270].

Pertaining to practice teaching critical thinking lesson, trainee students reflected that this practice teaching helped them deeply understand how to teach critical thinking lessons, and especially gave them new experiences. Trainee students discovered that they were very happy with classroom environment such as working together on real-life based content, sharing ideas with each other, using their own experiences, making their own decisions, doing presentation, using reflection, and particularly doing practice teaching. Trainee students also intended that they liked the ways of identifying the answers. For examples, they worked on critical papers by looking at alternative sources of information, using cites and credible sources, looking for explanations and reasons, or changing position on an issue with good reasons.

With reference to this matter, critical thinking can be taught and learned [56], and it is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by, observation, experiences, reflection, reasoning, or communication, as a guide to belief and action [226]. Also, Paul [229] construes

critical thinking as the ability to reach sound conclusions based on observations and information.

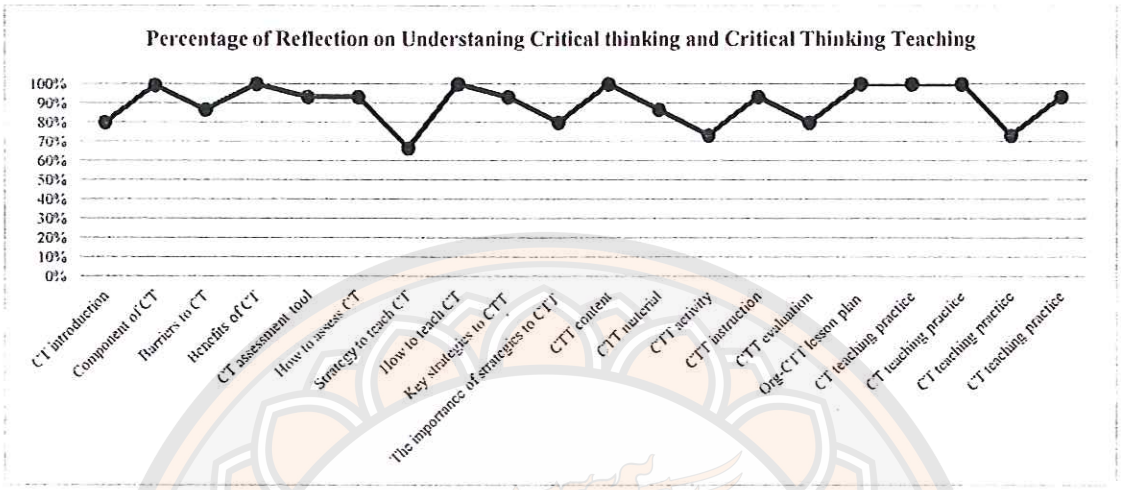


Figure 22 Summarization of Individual Reflection on Understanding of Critical Thinking and Critical Thinking Teaching

3. The Effect of Evaluation of the Instructional Implementation

The evaluation of implementation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability monitors the progress towards achievement of the desired goal. The evaluation is focused on the validation of progress rather than the judgment of the results. The evaluation is to make sure that changes are occurring as desired, the improvements are directional, and the results are as anticipated by the improvement design. The evaluation was done by describing individually and in relevant perspectives of the context; by comparing the actual and intended inputs and outputs; and by analyzing possible causes of the discrepancies between the actualities and intentions [317]. The evaluation was divided into two parts including individual perceptions about learning and teaching activities and structured interview about overall view of the implementation of the developed instructional model.

3.1 Perceptions about Critical Thinking Learning and Teaching

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 ($\overline{X}$ = 428). Concerning each element, the highest mean score was general instruction ($\overline{X}$ = 4.36), followed by critical thinking teaching ($\overline{X}$ = 4.28), interpersonal/team skill ($\overline{X}$ = 4.26), critical thinking skill ($\overline{X}$ = 4.13), and the lowest was on group work activities ($\overline{X}$ = 4.06) (See figure 23 below). The result was consistent with the approach stated by Halpern [48]. As Halpern [48] suggested, practice is important to the development of thinking skills. The integration of this instruction into specific subject matter allows greater opportunity for transfer of learning and development due to greater opportunities for practice in thinking through diverse situations and problems.

There are several reasons that lead to the highest level of trainee students' perceptions toward general course instruction ($\overline{X}$ = 4.36). The topics were involved in the realistic situations which persuaded intellectual faculties of every trainee students, learning materials were consistent with the individual needs and interests, the class was performed with different activities which vehemently fomented the understandings of critical thinking, and particularly underlined on group activities and participation which support trainee students to be active in learning. In tandem with this idea, Ruminski and Hanks indicated that a large majority of journalism and mass communication faculty integrate instruction on how to think critically into subject matter within their communication courses. Courses designed specifically to teach critical thinking skills may be quite helpful in assisting learners in gaining these skills in that they offer the opportunity for students to practice using them.

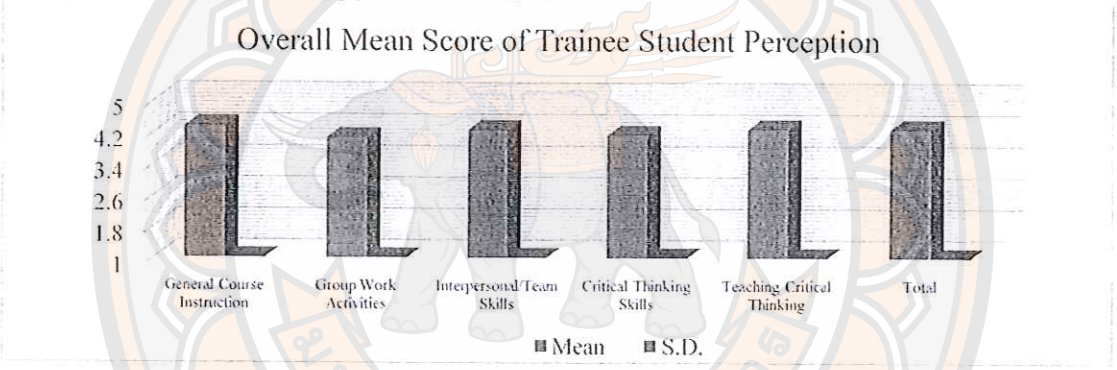
Trainee students' perceptions about group work activities were at high level ($\overline{X}$ = 4.06). This reflected that trainee students enjoyed working with others in solving problems which could lead a life of reason, reflection, and deliberation. Also, class activities dynamically encouraged students to work together to contribute to a comprehensive answer to an open-ended problem. Moreover, students found working with others to be less stressful and assist them to delve into the real data to decide how

to best use, interpret and display it and they were actively involved in sharing their findings, synthesizing important concepts, and or maximizing opportunities to practice. Tantamount with these ideas, Bonwell and Eison [216] 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.

Trainee students' perceptions about interpersonal/team skills were also at the highest level ($\overline{X}$= 4.26). Trainee students liberally work with others to identify, define, and solve problem, they consistently encourage others to engage in communication and use appropriate questions to find a mutually agreeable outcome and develop understanding, they learn from different points of view and try to see things from their perspectives, and they listen to others with respect and admiration. Relatively, Cega [240] also expressed the same ideas that critical thinking is a valid evaluation or adequate and correct judgment in forms of open-mindedness-listening to others and willing to change, objectivity-free of bias-avoiding grasping any unfair and personal opinion, and suspend judgment-getting clear evidence before judgment are essential to sustain critical thinking.

Interestingly, trainee students' perceptions about critical thinking skills were at high level ($\overline{X}$= 4.13). This explained good collaboration and cooperation among trainee students for promise of nurturing critical thinking. 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 the 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 [318]. Students who practice critical thinking not only apply real life skills of defining, summarizing, retrieving, analyzing, and synthesizing information but also appropriately determine relevance and reliability of information retrieved from the changing world of information technology.

Trainee students' perceptions about critical thinking teaching were at the highest level ($\overline{X}$ = 4.28). This indicated that trainee students clearly understood how to teach critical thinking lessons. Trainee students understood how to organize lesson plans, to identify critical thinking in context, manage critical thinking materials and activities, use sound learning instruction, and construct critical thinking evaluation. Also, trainee students' learning could be positively affected as trainer applied informed practice for critical thinking instruction. This critical thinking instruction can enhance trainee students' ability to view problems from multiple perspectives and equip them to employ solid reasoning and expert judgments as they devise solutions that are insightful, creative, and innovative [35, 214, 245].



Note: 1.00-1.80 = lowest level, 1.81-2.60 = low level, 2.61-3.40 = medium level, 3.41-4.20 = high level, 4.21-5.00 = highest level

Figure 23 Trainee Student Perceptions on Learning and Teaching Activity

3.2 Overall View about the Instructional Implementation

Awareness of the effectiveness of the developed instruction may prove to be significant value to trainers, educators, administrators, and particularly practitioners. Seven trainee students were asked and interviewed in order to share the ideas about the overall view of the instructional implementation. The main components of interview were divided into six compulsory types of content including overall view about training course, in-class activity, assignment, small group activity, teaching activity, and teaching process.

Overall view about training course: Training course to enhance critical thinking was very useful. This course provided a lot of new ideas and experiences, especially how to improve critical thinking. Critical thinking focused on how to look for different sources of information, link together facts, compare and contrast ideas, seek relationships and patterns, apply past experiences, evaluate, analyze, and synthesize assumptions and bias, interpret information, and draw conclusions. Moreover, trainee students are aware of the processes involved in their own thinking which makes them to be able to examine what they are learning about and raise questions, accept challenges, find out solutions that are not immediately apparent, explain concepts, justify their reasoning, and seek information [319]. Also, working together in small groups, sharing ideas, giving each other respect, and especially contents related to learners' background are crucial to enhance critical thinking.

In-class activity: All the activities were interesting and helped trainee students quickly understand the content of the lesson. These activities included working in small groups, discussion, site visit, and especially critical article analysis. Working together and sharing ideas to reach conclusions and decisions are considered to be useful for critical thinking enhancement. Trainee students shared ideas, discussed the subject matter, made their own decisions, did a variety of presentations, and reflected their own thoughts about learning outcome. Both content and activities made them have a sense of healthy learning, had strong friendships, learned from different perspectives, and arrived at the best possible solutions of the identified matter.

Similarly, critical thinking is involved in searching for knowledge through reasoning, problem-solving, and decision-making, guiding to accomplish the desired results more effectively and efficiently [56], and cannot avoid including the elements of comparing and contrasting ideas, using clear sources of information and experiences, constructing beliefs based on evidence, seeking relationship and pattern, analyzing and interpreting the information, and drawing conclusions [82].

Assignment: The assignments which concerned analyzing and interpreting helped trainee students advance in their critical thinking and critical thinking teaching ability. Trainee students were asked to identify the matter, to analyze some critical articles and reports, and especially to make their determinations which can be attained as trainee students improve their ability to reason and the quality of

their ideas. Also, trainee students involved the process of making inferences, drawing logical conclusions, and evaluating relevant sources of information to reach the possible conclusions [320].

Small group activity: Trainee students were divided into small groups for each activity. This small group work helped trainee students develop a host of skills including sharing ideas, being sensitive to each other feelings, respecting each other opinions, and especially helping make decisions to reach sound conclusions. Small group activities also gave 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. Also, Halpern [48] intended that courses designed specifically to teach critical thinking may be quite helpful in assisting learners and offering opportunities for them to practice which is considered as important to the development of critical thinking.

Teaching activity: Teaching practice was an interesting activity. This teaching practice made trainee students clearly understand their own abilities to both organize lesson plans and teach critical thinking lessons. Also, this teaching practice motivated them to use different approaches to teach, not just only student-centered. Noticeably, this teaching practice encouraged interaction and collaboration between among trainee students, encourages them to use active learning techniques, gives prompt feedback, emphasizes time on task, and especially communicates high expectations and respects diversity such as talents, experience, and ways of learning. This practice teaching reflected that student-focused approach which students are involved in problem-solving, cooperative learning, simulations, debates, and critical reporting sessions [270], and were encouraged to develop their own strategies for critical thinking [30].

Teaching process: Teaching process is necessary to accomplish the goals of learning teaching and learning activities. This teaching process is an active involvement of trainee students and enhances their motivation and learning interaction. Also, trainee students benefit from taking responsibility for their learning which is enhanced in an atmosphere of cooperation, meaningful materials, and especially critical and descriptive feedback. Trainee students employed critical thinking process which is to judge, evaluate, analyze, and synthesize the information, and make conclusions with sound reasons. Similarly, the key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge [273].

Conclusion

The research emphasizes an instructional model development based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability since their critical thinking was found at high level, and this consequence reflects the potentiality of the developed instructional model implemented to enhance trainee students' critical thinking and critical thinking teaching ability. Significantly, critical thinking is considered as one of the most compulsory skills in the 21st century which is highly needed by public and private organizations. With 21st century skills, students will be prepared to think, learn, work, solve problems, communicate, collaborate, and contribute effectively throughout their lives. Especially, these skills are essential for all students today, not just the elite few, required for success, yet rarely incorporated deliberately in the curriculum [321].

Concerning the result of this study, it revealed that an appropriate instruction was extremely successful in fostering trainee students' critical thinking and critical thinking teaching ability. 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 critical thinking teaching abilities.

Critical thinking skills requires training, practice, and patience whereas critical thinking teaching abilities need a variety of appropriate strategies, especially student-centered or active learning which are all related to authentic learning environment. To meet these demands, trainee students are required to be actively involved in synthesizing important concepts, consensus building, making rational judgments, solving problems, and making presentations to share their findings. Also, all trainee students need to develop more complex cognitive abilities so that they can find, analyze, and use information for a range of purposes, including the development of new products and ideas. Trainee students need to collaborate and communicate so that they can take advantage of each other's knowledge and expertise.

Also, cultivating critical thinking and critical thinking teaching ability require using an array of techniques and methods such as problem-based learning, project-based learning, real life-based learning, collaborative learning, or cooperative learning and many other activities including jigsaw activities, think-pair share, theme discussion, open-ended questions, in-class debates, or controversial issues. More importantly, encouraging students throughout the process and modeling thinking behaviors, trainee student's critical thinking skills and critical thinking teaching abilities can be improved, and at the end, they will be reason-driven thinkers. These descriptions and illustrations are congruent with critical thinking expressed by Geertsen [218]. In using critical thinking and critical thinking teaching, one learns to make critical judging, examine some claim or assertion, listen to or collect evidence in support this claim, determine the strength of the arguments derived from the evidence, assess the underlying assumptions and possible biases supporting the claim, and arrive at a judgment and course of action where appropriate.

Policy Implication for Educator

The implication for the results showed that there is a crucial need to train and strengthen critical thinking and critical thinking teaching of trainee students at the Regional Teacher Training Center in Takeo province. The implementation of the developed instructional model based on cognitive-based approach to enhance trainee students' critical thinking and critical thinking teaching ability reflected positive consequences in promoting trainee students' critical thinking and critical thinking

teaching ability. To help instill critical thinking and inject critical thinking teaching ability, educators are recommended having training to facilitate instruction and how to utilize critical thinking skills and critical thinking teaching methods when teaching trainee students.

Relatively, the educators should also reconsider promoting communication competence in trainee students through task-based activities, employing different techniques that enhance their critical thinking and critical thinking teaching ability, organizing workshops for capacity and professional development on techniques to improve critical thinking and critical thinking teaching ability, strengthening pedagogical approaches through motivating learners to express their views without fear of intimidation but with fairness, tolerance, dialogue, negotiation, care, active participation, and respect for each other's opinion, and exploring various teaching options and methods to determine the most effective approaches and environment for developing critical thinking skills and critical thinking teaching ability.

Also, 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. In addition, acquisition of critical thinking skills and critical thinking teaching methods would assure that trainee students could use these skills in their real life and daily-confronted situations. Particularly, cognitive knowledge should be put into the context of what trainee students need to know for the working world of the 21st century.

Implications for Further Research

The findings of this current study lead to several recommendations in the area of improving critical thinking and critical thinking teaching ability. This study indicates that more evidence is needed to demonstrate the needs to strengthen trainee students' critical thinking and critical thinking teaching ability. Therefore, there should be more investigation about critical thinking and teaching critical thinking resources sharing among trainee students. Moreover, trainee students desire more information about critical thinking, teaching critical thinking, and their best utilization. Hence, workshops to learn more about critical thinking and teaching critical thinking should

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



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APPENDIX

APPENDIX A

Evaluation of Components of Instructional Development

1= Strongly Agree, 2= Agree, 3=Neutral, 4=Disagree, 5= Strongly Disagree

Components of Instructional Model	Rating Scale				
	1	2	3	4	5
Principle					
All theoretical bases are clear and rationale.					
All theoretical bases support critical thinking perspectives.					
All theoretical bases clearly explain what is expected to be achieved achieve.					
Learning objective					
Objective is clear and reasonable.					
Objective answers the current needs of trainee students.					
Objective is consistent with the incumbent social needs.					
Learning content					
Learning content concerns trainee students' needs and experiences.					
Learning content is consistent with social needs.					
Learning content enhances trainee students' critical thinking and their teaching ability on critical thinking.					
Learning instruction					
Learning instruction is simple and clear.					
Learning instruction fosters trainee students in improving critical thinking and critical thinking teaching ability.					
Learning instruction engages trainee students in working in groups, sharing ideas, and analyzing to reach conclusions.					

Components of Instructional Model	Rating Scale				
	1	2	3	4	5
Learning materials					
Learning materials are sufficient and practical for enhancing critical thinking and critical thinking teaching ability.					
Learning materials help trainee students to enhance their critical thinking and critical thinking teaching ability.					
Learning materials are consistent with each critical thinking learning activity.					
Evaluation of effectiveness					
The evaluation is clear and measurable.					
The evaluation is consistent with learning objective.					
The evaluation reflects the effectiveness of an instructional model.					

APPENDIX B Learning Module

Summarization of Learning Module

No.	Learning Module	Content	Session/Hour
1	Critical Thinking	1. Critical Thinking Introduction 2. Critical thinking definition 3. Components of critical thinking 4. Barriers to critical thinking 5. Benefits of critical thinking	4 sessions/ 8 hours
2	Critical Thinking Evaluation	1. Critical Thinking Assessment Tool 2. How to assess Critical Thinking	2 sessions/ 4 hours
3	Critical Thinking Teaching	1. Teaching Critical Thinking 2. Strategy to teach critical thinking	4 sessions/ 8 hours
4	Critical Thinking Teaching Plan	1. Critical thinking teaching content 2. Critical thinking teaching materials 3. Critical thinking teaching activities 4. Critical thinking teaching instruction 5. Critical thinking teaching evaluation 6. Organizing critical thinking lesson plan	6 sessions/ 12 hours
5	Practice Teaching Critical Thinking Lesson	1. Practice teaching	4 sessions/ 8 hours
Total			**20 sessions/ 40 hours**

Learning Module I: Critical Thinking

Introduction and Definition of Critical Thinking

……Release statement (Sample)……

1. What is critical thinking?

2. List three key words used to define critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Components of Critical Thinking

……Release statement (Sample)……

1. List 5 components of critical thinking?

2. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Barriers to Critical Thinking

……Release statement (Sample)……

1. What is barrier to critical thinking?

2. List five barriers to critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Benefits of Critical Thinking

……Release statement (Sample)……

1. Why is critical thinking important?

2. List three benefits of critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Learning Module II: Critical Thinking Evaluation

Critical Thinking Assessment

……Release statement (Sample)……

1. What is critical thinking assessment?

2. List three key tools used to assess critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Critical Thinking Assessment Tool

.....Release statement (Sample).....

1. What is the tool used to evaluate critical thinking?

2. List three key tools used to evaluate critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Learning Module III: Critical Thinking Teaching

Critical Thinking Teaching

.....Release statement (Sample).....

1. What is critical thinking teaching?

2. List three key words used to define critical thinking teaching?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Strategy to Teach Critical Thinking

.....Release statement (Sample).....

1. What is strategy to teach critical thinking?

2. List five strategies used to teach critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Critical Thinking Teaching Content

.....Release statement (Sample).....

1. What content should be used in teaching critical thinking?

2. List three key types of content used to teach critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Learning Module IV: Critical Thinking Teaching Plan

Critical Thinking Teaching Material

……Release statement (Sample)……

1. What types of materials used to teach critical thinking?

2. List three key types of materials used to teach critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Critical Thinking Teaching Activities

.....Release statement (Sample).....

1. What activities used to teach critical thinking?

2. List three key activities used to teach critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Critical Thinking Instruction

……Release statement (Sample)……

1. What is instruction used to teach critical thinking?

2. List key instruction used to teach critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Critical Thinking Teaching Evaluation

……Release statement (Sample)……

1. What evaluation used in critical thinking teaching?

2. List three key types of evaluations used in teaching critical thinking?

3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

Organizing Critical Thinking Lesson Plan

.....Release statement (Sample).....

1. What elements should be used in organizing critical thinking lesson plan?

2. List key elements used in organizing critical thinking lesson plan?

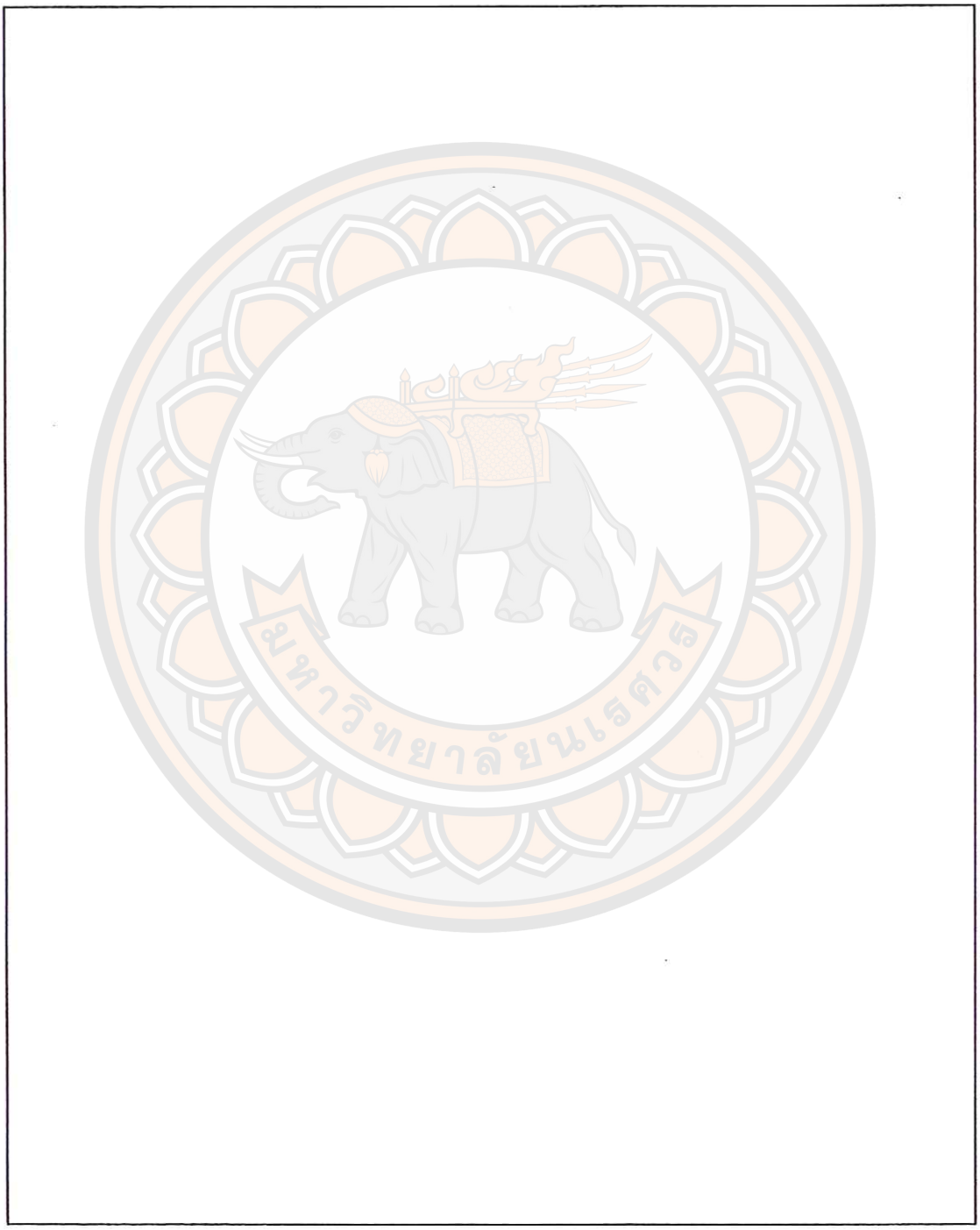
3. What is your decision?

Why did you make that decision? List your reasons and the data used as evidence

Reasons	Data & Source

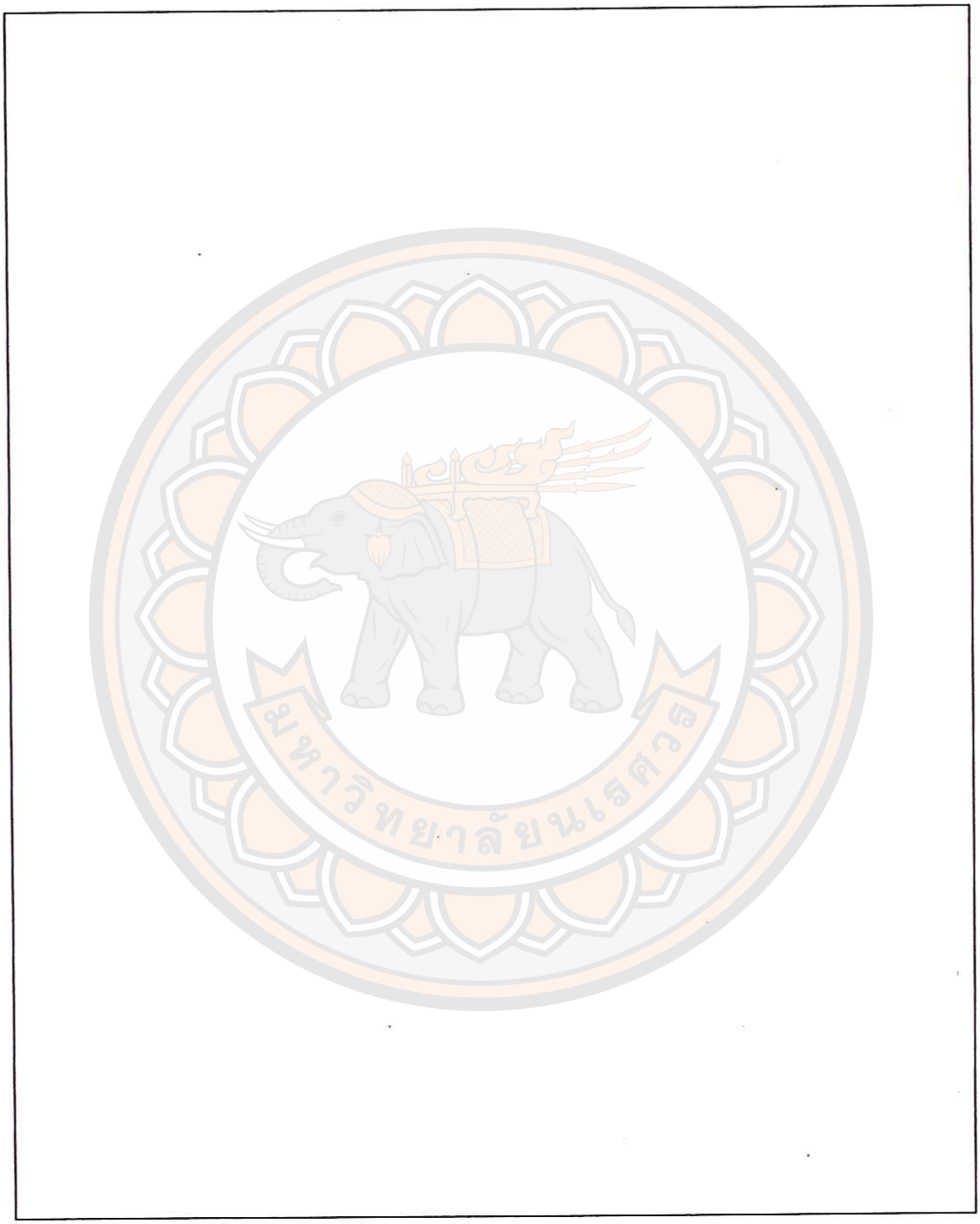
Learning Module V: Practice Teaching Critical Thinking

Practice Teaching Critical Thinking
(Group 1)



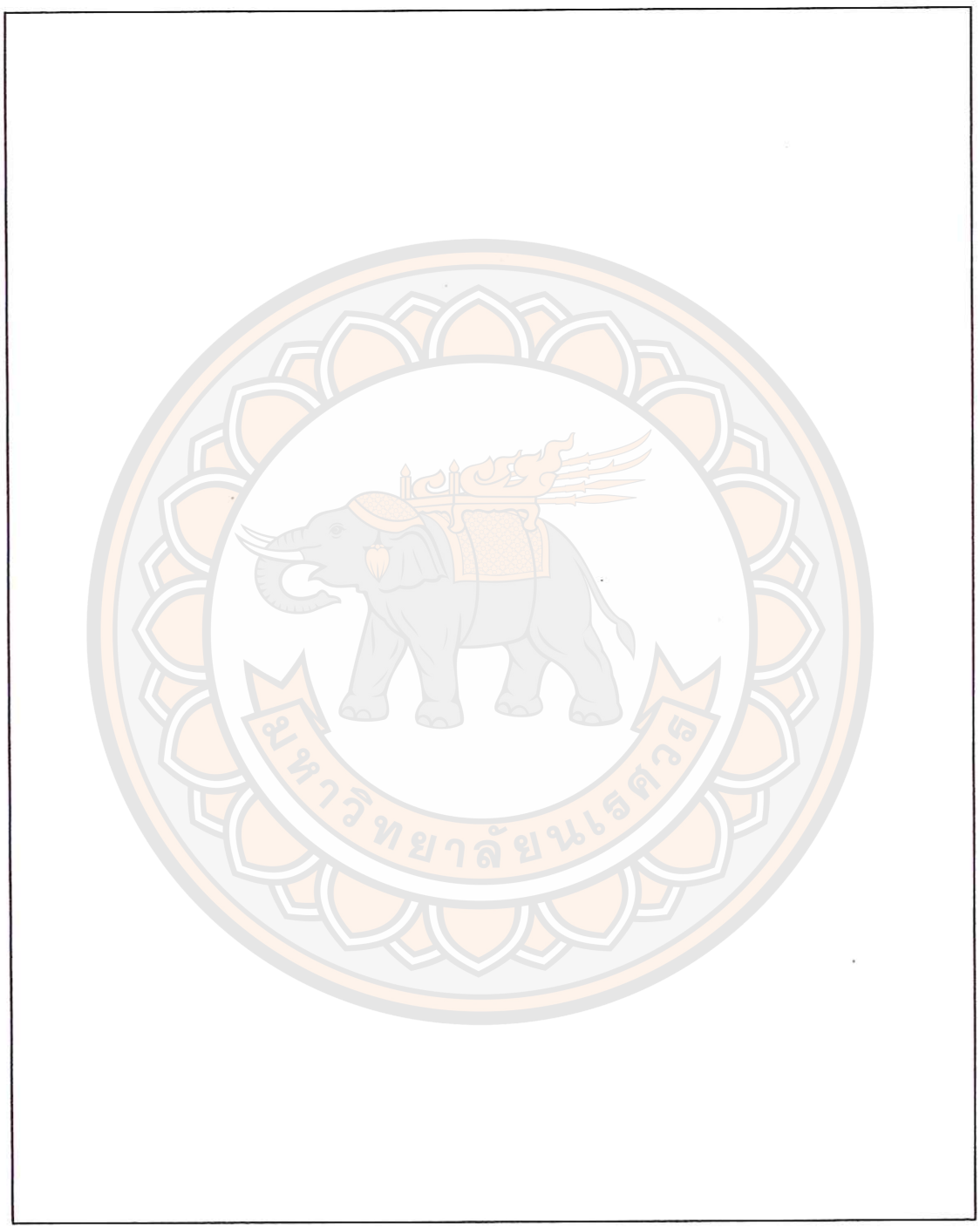
Practice Teaching Critical Thinking

(Group 2)



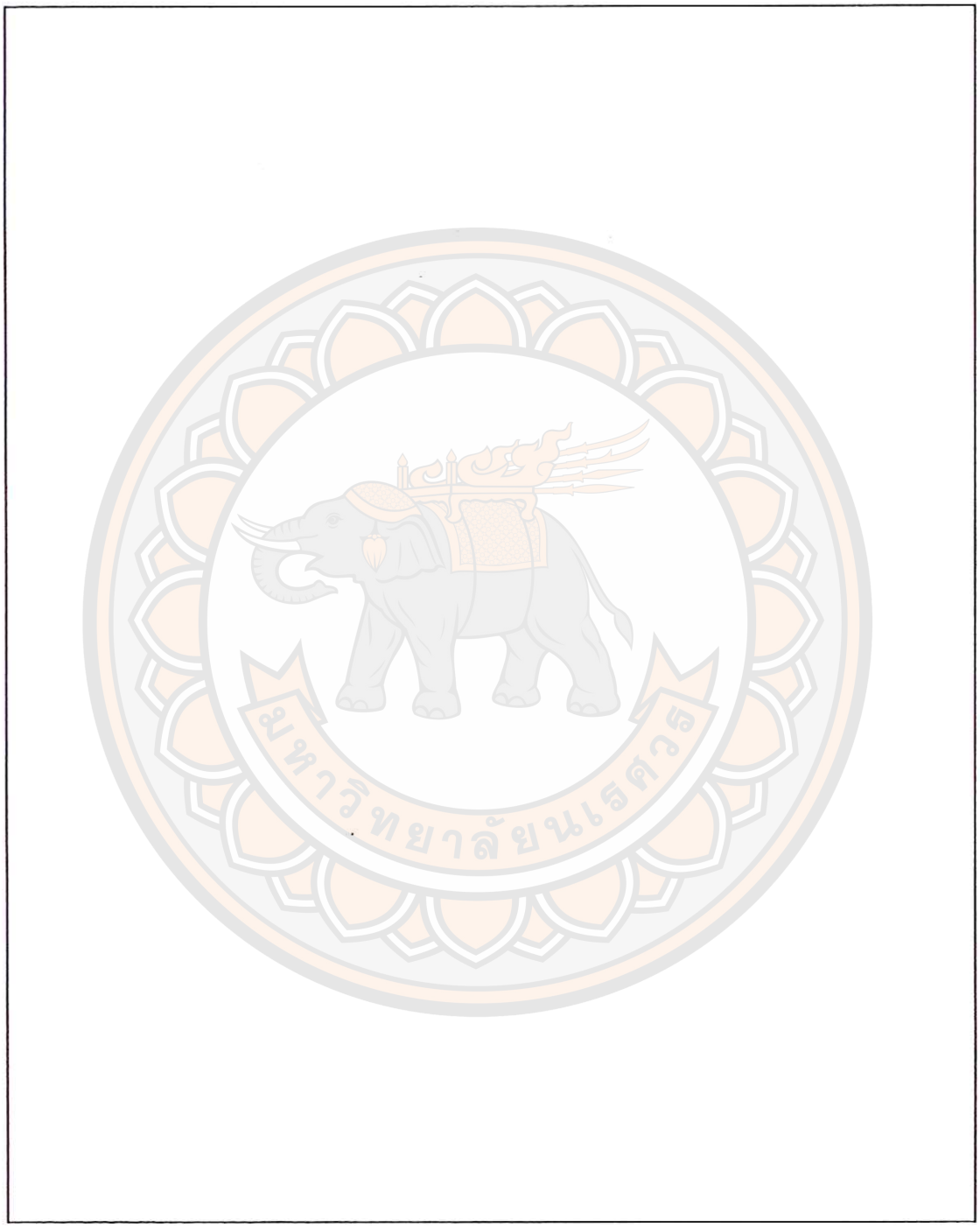
Practice Teaching Critical Thinking

(Group 3)



Practice Teaching Critical Thinking

(Group 4)



APPENDIX C Individual Reflection Paper

Name:.....

Lesson:.....

Date:.....

What is your reflection about this lesson?

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APPENDIX D Classroom Observation Record

Date:					
Class number:					
Main topic for discussion:					
Led by:					
Time	**Class Activity**	**Trainee and Trainee interactions**	**Trainee & Trainer Interactions**	**Learning Materials**	**Comments**
	- Small group activities - Watching video clip - Presentation - Whole class discussion - Problem-solving - Presenting - Practice teaching	- Working in group and individual - Discussions - Presentation - Practice teaching	- Asking questions - Answering questions - Checking responses	- Handouts - Posters - Video clips - Flip charts - Projectors	- The interaction between trainee and trainee - The interactions between trainer and trainees

APPENDIX E

Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability
4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience

6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly
10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented

11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Source: Educational Assessment of Students Anthony, J. Nitko, 2004

Note: Score/Weigh [82]

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein, 2012, p.200

- 24.75 - 33.00: Exemplary
- 16.51 - 24.74: Proficient
- 08.26 - 16.50: Basic
- 00.00 - 08.25: Novice

APPENDIX F

Critical Thinking Teaching Rubric

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Lesson Plan				
Topic concerned problem of current situation and students' experience				
Purposes/Objectives are clear and foster in critical thinking				
Learning content concerned critical analysis about real-life problem.				
Learning materials include critical articles, posters, research report, video clips….				
Learning activities engage in small group discussion, collaborative activities, debate, simulation, reporting session, reflection…..				
Learning instruction concerned using Bloom's cognitive domain, Socratic's question, or Brown and Kelley's questions (analyzing, evaluating, or synthesizing…)				
The duration is long enough for each activity.				
Assessment of lesson engaged students in developing new knowledge through making a conclusion, creating new results, and sharing self-reflection				
Teaching Activities				
Stimulate students for their curiosity and participation to establish learning issues				
Involve students in identifying problem through using critical articles, portfolio…….				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Engage students in authentic learning environment through data collection and verification hypothesis				
Encourage students to work in groups, share ideas, or discuss findings				
Involve students in analyzing, evaluating using alternative sources of information collected on the problem				
Encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience				
Involve students to present findings using different methods such as posters, mind map……				
Involves students in demonstrating the implication, refining the existing questions, and raising new ones				
Learning Outcome				
Students could seek the statements of the main point or question				
Students could look for explanation and reasons				
Student could use and cite credible sources				
Students could look for alternatives				
Students could change position on an issue with good reasons				
Students could suggested new ideas				
Students could have a respect for and willingness to entertain other viewpoints.				
Students could have the propensity to seek reasons, be inquisitive, and have the desire to be well-informed and flexible.				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Transformation

According to Greenstein [82], critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

- 18.00 - 24.00: The high level of critical thinking teaching ability
- 12.00 - 17.99: The medium level of critical thinking teaching ability
- 06.01 - 11.99: The low level of critical thinking teaching ability
- 00.00 - 06.00: The lowest level of critical thinking teaching ability

APPENDIX G

Critical Thinking Pre and Post Test

Critical thinking test is divided into 5 main sections comprising 86 items and divided as follows:

Section I: Inference, 14 items (1-14)

Section II: Recognition of Assumption, 14 items (15-28)

Section III: Deduction, 20 items (29-49)

Section IV: Interpretation, 11 items (50-61)

Section V: Evaluation of Arguments, 24 items (62-86)

Section I: Inference, 14 items (1-14)

In this section, the exercise begins with a statement of facts that you are to regard as true. After the statements of facts you will find several possible inferences, conclusions that some persons might draw from the stated facts. Examine each inference separately, and make a decision as to its degree of truth or falsity. T=True, PT= Probably True, ID= Insufficient Data, PF= Probably False, F= False

Although it is agreed that China is rapidly modernizing its army, there is some doubt surrounding the exact amount it is spending. The research institute PIPPI submits that the annual Chinese defense spending has risen from almost $31 billion in 2000 to over $ 120 billion in 2010. This figure is almost double the official figure published by the Chinese government, who failed to include other areas such as research and development spent around $ 400 billion on military defense. Based on the current level of military growth, statistics suggest that China's defense spending could overtake America's by 2030. In addition to military spending, China's army continues to enjoy the largest number of people within the rants of its army than any other county.

1. The official figures published by the Chinese government in relation to their military spending are thought to be misleading.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

2. It is known that the Chinese government leave areas such as research and development form their official figures; however, this would also suggest that other areas of spending are also omitted from the official figure.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

3. The Chinese government omits several key areas from its official spending figures, in areas such as military spending agriculture, human rights and law.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

4. If there are any anomalies between the published figures on military spending and the actual figure, this is merely a clerical error.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

5. In 2010, the United States of America spent less on its military defenses than the Chinese government.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

6. The official figures published by the Chinese government in relation to their military spending are thought to be misleading.

a) True b) Probably true c) Insufficient data

d) Probably false e) False

Turkey is a surprising addition to the list of rapidly developing economies; with a GDP increase of 8.5% in the year 2011 alone. However, such rapid growth leaves worries regarding possible side-effects. For instance, in 2011 Turkey's rate of inflation was well above that of its peers. Secondly, there is increasing concern regarding Turkey's growing dependency on foreign capital. A large portion of the Turkish banking system is part-owned by banks within the Euro zone. As the single currency falters, such a dependency raises questions about the stability of Turkish growth.

7. There are concerns that Turkey's development is at risk of faltering in the years after 2011.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

8. As Turkish banks are part-owned by those in the Euro zone, they may suffer if the European banks face financial difficulty.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

9. The Turkish banks are part-owned by European banks as this provides greater variation to the market and extra finance to the economy.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

10. The Turkish economy was surprisingly stagnant in 2011.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

Some people that prospective employees should include a photograph with their application form. Such practice has traditionally been criticized for allowing more attractive individuals to get ahead in their career over plain colleagues. However, one study demonstrates that is, in fact, untrue, Ruffle, the creator of this study, attributes his findings to the dumb-blonde hypothesis that beautiful women are thought to be unintelligent. Ruffle submits that companies would be better advised adopting the selection model employed by the Belgian public sector, where CVs are anonymous and candidate names, gender and photographs are not allowed to be included on CVs. Such a model allows the candidate to be selected on factors relevant to the role applied for.

11. The dumb-blonde hypothesis says that more attractive women are less capable of being intelligent.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

12. The model of selecting future employees adopted by the Belgium public sector aims to reduce discrimination based on appearance and gender.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

13. The method of selecting future employees adopted by the Belgian public sector has helped to eliminate discrimination in the Belgian public sector.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

14. The method of selecting future employees adopted by the Belgian public sector has had effect of increasing discrimination based on appearance within the Belgian public sector.

a) True b) Probably true c) Insufficient data
d) Probably false e) False

Section II: Recognition Assumptions, 14 items (15-28)

Below is a statement followed by several proposed assumptions. You are decided for each assumption whether a person, in making the given statement, is really making that assumption. If you think that the given assumption is **taken for granted** in the statement, select **"Yes"** or **if not, select "No"**. Remember to judge each assumption independently.

Monarchic nations, i.e. those with royal family, differ from republican nations in several ways. An example of this difference is that citizens of monarchic nations pay more tax than citizens of republic nations.

1. The governments of Monarchic nations are responsible for setting tax rates on their citizens.

   a) Yes b) No

2. Republican nations do not have a royal family.

   a) Yes b) No

3. The only types of nation are monarchic and republican.

   a) Yes b) No

4. A monarchic nation cannot be a republican nation.

   a) Yes b) No

In 2008, the president of the USA promised to prevent the country entering economic depression, but he failed because at the beginning of 2012, over 12 million USA citizens were unemployed.

5. Unemployment is an indicator of economic depression.

   a) Yes b) No

6. The number of USA citizens out of work ought to be less than 12 million.

   a) Yes b) No

7. The presided should stick to their promises.

   a) Yes b) No

Chilean students were right in 2012 to stage protests demanding that university education in Chile should be made free.

8. Some universities outside of Chile are free.

a) Yes b) No

9. Staging protests will influence the cost of Chilean university education.

a) Yes b) No

10. Chilean students cannot afford to pay fees for university education.

a) Yes b) No

11. Chilean students want to attend university.

a) Yes b) No

Charities do not have to charge VAT to customers, which means charity bookshops can charge lower prices than those charge by the second-hand bookshops which are not registered as a charity.

12. Charities pay less tax than non-charities.

a) Yes b) No

13. Customers prefer to pay lower prices.

a) Yes b) No

14. VAT increases the price customers pay for things.

a) Yes b) No

Section III: Deduction, 20 items (29-49)

In this section, the exercise consists of a statement (premise) followed by several suggested conclusions. Read the conclusion beneath the statement. If you think it necessarily follows from the statement given, select "Yes" or if not, select "No"

In an attempt to cut expenses, an organization disbanded its IT department and outsourced its IT function to a Business Process outsourcing company. In doing so the company has managed to save 20% on its IT function expenditure.

1. Outsourcing functions to Business process outsourcing companies will cut expenses.

a) Yes b) No

2. The aim of this company's outsourcing was to make the organization more profitable.

a) Yes b) No

3. The outsource IT function has saved the organization $1/5^{th}$ on their IT function expenditure compared to the in-house IT function.

a) Yes b) No

Sarah owns a new company. New companies are more likely to fail than well-established companies. Therefore:

4. Sarah's company will fail.

a) Yes b) No

5. Sarah's company is more likely to fail than a well-established company.

a) Yes b) No

6. Well-established companies are more likely to succeed than new companies.

a) Yes b) No

Statistics have shown that companies selling baked goods, such as cakes and pastries, are more likely to be successful if they are advertised as French or

7. French and Belgian products are more expensive.

a) Yes b) No

8. French and Belgian baked goods mist taste better.

a) Yes b) No

9. It is a sound business model to advertise baked goods as "French" or "Belgian" as this is more likely to result in successful sales.

a) Yes b) No

May 2012 has the highest level of rainfall on record for the preceding fifty years. Predictions of rainfall are rarely accurate. Therefore:

10. It rained more than expected in May 2012.

a) Yes b) No

11. The rainfall in May 2012 was greater than in May 2011.

a) Yes b) No

12. May is usually dry.

a) Yes b) No

Face book was launched on the American stock marked in May 2012. However, statistics suggest that several previously high-performing companies, such as Pandora, Groupon, and LinkedIn fell in value after they were launched on the American stock market. Therefore:

13. It is possible that face book will also drop in value after May 2012.

a) Yes b) No

14. Social networking sites perform badly once they become publicly listed on the stock market.

a) Yes b) No

15. All companies decrease in value when first launched on the America stock market.

a) Yes b) No

There are currently three problems facing the financial sector. Firstly, bankers are no longer seen as reliable or trustworthy. Secondly, executives of financial institutions are seen by the general public as being overpaid. Finally, it is difficult to regulate the financial sector. Therefore:

16. Banks have never been trusted by the general public.

a) Yes b) No

17. Reliability is no longer an issue when considering the failings of the financial.

a) Yes b) No

18. Overpaying financial executives may contribute to problems facing the financial sector.

a) Yes b) No

Coley is a company that produces scented candles, using only natural products. Coley is against testing on animals and does not use pesticides in any of its products. Therefore:

19. The scent from Coley's candles is made from fruits and barriers.

a) Yes b) No

20. Coley products are unlikely to contain man made setting agents

a) Yes b) No

21. Coley's products are likely to more expensive.

a) Yes b) No

Section IV: Interpreting information, 11 items (50-61)

In this section, the exercise consists of a short paragraph followed by several suggested conclusions. If you think that the proposed conclusions followed beyond a reasonable doubt, select "Yes" if not, select "No"

The Tapoloa Club is a Hawaiian-themed night club central London. Its most popular drink is the Volcano, which emits sparks and flames. The Tapoloa Club also offers a range of cocktails in perverse containers such as pineapples and coconuts, such as the Coconut Express and the Pineapple Pick-Up respectively.

1. The "Coconut Express" is the second most popular drink sold by the Tapoloa Club.

a) Yes b) No

2. All themed clubs in London sell unusual drinks.

a) Yes b) No

3. The "Coconut Express" is contained in a pineapple, and the "Pineapple Pick-Up" is contained in a coconut.

a) Yes b) No

The British National Library has the largest collection of publicly-owned books in the United Kingdom. Therefore:

4. There might be a larger collection of books in the United Kingdom.

a) Yes b) No

5. There might be a larger collection of publicly-owned books in the United Kingdom.

a) Yes b) No

6. The British National Library is in the United Kingdom.

a) Yes b) No

People with a master's degree in business administration (MBA) earn an income on average 70% higher than people with an undergraduate degree. MBA students from top business schools earn an income on average 50% higher than the average income of people with MBAs.

7. If a person obtains an MBA, their income will increase.

a) Yes b) No

8. If a person obtains an MBA from a top business school, their income will be higher than that of the average MBA graduate.

a) Yes b) No

9. The average income of MBA graduate from a top business school is over double that of the average of a person holding only an undergraduate degree.

a) Yes b) No

Hannah has been a solicitor for three years. She works for a law firm in central London and has hopes f being promoted. To be promoted in Hannah's firm, employees most have at least four years' experience practicing as a solicitor.

10. Hannah cannot be promoted because she does not have enough experience.

a) Yes b) No

11. We cannot know whether Hannah can be promoted or not.

a) Yes b) No

12. In 3 years' time, assuming that Hannah has not been promoted, she will be over qualified for her current position.

a) Yes b) No

Section V: Analyzing arguments, 24 items (62-86)

In this section, a question is followed by several arguments. You are to regard each argument as true and then decide whether it is **strong or weak**

Should companies downsize their workforces to decreases and maximize profits?

1. Yes, downsizing will protect the company from bankruptcy in hard economic times.

a) Strong b) Weak

2. Yes, companies have no obligation to employ more people than it can handle.

a) Strong b) Weak

3. No, downsizing leads to demoralization of the workforce and causes a drop in employee productivity.

a) Strong b) Weak

4. Yes, companies which have no control over the size of their workforce will be highly vulnerable to economic climates and market changes.

a) Strong b) Weak

Should university-level education be free to all students?

5. No. Too much education can lead to over-qualification, and therefore unemployment.

a) Strong b) Weak

6. Yes, having a high qualified workforce ensures high levels of employee productivity in organizations.

a) Strong b) Weak

7. No. Research has shown that students that are not required to pay tuition fees: tend to slack off more and learn less during their degree.

a) Strong b) Weak

Should employers allow all staff the option of flexi-time working hours?

8. Yes, giving staff greater flexibility will improve their work-life balance, and therefore their productivity.

a) Strong b) Weak

9. Yes, organizations that value their staff are on average more productive and show lower staff turnover.

a) Strong b) Weak

10. No, flexi-time leads to employees working fewer hours. Working fewer hours will decrease an employee's exposure to the workplace, making career progression harder and leading to a less experienced workforce.

a) Strong b) Weak

Should government implement a minimum wage, outlining a minimum amount an employee is to be paid per hour?

11. Yes, the existence of minimum wages is a key part of a civilized society.

a) Strong b) Weak

12. Yes, countries that do not have a minimum wage are often impoverished and dysfunctional.

a) Strong b) Weak

13. No, minimum wage leads to under-employment by forcing companies to take on staff part time, as they cannot afford to hire them on a full basis.

a) Strong b) Weak

Should and financial institutions be on obligated to engage in socially responsible investing?

14. Yes, engaging in socially responsible investing leads to a happier and more fulfilled workforce compared to banks which do not engage in socially-responsible investing.

a) Strong b) Weak

15. No, banks are for profits institutions and have no obligation to social issues.

a) Strong b) Weak

16. No, focusing on social responsibility detracts from the aim of making money, which is the most important endeavor for banks, and leads to a decrease in revenue and profit.

a) Strong b) Weak

17. No, over-regulation in the financial sector leads to decreased opportunities and therefore lower profits.

a) Strong b) Weak

Should all members of European Union join the Euro zone and adopt the euro?

18. No, countries may find it difficult to adapt to a new currency.

a) Strong b) Weak

19. Yes, the function of European Union is to form a single currency union.

a) Strong b) Weak

20. Yes, greater economic unity between countries improves foreign relations between those member countries, which in turn each country stronger.

a) Strong b) Weak

21. No, instability of one Euro zone country could cause the whole Euro zone to become unstable, disrupting the economies of all countries that use the euro.

a) Strong b) Weak

Should government be engaging in space exploration research?

22. No, the money spent on these programs could be used to increase funding for education and healthcare, which would lead to increasing the quality of life for a country's people.

a) Strong b) Weak

23. No, countries have collectively spent trillions of dollars on space exploration research already.

a) Strong b) Weak

24. Yes, space exploration has led to numerous discoveries and ushered in the space age.

a) Strong b) Weak

25. Yes, the findings of these space exploration research and development programs have been successfully applied to industry, boosting the economies of the host country.

a) Strong b) Weak

APPENDIX H Questionnaire

Learning Experience in the Course

This section of the questionnaire asks you to respond by describing your learning experience as a student in the course of improving critical thinking. Respond to each statement by checking one of the boxes as follows:

1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

No.	Statements	Rating Scale				
		1	2	3	4	5
General Course Instruction						
1	I enjoyed learning about the topic of this class.					
2	The learning materials used in this class were helpful for learning.					
3	I am satisfied with overall structure of the course.					
4	I enjoyed the class activities.					
5	I found the class activities useful to my understanding of critical thinking.					
6	I found that the emphasis on the group activities and participation encouraged me to be active in learning.					
Group Work Activities						
7	I enjoyed working with others in classroom (solving problems & working on the activities together).					
8	I actively engaged with in-class exercises.					
9	I found working with others to be less stressful than doing similar tasks alone.					
10	I felt that my teammates collaborated in solving the in-class exercises.					
11	I found that working with others improved my understanding of the course material.					
12	I was able to help my teammates learn the course content.					
Interpersonal/Team Skills						
Learning activities used in this course help me to develop my ability to:						
13	Orally present and support personal view					

No.	Statements	Rating Scale				
		1	2	3	4	5
14	Handle conflicts, negotiate agreements, and accept compromises					
15	Engage in discussion with an open mind					
16	Feel comfortable asking questions to clarify facts, concepts, and relationships.					
Critical Thinking Skills						
Learning activities used in this course helped me develop my ability to:						
17	Identify what information is needed to solve a problem					
18	Plan my work					
19	Set goals					
20	Stay on task while working on a problem					
21	Organize information					
22	Apply scientific concepts/ideas to real-world problems					
23	Divide complex problems into manageable components					
24	Consider other people's perspectives while making decisions					
25	Approach the problem from various perspectives (economic, social, and cultural, etc.)					
26	Recognize contractions/inconsistencies in ideas, data ect					
27	Use established criteria to evaluate solutions.					
28	Recognize mistakes in my own thinking					
29	Understand the impact of real-life cause of problems					
30	Express my thinking clearly in writing and speaking					
31	Evaluate arguments and evidence so that strengths and weakness of competing alternatives can be judged					
32	Use discussion strategies to analyze and solve a problem					
Critical Thinking Teaching						
33	Be able to identify topics for critical thinking lessons					
34	Understand how to manage critical thinking activities					
35	Understand how to evaluate critical thinking results					
36	Feel comfortable in continuous teaching critical thinking					

Thank you!

APPENDIX I Interview Questions

I. Background of Information Questions

- What is your name?
- Where is your hometown?
- Have you ever taken any critical thinking course before?

II. General Characteristics of Learning Activities

A. Overall

- Would you describe how you experienced from this course?

- What were the characteristics that helped you be more active and engaged in your learning?

- What is the most helpful feature that supported your learning?

B. In-Class Activities

- Can you describe your in-class activities you experienced from this course?

- Which type you were the most active?

- What would be different characteristics from other courses you have attended?

- You worked on real problems in society. How did this help your learning?

C. Assessment

You were asked to do several assignments such as pre-and-posttest, teaching practice etc. You liked or dislike them? How did they help you improve your critical thinking?

III. Small Group Work Activities

- What experience have you had in terms of small group work?
- In what way did the small group activity help you to make a decision?

IV. Teaching Activity

As you engaged in teaching activity, how did it help you to improve critical thinking teaching?

V. Teaching Process

- How did instructional materials help you make the decisions? (Example, you were asked to list some facts or reasoning to help you make decisions.)
- As you engaged in the activities, how did this process help you deal with the complexity of the real-life problem? How did you consider different perspectives?
- Overall, did the course help you improve your critical thinking?

APPENDIX J Lesson Plan

Learning Module I: Critical Thinking

Lesson Plan 1

Topic: Critical Thinking

1. Introduction of Critical Thinking
2. Definition of Critical Thinking

Session/Hour: Session1, 2 hours

1. Significance

The complexities of knowledge in the 21st century require students to comprehend texts and refine skills such as defining, summarizing, retrieving, analyzing, synthesizing, and reflecting. Students who are critical learners must learn not only to question and organize but also interpret, digest, and synthesize what they learn. Moreover, students are required to be involved in critical thinking which underlies a process of purposeful, reasoned, and goal-directed higher-order think.

2. Objective

To introduce the meaning of critical thinking to trainee students

3. Content

Definition of critical thinking selected from different sources

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Asks students "Have ever heard about critical thinking? What is critical thinking?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to watch clip video about critical thinking activities - Asks them to work in group and share ideas about clip video	- Students get into small groups - Students watch clip video - Student discuss and share ideas about clip video
Investigated related data (20 minutes)	- Provides the articles about critical thinking enhancement - Asks students to work in small group and investigate the data related to the definition of critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to the definition of critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the definition of critical thinking	- Students share ideas about the definition of critical thinking - Students discuss the meaning of critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the definition of critical thinking using clear and alternative source of information	- Students work together to analyze and synthesize the meaning of critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the meaning of critical thinking	- Students work together - Students summarize and draw conclusions about the meaning of critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video about critical thinking

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the meaning critical thinking& how to reach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 2

Topic: Critical Thinking

Component of Critical Thinking

Session/Hour: Session1, 2 hours

1. Significance

The complexities of knowledge in the 21st century require students to comprehend texts and refine skills such as defining, summarizing, retrieving, analyzing, synthesizing, and reflecting. Students who are critical learners must learn not only to question and organize but also interpret, digest, and synthesize what they learn. Moreover, students are required to be involved in critical thinking which underlies a process of purposeful, reasoned, and goal-directed higher-order think.

2. Objective

To identify the differences between normal thinking and critical thinking

3. Content

Components of normal thinking and critical thinking

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Asks students to ask each other a question, using why……. - Asks 2 or 3 students to tell questions and answers to the class - Ask students to do pre-test to evaluate critical thinking	- Students listen carefully - Students ask each other questions - 2 or 3 students presents the answers and questions to the class - Students do pre-test to evaluate their current critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to look at the picture (Angkor Wat) - Asks students "Why is Angkor famous?" - Asks students to write the short answers on the cards - Asks students to stick the cards on the board - Asks students to compare the answers (normal and critical thinking)	- Students write individual answer on the cards - Students stick the cards on the board - Students compare the answers (normal and critical thinking)
Investigated related data (20 minutes)	- Provides two articles about critical thinking and non critical thinking - Asks students to work in small group and investigate the data related to critical thinking and non-critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the differences between critical thinking and non-critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about critical thinking and non-critical thinking	- Students share ideas about critical thinking and non-critical thinking - Students discuss the differences between critical thinking and non-critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the components of critical thinking using clear and alternative source of information	- Students work together to analyze and synthesize the determinants of critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the components of critical thinking	- Students work together - Students summarize and draw conclusions about the components of critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

Note: Pre-test is conducted during this session, so it might take longer time than the actual is.

5. Learning Material

5.1 Picture about Angkor Wat

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of components of critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally

3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability
4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument

9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly
10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 3

Topic: Critical Thinking

Barriers to Critical Thinking

Session/Hour: Session1, 2 hours

1. Significance

The complexities of knowledge in the 21st century require students to comprehend texts and refine skills such as defining, summarizing, retrieving, analyzing, synthesizing, and reflecting. Students who are critical learners must learn not only to question and organize but also interpret, digest, and synthesize what they learn. Moreover, students are required to be involved in critical thinking which underlies a process of purposeful, reasoned, and goal-directed higher-order think.

2. Objective

To demonstrate factors considered as barriers to critical thinking

3. Content

Barriers to critical thinking

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Reads a short story ….One day, Mr. Sok joined the meeting at Continental Hotel in Phnom Penh. While walking into the hotel with his secretary, a friend of him saw and informed his wife about this matter…… - Ask students "What is reaction of his wife after hearing this information?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to watch clip video about barriers to critical thinking - Asks them to work in group and share ideas about clip video	- Students get into small groups - Students watch clip video - Student discuss and share ideas about clip video
Investigated related data (20 minutes)	- Provides the articles about barriers to critical thinking - Asks students to work in small group and investigate the data related to barriers to critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to barriers to critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about barriers to critical thinking	- Students share ideas about barriers to critical thinking - Students discuss the barriers to critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the barriers to critical thinking using clear and alternative source of information	- Students work together to analyze and synthesize the barriers to critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	Students
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the barriers to critical thinking	- Students work together - Students summarize and draw conclusions about the barriers to critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video about barriers to critical thinking

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of barriers to critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 4

Topic: Critical Thinking

Benefits of Critical Thinking

Session/Hour: Session1, 2 hours

1. Significance

The complexities of knowledge in the 21st century require students to comprehend texts and refine skills such as defining, summarizing, retrieving, analyzing, synthesizing, and reflecting. Students who are critical learners must learn not only to question and organize but also interpret, digest, and synthesize what they learn. Moreover, students are required to be involved in critical thinking which underlies a process of purposeful, reasoned, and goal-directed higher-order think.

2. Objective

To identify the benefits of using critical thinking

3. Content

Benefits of using critical thinking

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	Students
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Asks a question….modern technology leads to having a variety of communication functions such as face book, Viber, line…..How do you correctly use the information from these sources?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	Students
Identifying problem (10 minutes)	- Asks students to watch clip video about critical thinking class - Asks them to work in group and share ideas about clip video	- Students get into small groups - Students watch clip video - Student discuss and share ideas about clip video
Investigated related data (20 minutes)	- Provides the articles about the benefits of using critical thinking - Asks students to work in small group and investigate the data related benefits of using critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to barriers to critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the benefits of critical thinking	- Students share ideas about the benefits of critical thinking - Students discuss the benefits of critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the benefits of critical thinking using clear and alternative source of information	- Students work together to analyze and synthesize the benefits of critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the benefits of critical thinking	- Students work together - Students summarize and draw conclusions about the benefits of critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video about benefits of critical thinking

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of benefits of critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable

8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument

9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly
10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Learning Module II: Critical Thinking Evaluation

Lesson Plan 5

Topic: Critical Thinking Evaluation

Critical Thinking Evaluation Tool

Session/Hour: Session1, 2 hours

1. Significance

More support has been offered in the literature for assessing critical thinking through the use of performance assessment and portfolios. The assessment of critical thinking allows learners to document, demonstrate, and justify their own engagement in critical thinking. There are a variety of standardized tools used to assess critical thinking, especially portfolio and performance assessment.

2. Objective

To introduce critical thinking assessment tools to trainee students

3. Content

Critical thinking assessment tools

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Asks questions…..How many types of assessment tools have you used so far? What are they?	- Students listen carefully - Students try to identify the answers - Students present the answers
Identifying problem (10 minutes)	- Provides the articles about the assessment of critical thinking - Asks students to tell the main ideas of the article	- Students read the articles - Student presents the main ideas of the article

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Investigated related data (20 minutes)	Asks students to work in small group and investigate the data related to types of critical thinking assessment tools	- Students work in small group - Students read the handouts - Students investigate and identify the data related to types of critical thinking assessment tools
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about types of critical thinking assessment tools	- Students share ideas about types of critical thinking assessment tools - Students discuss types of critical thinking assessment tools
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize types of critical thinking assessment tools using clear and alternative sources of information	- Students work together to analyze and synthesize types of critical thinking assessment tools - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about types of critical thinking assessment tools	- Students work together - Students summarize and draw conclusions about types of critical thinking assessment tools
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map

Learning Instruction	Learning Procedure	
	Teacher	Students
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of types of critical thinking assessment tools	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability
4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary

7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly
10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 6

Topic: Critical Thinking Evaluation

Assessment of Critical Thinking

Session/Hour: Session1, 2 hours

1. Significance

More support has been offered in the literature for assessing critical thinking through the use of performance assessment and portfolios. The assessment of critical thinking allows learners to document, demonstrate, and justify their own engagement in critical thinking. There are a variety of standardized tools used to assess critical thinking, especially portfolio and performance assessment.

2. Objective

To demonstrate how to assess critical thinking

3. Content

Assessment of critical thinking

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	Students
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Show picture of …spoon, knife, weigh, spade, hoe… - Ask students questions about the equipment….what are they used for?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to walk out of the room - Asks students to pick a piece of something they met - Asks to talk about that thing using question why…….	- Students walk out of the room - Students pick out pieces of things - Students talk about those things
Investigated related data (20 minutes)	- Provides articles how to assess critical thinking - Asks students to work in small group and investigate the data related to how to assess critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to how to assess critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about how to assess critical thinking	- Students share ideas about how to assess critical thinking - Students discuss how to assess critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize how to assess critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize how to assess critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about how to assess critical thinking	- Students work together - Students summarize and draw conclusions about how to assess critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about critical thinking

5.2 Flip chart

5.3 Posters

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to assess critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Learning Module III: Critical Thinking Teaching

Lesson Plan 7

Topic: Critical Thinking Teaching

Critical Thinking Teaching

Session/Hour: Session1, 2 hours

1. **Significance**

The most fundamental role of educators, especially those of adults, is to encourage and develop critical thinking not only because critical thinking is a central component of education, but also it is the one function that many learners find most difficult to perform themselves. Improving critical thinking skills in education will improve education altogether by increasing a student's quantity and quality of meaning from what a student reads, perceives, and in expressing what he or she says and writes.

2. **Objective**

To introduce critical thinking teaching to trainee students

3. **Content**

Critical thinking teaching

4. **Learning Instruction**

Learning Instruction	**Learning Procedure**	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Shows two pictures about teaching activity - Asks students about this teaching activity	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to watch clip video about critical thinking teaching - Asks students to work in small groups and share ideas about clip video	- Students watch clip video about teaching critical thinking - Students work in small groups and share ideas about clip video
Investigated related data (20 minutes)	- Provides articles about teaching critical thinking - Asks students to work in small group and investigate the data related to teach critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to how to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about how to teach critical thinking	- Students share ideas about how to teach critical thinking - Students discuss how to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize how to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize how to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about how to teach critical thinking	- Students work together - Students summarize and draw conclusions about how to teach critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 8

Topic: Critical Thinking Teaching

Strategy of teaching critical thinking

Session/Hour: Session1, 2 hours

1. Significance

There are many strategies and approaches for the enhancement of critical thinking. Critical thinking compromises the mental processes or strategies that students use to analyze and evaluate ideas and choice, judge the possibility of specific assertions, weigh and validate the evidence, assess the logical soundness of inferences, construct counter arguments and hypotheses, ask insightful and probing questions, and clarify and assess an idea's reasonableness.

2. Objective

To explain strategies used to teach critical thinking

3. Content

Strategies to teach critical thinking

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Asks questions….What approach do you normally use to teach students?	- Students listen carefully - Students try to identify the answers - Students present the answers
Identifying problem (10 minutes)	- Asks students to watch clip video about different strategies used to teach critical thinking - Asks students to work in small groups and share ideas about clip video	- Students watch clip video about strategies used to teach critical thinking - Students work in small groups and share ideas about clip video

Learning Instruction	Learning Procedure	
	Teacher	Students
Investigated related data (20 minutes)	- Provides articles about strategies used to teach critical thinking - Asks students to work in small group and investigate the data related to strategies used to teach critical thinking	- Students work in small group - Students read the handouts - Students investigate and identify the data related to strategies used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about strategies used to teach critical thinking	- Students share ideas about strategies used to teach critical thinking - Students discuss how to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize strategies used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize strategies used to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about strategies used to teach critical thinking	- Students work together - Students summarize and draw conclusions about strategies used to teach critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map

Learning Instruction	Learning Procedure	
	Teacher	Students
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video

5.2 Handout about critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of strategies used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2.Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary

7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly
10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 9

Topic: Critical Thinking Teaching

Strategy of teaching critical thinking (Cont-)

Session/Hour: Session1, 2 hours

1. Significance

There are many strategies and approaches for the enhancement of critical thinking. Critical thinking compromises the mental processes or strategies that students use to analyze and evaluate ideas and choice, judge the possibility of specific assertions, weigh and validate the evidence, assess the logical soundness of inferences, construct counter arguments and hypotheses, ask insightful and probing questions, and clarify and assess an idea's reasonableness.

2. Objective

To introduce active learning/student-centered approach consisted of inquiry-based learning, case-based learning, and problem-based learning to trainee students

3. Content

Inquiry-based learning, case-based learning, and problem-based learning

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	Students
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students …..What is student-center approach?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Provides articles about inquiry-based learning, case-based learning, and problem-based learning - Asks students to work in small groups and share ideas each article	- Students work in small groups - Students read and share ideas about the articles
Investigated related data (20 minutes)	Asks students to investigate the data related to each article concerning approaches to teach critical thinking	Students investigate and identify the data related to each approach used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about each approach used to teach critical thinking	- Students share ideas about each approach used to teach critical thinking - Students discuss about the approach to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize each approach used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize each approach used to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about each approach used to teach critical thinking	- Students work together - Students summarize and draw conclusions about each approach used to teach critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about approaches to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of approaches consisted of inquiry-based learning, case-based learning, and problem-based learning used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 10

Topic: Critical Thinking Teaching

Strategy of teaching critical thinking (Cont-)

Session/Hour: Session1, 2 hours

1. Significance

There are many strategies and approaches for the enhancement of critical thinking. Critical thinking compromises the mental processes or strategies that students use to analyze and evaluate ideas and choice, judge the possibility of specific assertions, weigh and validate the evidence, assess the logical soundness of inferences, construct counter arguments and hypotheses, ask insightful and probing questions, and clarify and assess an idea's reasonableness.

2. Objective

To introduce active learning/student-centered approach consisted of cooperative learning, Bloom's cognitive taxonomy, and Socratic questioning to trainee students

3. Content

Cooperative learning, Bloom's cognitive taxonomy, and Socratic questioning

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	Students
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students …..What are other approaches used to teach critical thinking?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	Students
Identifying problem (10 minutes)	- Provides articles about cooperative learning, Bloom's cognitive taxonomy, and Socratic's questioning - Asks students to work in small groups and share ideas each article	- Students work in small groups - Students read and share ideas about the articles
Investigated related data (20 minutes)	Asks students to investigate the data related to each article concerning approaches to teach critical thinking	Students investigate and identify the data related to each approach used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about each approach used to teach critical thinking	- Students share ideas about each approach used to teach critical thinking - Students discuss about the approach to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize each approach used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize each approach used to teach critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about each approach used to teach critical thinking	- Students work together - Students summarize and draw conclusions about each approach used to teach critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about approaches to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of approaches consisted of cooperative learning, Bloom's cognitive taxonomy, and Socratic's questioning used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Learning Module IV: Critical Thinking Teaching Lesson Plan

Lesson Plan 11

Topic: Critical Thinking Teaching Lesson Plan
Critical Thinking Teaching Content

Session/Hour: Session1, 2 hours

1. **Significance**

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. **Objective**

To introduce the content of critical thinking teaching to trainee students

3. **Content**

Content of critical thinking teaching

4. **Learning Instruction**

Learning Instruction	**Learning Procedure**	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students ……what is the content of EFC book about?...how do you relate this content to student learning?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Provides articles about the content of teaching critical thinking - Asks students to work in small groups and share ideas each article	- Students work in small groups - Students read and share ideas about the articles
Investigated related data (11 minutes)	Asks students to investigate the data related to each article concerning content used to teach critical thinking	Students investigate and identify the data related to content used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the content used to teach critical thinking	- Students share ideas about the content used to teach critical thinking - Students discuss about the content used to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize content used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize content used to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the content used to teach critical thinking	- Students work together - Students summarize and draw conclusions about the content used to teach critical thinking

Learning Instruction	Learning Procedure	
	Teacher	Students
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about the content used to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the content used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 12

Topic: Critical Thinking Teaching Lesson Plan
Critical Thinking Teaching Materials

Session/Hour: Session1, 2 hours

1. **Significance**

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. **Objective**

To introduce how to use critical thinking teaching materials to trainee students

3. **Content**

Critical thinking teaching materials

4. **Learning Instruction**

Learning Instruction	**Learning Procedure**	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students ……what visual aids do you always use for teaching? How are they important?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Provides articles about materials for teaching critical thinking - Asks students to work in small groups and share ideas each article	- Students work in small groups - Students read and share ideas about the articles
Investigated related data (11 minutes)	Asks students to investigate the data related to materials used to teach critical thinking	Students investigate and identify the data related to materials used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the materials used to teach critical thinking	- Students share ideas about the materials used to teach critical thinking - Students discuss about the materials used to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize materials used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize materials used to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the materials used to teach critical thinking	- Students work together - Students summarize and draw conclusions about the materials used to teach critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about the materials used to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the materials used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 13

Topic: Critical Thinking Teaching Lesson Plan
Critical Thinking Teaching Activities

Session/Hour: Session1, 2 hours

1. **Significance**

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. **Objective**

To introduce how to use critical thinking teaching activities to trainee students

3. **Content**

Critical thinking teaching activities

4. **Learning Instruction**

Learning Instruction	**Learning Procedure**	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students ……what teaching activities do you always use teaching? How are they important?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to watch different clip video about the activities of teaching critical thinking - Asks students to work in small groups and share ideas clip videos	- Students work in small groups - Students share ideas about clip videos
Investigated related data (12 minutes)	- Provides articles about activities used to teach critical thinking - Asks students to investigate the data related to activities used to teach critical thinking	Students investigate and identify the data related to activities used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the activities used to teach critical thinking	- Students share ideas about the activities used to teach critical thinking - Students discuss about the activities used to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the activities used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize the activities used to teach critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the activities used to teach critical thinking	- Students work together - Students summarize and draw conclusions about the activities used to teach critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video about activities used to teach critical thinking

5.2 Handout about the materials used to teach critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the activities used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 14

Topic: Critical Thinking Teaching Lesson Plan
Critical Thinking Teaching Instruction

Session/Hour: Session1, 2 hours

1. **Significance**

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. **Objective**

To introduce how to use critical thinking teaching instruction to trainee students

3. **Content**

Critical thinking teaching instruction

4. **Learning Instruction**

Learning Instruction	**Learning Procedure**	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students ……to get students to participate in doing activities and sharing ideas, what instruction do you always use?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students to watch clip video how to use instruction for teaching critical thinking - Asks students to work in small groups and share ideas clip video	- Students work in small groups - Students share ideas about clip videos
Investigated related data (6 minutes)	- Provides articles about instruction used to teach critical thinking - Asks students to investigate the data related to instruction used to teach critical thinking	Students investigate and identify the data related to instruction used to teach critical thinking
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the instruction used to teach critical thinking	- Students share ideas about the instruction used to teach critical thinking - Students discuss about the instruction used to teach critical thinking
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the instruction used to teach critical thinking using clear and alternative sources of information	- Students work together to analyze and synthesize the instruction used to teach critical thinking - Students use different sources of information

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the instruction used to teach critical thinking	- Students work together - Students summarize and draw conclusions about the instruction used to teach critical thinking
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Clip video about instruction used to teach critical thinking

5.2 Handout about the materials used to teach critical thinking

5.3 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the instruction used to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 15

Topic: Critical Thinking Teaching Lesson Plan
Critical Thinking Teaching Evaluation

Session/Hour: Session1, 2 hours

1. Significance

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. Objective

To introduce how to use critical thinking teaching evaluation to trainee students

3. Content

Critical thinking teaching evaluation

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	Students
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students ……What tools do you use to evaluate students' learning outcome? How do you use them?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students read the articles about evaluation of critical thinking teaching - Asks students to work in small groups and share ideas the articles	- Students work in small groups - Students share ideas about the articles
Investigated related data (6 minutes)	Asks students to investigate the data related to evaluation of critical thinking teaching	Students investigate and identify the data related to evaluation of critical thinking teaching
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas about the evaluation of critical thinking teaching	- Students share ideas about the evaluation of critical thinking teaching - Students discuss about the evaluation of critical thinking teaching
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the evaluation of critical thinking teaching using clear and alternative sources of information	- Students work together to analyze and synthesize the evaluation of critical thinking teaching - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the evaluation of critical thinking teaching	- Students work together - Students summarize and draw conclusions about the evaluation of critical thinking teaching

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	Asks students to reflect about the lesson, what did they learn from this lesson?	Students answer the questions using their own experiences from the lesson learned.

5. Learning Material

5.1 Handout about the materials used to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of the evaluation of critical thinking teaching	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Lesson Plan 16

Topic: Critical Thinking Teaching Lesson Plan

Organizing Critical Thinking Lesson Plan

Session/Hour: Session1, 2 hours

1. Significance

Students are expected to operate on the most complex level of the intellectual skills, however; many students do not operate effectively on the level of problem. The key to successful learning is that learners must be given an opportunity to learn and perform with their acquired knowledge. Also, the classroom activities that support critical thinking include simulation modules, scenarios with alternative methods/solutions, concept mapping, reflective journaling and portfolio development, and research reports/critical analysis papers.

2. Objective

To introduce how to organize critical thinking teaching lesson plan to trainee students

3. Content

Critical thinking teaching lesson plan

4. Learning Instruction

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Triggering activity (5 minutes)	- Greets students, hello!, How are you? - Ask students …..how do you organize lesson plan to teach students? What is the main element used to organize the lesson plan?	- Students listen carefully - Students try to identify the answers - Students present the answers

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Identifying problem (10 minutes)	- Asks students read some lesson plans about critical thinking teaching - Asks students to work in small groups and share ideas the articles	- Students work in small groups - Students share ideas about the articles
Investigated related data (7 minutes)	- Asks students to investigate the data related to organizing critical thinking teaching lesson plan - Asks students to conduct lesson plans for teaching critical thinking	- Students investigate and identify the data related to lesson plan of critical thinking teaching - Students conduct lesson plans
Discussing findings (20 minutes)	Asks and motivates students to discuss and share ideas in order to conduct lesson plan of critical thinking teaching	Students share ideas in order to conduct lesson pan of critical thinking teaching
Evaluating the findings (15 minutes)	Ask students to analyze and synthesize the developed lesson plan to teach critical thinking using different sources of information	- Students work together to analyze and synthesize the developed lesson plan to teach critical thinking - Students use different sources of information
Creating solutions (15 minutes)	Ask students to summarize and draws conclusion about the developed lesson plan to teach critical thinking	- Students work together - Students summarize and draw conclusions about the developed lesson plan to teach critical thinking

Learning Instruction	Learning Procedure	
	Teacher	**Students**
Presenting solutions (20 minutes)	Asks the representative of each group to present the results	Students (representatives) presents the results using various materials such as flip chart, power point, mind map
Reflecting learning outcome (15 minutes)	- Asks students to reflect about the lesson, what did they learn from this lesson? - Asks students to do post test	- Students answer the questions using their own experiences from the lesson learned. - Students do post test to evaluate the enhancement of critical thinking

Note: Post test is conducted during this session, so it might take longer time than the actual is.

5. Learning Material

5.1 Handout about organizing lesson plan to teach critical thinking

5.2 Flip chart

6. Learning Evaluation

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of organizing lesson plan to teach critical thinking	Reflection and Observation	The mean score of evaluation is at high level or above

Individual Reflection Paper

Name:.....
Lesson:.....
Date:.....

What is your reflection about this lesson?

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Rating Scale for Critical Thinking

1. Consider different points of view			
0	1	2	3
Acts as if own point of view is accepted by everyone	Awares that own point of view is not accepted by every one	Shows awareness that others have legitimate points of view that differ from own	Actively looks for and encourages others to express points of view different from or opposite from own
2. Treat other's points of view			
0	1	2	3
Acts in a way that avoids or discourages points of views	Shows some attention of other's points of view	Makes a serious effort to consider other's points of view but is not consistently objective or rational	Attends seriously to other's points of view and consistently reviews them objectively and rationally
3. Communicate well with others who had less knowledge or ability			
0	1	2	3
Cannot work or communicate with others who have less knowledge or ability	Attempts to work or communicate with others who have less knowledge or ability, but is less than adequate in doing so	Works or communicates adequately with others who have less knowledge or ability	Works or communicates excellently with others who have less knowledge or ability

4. Sensitive to the feelings of others with less knowledge or ability			
0	1	2	3
Acts apathetically or cruelly toward others who have less knowledge and ability	Does the minimum to help or encourage respect for the feelings of others who have less knowledge and ability	Offer good encouragement and respect for the feelings of others who have less knowledge and ability	Actively seeks to bolster and increase respect for the feelings of others who have less knowledge and ability
5. Clearly stated the thesis or mains points			
0	1	2	3
Did not state or imply the main point or thesis	Implied the main point or thesis but did not state it clearly	Stated the main ideas or thesis clearly but only matter-of-fact	Stated the main idea of thesis clearly, enthusiastically, and interestingly for the audience
6. Defined the key terms when necessary to do so			
0	1	2	3
No attempt to define key terms, even when it was necessary to do so	Attempts to define the key terms, but was not effective in doing so	Clearly and effectively defines the necessary key terms	The presentation was that such defining key terms was unnecessary
7. Use sound reasoning to support the main point or thesis			
0	1	2	3
Offer no supporting reasons for the thesis or position taken	Supporting reasons given but they are off-target or they do not lend direct support for the thesis	Give relevant supporting reasons but could have given better or more diverse reasons	Give excellent supporting reasons, good diversity, directly applicable
8. Used relevant facts in appropriate ways to support the thesis			
0	1	2	3
Gave no facts, used completely irrelevant facts, or cited facts from non-credible sources	Gave facts to support the thesis but the generalization from them were weak, somewhat inappropriate, or incomplete; facts are cited from credible sources	Gives several appropriate facts that support the thesis, generalizations from facts are appropriate, sources for facts credible	Gives highly appropriate facts, excellent generalizations from facts that support the thesis, sources of the facts are credible, facts used well in making the argument
9. Portrayed and Evaluated alternative positions clearly			
0	1	2	3
Alternative positions not mentioned and not evaluated	Alternative positions are mentioned but they are either not portrayed fairly, not evaluated properly, or relevant to the thesis	Some of the relevant alternative positions are mentioned, they are portrayed properly, other important alternative positions are omitted	All relevant and important alternative positions are mentioned, presented fairly and evaluated properly

10. Rebutted the alternative positions well			
0	1	2	3
No attempt was made at the rebuttal	Attempts at rebuttal were made but they are ineffective or incomplete	Rebutted adequately, but could have been more effective in explaining the shortcomings of the alternatives	Rebutted well, was effective, clear about the inadequacies of the alternatives, convincingly presented
11. Presented a well-organized argument			
0	1	2	3
Organization was disconnected, lacked direction, confused the thesis or main point	Organization was clear, but not effective, connections to thesis or main point were not sharp; details were often out of place	Organization was good and contributed to the effectiveness of the argument, but a few details were out of place; sometimes the connections to the main point were weak or out of place	Organization was very clear and enhanced the argument; the presentation kept the audience interest focused on the main issues

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Interpretation

The interpretation of scoring rubrics was interpreted based on the weigh (exemplary, proficient, basic, and novice) developed by Greenstein [82]

24.75 - 33.00: Exemplary

16.51 - 24.74: Proficient

08.26 - 16.50: Basic

00.00 - 08.25: Novice

Critical Thinking Lesson Plan

Lesson Plan 17

Group 1

Topic: Practice Teaching Critical Thinking Lesson Plan

Session/Hour: Session1, 2 hours

1. **Significance**

Critical thinking provides an intellectual approach that enables students to select from the available information. When student know how to use critical thinning and critical thinking teaching, they will become critical thinkers who are able to analyze information, apply strategies for deciding, be ready to consider ideas, use logical inquiry, make inferences, appraise evidence, test conclusions, make accurate judgments, and analyze assumptions.

2. **Objective**

To follow up trainee students critical thinking teaching ability

3. **Evaluation**

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to teach critical thinking	Critical Thinking Teaching Rubric	The mean score of evaluation is at high level or above

Critical Thinking Teaching Rubric

Critical Thinking Teaching	Novice	Basic	Proficiency	Exemplary
	Demonstrate unsuccessfully	Just getting started	Demonstrate some success	Demonstrate competence and Confidence
	0	1	2	3
Lesson Plan				
Topic concerned problem of current situation and students' experience				
Purposes/Objectives are clear and foster in critical thinking				
Learning content concerned critical analysis about real-life problem.				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Learning materials include critical articles, posters, research report, video clips….				
Learning activities engage in small group discussion, collaborative activities, debate, simulation, reporting session, reflection…..				
Learning instruction concerned using Bloom's cognitive domain, Socratic's question, or Brown and Kelley's questions (analyzing, evaluating, or synthesizing…)				
The duration is long enough for each activity.				
Assessment of lesson engaged students in developing new knowledge through making a conclusion, creating new results, and sharing self-reflection				
Teaching Activities				
Stimulate students for their curiosity and participation to establish learning issues				
Involve students in identifying problem through using critical articles, portfolio…….				
Engage students in authentic learning environment through data collection and verification hypothesis				
Encourage students to work in groups, share ideas, or discuss findings				
Involve students in analyzing, evaluating using alternative sources of information collected on the problem				
Encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience				
Involve students to present findings using different methods such as posters, mind map……				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Involves students in demonstrating the implication, refining the existing questions, and raising new ones				
Learning Outcome				
Students could seek the statements of the main point or question				
Students could look for explanation and reasons				
Student could use and cite credible sources				
Students could look for alternatives				
Students could change position on an issue with good reasons				
Students could suggested new ideas				
Students could have a respect for and willingness to entertain other viewpoints.				
Students could have the propensity to seek reasons, be inquisitive, and have the desire to be well-informed and flexible.				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Transformation

According to Greenstein [82], critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

18.00 – 24.00: The high level of critical thinking teaching ability

12.00 – 17.99: The medium level of critical thinking teaching ability

06.01 – 11.99: The low level of critical thinking teaching ability

00.00 – 06.00: The lowest level of critical thinking teaching ability

Lesson Plan 18

Group 2

Topic: Practice Teaching Critical Thinking Lesson Plan

Session/Hour: Session1, 2 hours

1. **Significance**

Critical thinking provides an intellectual approach that enables students to select from the available information. When student know how to use critical thinning and critical thinking teaching, they will become critical thinkers who are able to analyze information, apply strategies for deciding, be ready to consider ideas, use logical inquiry, make inferences, appraise evidence, test conclusions, make accurate judgments, and analyze assumptions.

2. **Objective**

To follow up trainee students critical thinking teaching ability

3. **Evaluation**

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to teach critical thinking	Critical Thinking Teaching Rubric	The mean score of evaluation is at high level or above

Critical Thinking Teaching Rubric

Critical Thinking Teaching	Novice	Basic	Proficiency	Exemplary
	Demonstrate unsuccessfully	Just getting started	Demonstrate some success	Demonstrate competence and Confidence
	0	1	2	3
Lesson Plan				
Topic concerned problem of current situation and students' experience				
Purposes/Objectives are clear and foster in critical thinking				
Learning content concerned critical analysis about real-life problem.				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Learning materials include critical articles, posters, research report, video clips….				
Learning activities engage in small group discussion, collaborative activities, debate, simulation, reporting session, reflection…..				
Learning instruction concerned using Bloom's cognitive domain, Socratic's question, or Brown and Kelley's questions (analyzing, evaluating, or synthesizing…)				
The duration is long enough for each activity.				
Assessment of lesson engaged students in developing new knowledge through making a conclusion, creating new results, and sharing self-reflection				
Teaching Activities				
Stimulate students for their curiosity and participation to establish learning issues				
Involve students in identifying problem through using critical articles, portfolio…….				
Engage students in authentic learning environment through data collection and verification hypothesis				
Encourage students to work in groups, share ideas, or discuss findings				
Involve students in analyzing, evaluating using alternative sources of information collected on the problem				
Encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience				
Involve students to present findings using different methods such as posters, mind map……				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Involves students in demonstrating the implication, refining the existing questions, and raising new ones				
Learning Outcome				
Students could seek the statements of the main point or question				
Students could look for explanation and reasons				
Student could use and cite credible sources				
Students could look for alternatives				
Students could change position on an issue with good reasons				
Students could suggested new ideas				
Students could have a respect for and willingness to entertain other viewpoints.				
Students could have the propensity to seek reasons, be inquisitive, and have the desire to be well-informed and flexible.				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Transformation

According to Greenstein [82], critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

18.00 – 24.00: The high level of critical thinking teaching ability

12.00 – 17.99: The medium level of critical thinking teaching ability

06.01 – 11.99: The low level of critical thinking teaching ability

00.00 – 06.00: The lowest level of critical thinking teaching ability

Lesson Plan 19

Group 3

Topic: Practice Teaching Critical Thinking Lesson Plan

Session/Hour: Session1, 2 hours

1. **Significance**

Critical thinking provides an intellectual approach that enables students to select from the available information. When student know how to use critical thinning and critical thinking teaching, they will become critical thinkers who are able to analyze information, apply strategies for deciding, be ready to consider ideas, use logical inquiry, make inferences, appraise evidence, test conclusions, make accurate judgments, and analyze assumptions.

2. **Objective**

To follow up trainee students critical thinking teaching ability

3. **Evaluation**

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to teach critical thinking	Critical Thinking Teaching Rubric	The mean score of evaluation is at high level or above

Critical Thinking Teaching Rubric

Critical Thinking Teaching	Novice	Basic	Proficiency	Exemplary
	Demonstrate unsuccessfully	Just getting started	Demonstrate some success	Demonstrate competence and Confidence
	0	1	2	3
Lesson Plan				
Topic concerned problem of current situation and students' experience				
Purposes/Objectives are clear and foster in critical thinking				
Learning content concerned critical analysis about real-life problem.				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Learning materials include critical articles, posters, research report, video clips....				
Learning activities engage in small group discussion, collaborative activities, debate, simulation, reporting session, reflection.....				
Learning instruction concerned using Bloom's cognitive domain, Socratic's question, or Brown and Kelley's questions (analyzing, evaluating, or synthesizing...)				
The duration is long enough for each activity.				
Assessment of lesson engaged students in developing new knowledge through making a conclusion, creating new results, and sharing self-reflection				
Teaching Activities				
Stimulate students for their curiosity and participation to establish learning issues				
Involve students in identifying problem through using critical articles, portfolio.....				
Engage students in authentic learning environment through data collection and verification hypothesis				
Encourage students to work in groups, share ideas, or discuss findings				
Involve students in analyzing, evaluating using alternative sources of information collected on the problem				
Encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience				
Involve students to present findings using different methods such as posters, mind map.....				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Involves students in demonstrating the implication, refining the existing questions, and raising new ones				
Learning Outcome				
Students could seek the statements of the main point or question				
Students could look for explanation and reasons				
Student could use and cite credible sources				
Students could look for alternatives				
Students could change position on an issue with good reasons				
Students could suggested new ideas				
Students could have a respect for and willingness to entertain other viewpoints.				
Students could have the propensity to seek reasons, be inquisitive, and have the desire to be well-informed and flexible.				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Transformation

According to Greenstein (2012, p.200), critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

18.00 – 24.00: The high level of critical thinking teaching ability

12.00 – 17.99: The medium level of critical thinking teaching ability

06.01 – 11.99: The low level of critical thinking teaching ability

00.00 – 06.00: The lowest level of critical thinking teaching ability

Lesson Plan 20

Group 4

Topic: Practice Teaching Critical Thinking Lesson Plan

Session/Hour: Session1, 2 hours

1. **Significance**

Critical thinking provides an intellectual approach that enables students to select from the available information. When student know how to use critical thinning and critical thinking teaching, they will become critical thinkers who are able to analyze information, apply strategies for deciding, be ready to consider ideas, use logical inquiry, make inferences, appraise evidence, test conclusions, make accurate judgments, and analyze assumptions.

2. **Objective**

To follow up trainee students critical thinking teaching ability

3. **Evaluation**

Evaluation	Assessment Tool	Learning Outcome
The evaluation of an understanding of how to teach critical thinking	Critical Thinking Teaching Rubric	The mean score of evaluation is at high level or above

Critical Thinking Teaching Rubric

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Lesson Plan				
Topic concerned problem of current situation and students' experience				
Purposes/Objectives are clear and foster in critical thinking				
Learning content concerned critical analysis about real-life problem.				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Learning materials include critical articles, posters, research report, video clips….				
Learning activities engage in small group discussion, collaborative activities, debate, simulation, reporting session, reflection…..				
Learning instruction concerned using Bloom's cognitive domain, Socratic's question, or Brown and Kelley's questions (analyzing, evaluating, or synthesizing…)				
The duration is long enough for each activity.				
Assessment of lesson engaged students in developing new knowledge through making a conclusion, creating new results, and sharing self-reflection				
Teaching Activities				
Stimulate students for their curiosity and participation to establish learning issues				
Involve students in identifying problem through using critical articles, portfolio…….				
Engage students in authentic learning environment through data collection and verification hypothesis				
Encourage students to work in groups, share ideas, or discuss findings				
Involve students in analyzing, evaluating using alternative sources of information collected on the problem				
Encourage students to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience				
Involve students to present findings using different methods such as posters, mind map……				

Critical Thinking Teaching	Novice Demonstrate unsuccessfully 0	Basic Just getting started 1	Proficiency Demonstrate some success 2	Exemplary Demonstrate competence and Confidence 3
Involves students in demonstrating the implication, refining the existing questions, and raising new ones				
Learning Outcome				
Students could seek the statements of the main point or question				
Students could look for explanation and reasons				
Student could use and cite credible sources				
Students could look for alternatives				
Students could change position on an issue with good reasons				
Students could suggested new ideas				
Students could have a respect for and willingness to entertain other viewpoints.				
Students could have the propensity to seek reasons, be inquisitive, and have the desire to be well-informed and flexible.				

Rating Scale

0 = Novice

1 = Basic

2 = Proficient

3 = Exemplary

Scoring Transformation

According to Greenstein [82], critical thinking was weighed by identifying with novice and followed by basic, proficient, and exemplary. The score of valid evaluation was interpreted as follows:

18.00 – 24.00: The high level of critical thinking teaching ability

12.00 – 17.99: The medium level of critical thinking teaching ability

06.01 – 11.99: The low level of critical thinking teaching ability

00.00 – 06.00: The lowest level of critical thinking teaching ability

APPENDIX K

On Wednesday, June 11, 2014 3:36 PM, AssessmentDay <info@assessmentday.co.uk> wrote:

Hi Sam,

Thank you for your message. You are welcome to use the free critical thinking test for free.

Kind regards
AssessmentDay

On Tue, Jun 10, 2014 at 4:56 PM, Samaun Vong <vsamaun@yahoo.com>wrote:

Dear Sir/Madam,

My name is Sam Aun, and I am a Cambodian student who is attending the course of curriculum and instruction. I found Free Critical Thinking Test (Solutions Booklet) with a total of 86 subsets from Website. I want to use this manual to test trainee students' critical thinking in my country, but I can't afford to purchase it.

Is there any matter if I use this one to evaluate students' critical thinking in my country?

Thank you in advance for your consideration.

With regards,
Sam Aun

--
AssessmentDay Team

AssessmentDay Ltd

Tel: +44 2071003085
Web: www.assessmentday.co.uk

Naresuan University

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Phitsanulok 65000 Thailand
Tel : +66 55 962378-83 Fax: +66 55 962380
E-mail: international@nu.ac.th
Website: www.english.nu.ac.th

April 28 , 2015

Subject: Request a letter for data collection.

Mr. Vong Sam Aun is a Ph.D. student (ID 56032036) in Curriculum and Instruction at the Faculty of Education, Naresuan University. He currently works on his thesis entitled "An Instructional Model Development Based on Cognitive-based Approach to Enhance Trainee Student Critical Thinking Teaching Ability at Regional Teacher Training Center in Takeo Province, Cambodia: Cognitive and Professional Development" under the supervision of Associate Professor Dr. Wareerat Kaewural. Therefore, he needs to get a permission from Ministry of Education, Youth, and Sport of the Kingdom of Cambodia to collect data in the following institutions:

1. Regional Teacher Training Center in Phnom Penh for pilot study.
2. Regional Teacher Training Center in Takeo Province for research implementation.

Your kind consideration regarding the previously described matter would be very much appreciated

Sincerely Yours,

R. Wongvilairat

(Assoc. Prof. Dr. Rosarin Wongvilairat)
Vice President for Academic Affairs

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ
ឥសរាណាឥឥ

ខ្ញុំបាទឈ្មោះ **ហង់ សំអូន** ជានិស្សិតដែលបានប្រលងជាប់អាហារូបករណ៍អាស៊ាន (ASEAN SCHOLARSHIP) ដើម្បីសិក្សាបន្តថ្នាក់ បណ្ឌិត លើជំនាញ ការអភិវឌ្ឍន៍កម្មវិធីសិក្សា (Curriculum and Instruction) រយៈពេល ០៣ឆ្នាំ ចាប់ពីឆ្នាំ ២០១៣-២០១៦ នៅសាកលវិទ្យាល័យ **ណារ៉ែសួន** (NARESUAN UNIVERSITY) នៃព្រះរាជាណាចក្រថៃឡង់ដ៍ សម្រាប់ឆ្នាំសិក្សា ២០១៤-២០១៥។ ដើម្បីបញ្ចប់ការសិក្សា ខ្ញុំបាទបានធ្វើការសិក្សាស្រាវជ្រាវលើប្រធានបទ "**ការបង្កើតចិធីសាស្ត្របង្រៀនដើម្បីជួយពង្រឹងការគិតប្រកបដោយចិចារណញ្ញាណ ដល់ឥរុសិស្សនៅមជ្ឈមណ្ឌលឥរុកោសល្យភូមិភាគតាកែវ**" ដោយសាកលវិទ្យាល័យ្ត្រតម្រូវឲ្យចុះធ្វើការសាកល្បង និងអនុវត្តនៅ ០២ កន្លែងផ្សេងគ្នា។

សូមគោរពជូន
ឯកឧត្តមបណ្ឌិត ហង់ ជូនណារ៉ុន
រដ្ឋមន្ត្រីក្រសួងអប់រំ យុវជន និងកីឡា

តាមរយៈ ៖ លោកប្រធាននាយកដ្ឋានអាហារូបករណ៍នៃក្រសួងអប់រំ យុវជន និងកីឡា

កម្មវត្ថុ ៖ សំណើសុំអនុញ្ញាតចុះធ្វើការសាកល្បង និងធ្វើកម្មសិក្សាចំនួន ០២ កន្លែង

- រយៈពេល**៦សប្តាហ៍**គឺចាប់ពីថ្ងៃទី**២០ ឧសភា** ដល់ថ្ងៃទី**២៦ ខែមិថុនា** ឆ្នាំ**២០១៥**
- សាកល្បងនៅសាលាគរុកោសល្យភូមិភាគ រាជធានីភ្នំពេញ រយៈពេល ០៤ថ្ងៃសម្រាប់ឆ្នាំសិក្សា**២០១៥**
- អនុវត្តនៅសាលាគរុសល្យភូមិភាគតាកែវ រយៈពេល ០១ខែ សម្រាប់ឆ្នាំសិក្សា**២០១៥**

យោង ៖ លិខិតប្រកាសលទ្ធផលអាហារូបករណ៍ ចុះថ្ងៃទី ០១ កក្កដា**២០១៣** សាកលវិទ្យាល័យ ណារ៉ែសួន

- លិខិតស្នើសុំធ្វើកម្មសិក្សា ចុះថ្ងៃទី**២៨** ខែមេសា ឆ្នាំ**២០១៥** សាកលវិទ្យាល័យ ណារ៉ែសួន

អាស្រ័យដូចបានជម្រាបជូននៅក្នុងកម្មវត្ថុខាងលើ សូម **ឯកឧត្តមបណ្ឌិត** មេត្តាពិនិត្យនិងជួយសម្រួលដោយក្តីអនុគ្រោះ។

សូម **ឯកឧត្តមបណ្ឌិត** មេត្តាទទួលនូវសេចក្តីគោរពដ៏ខ្ពង់ខ្ពស់បំផុតអំពីខ្ញុំបាទ។

តាកែវ ថ្ងៃ ច័ន្ទ ទី ០៩ ខែឧសភា ឆ្នាំ ២០១៥
ហត្ថលេខា

រង់ សំអូន

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងអប់រំ យុវជន និងកីឡា
លេខ: ២៣៨៥ អយក.ទប៤

រាជធានីភ្នំពេញ ថ្ងៃទី១៨ ខែ មិថុនា ឆ្នាំ ២០១៥

ជម្រាបជូន
-លោកនាយកមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគរាជធានីភ្នំពេញ
-លោកនាយកមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគតាកែវ

កម្មវត្ថុ :សំណើសុំចុះធ្វើកម្មសិក្សាស្រាវជ្រាវប្រមូលទិន្នន័យ សម្រាប់សរសេរនិក្ខេបបទបញ្ចប់ការសិក្សាពីថ្ងៃទី 20 ខែ ឧសភា ឆ្នាំ ២០១៥ ដល់ ថ្ងៃទី ២៦ ខែ មិថុនា ឆ្នាំ ២០១៥ ។

យោង : -លិខិតរបស់សាកលវិទ្យាល័យណារ៉ែសួន ចុះថ្ងៃទី ២៨ ខែ មេសា ឆ្នាំ ២០១៥ ។
-ពាក្យស្នើសុំរបស់សាមីជនចុះថ្ងៃទី ០៨ ខែ ឧសភា ឆ្នាំ ២០១៥ ។

តបតាមកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមជម្រាបជូន **លោកនាយក** ជ្រាបថា លោក **វង់ សំអូន** ជានិស្សិតអាហារូបករណ៍ក្រោមគម្រោងព្រះរាជឧបត្ថម្ភដល់ព្រះរាជាណាចក្រកម្ពុជាលើវិស័យអប់រំ របស់ព្រះអង្គម្ចាស់ក្សត្រីយ៍មហាចក្រីសិរិនថន នៃព្រះរាជាណាចក្រថៃ ។ សព្វថ្ងៃលោក **វង់ សំអូន** កំពុងសិក្សាថ្នាក់បណ្ឌិត នៅសាកលវិទ្យាល័យណារ៉ែសួន សាមីជនស្នើសុំចុះធ្វើ កម្មសិក្សាស្រាវជ្រាវ និងប្រមូលទិន្នន័យលើប្រធានបទ " **ការបង្កើតវិធីសាស្ត្របង្រៀនដើម្បីជួយពង្រឹងការគិតប្រកបដោយវិចារណញ្ញាណ ដល់គរុសិស្សនៅមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគតាកែវ** " សម្រាប់សរសេរនិក្ខេបបទបញ្ចប់ការសិក្សានៅឆ្នាំ ២០១៦ ខាងមុខនេះ ។

អាស្រ័យដូចបានជម្រាបជូនខាងលើ ខ្ញុំសូម **លោកនាយក** អនុញ្ញាតឲ្យ លោក **វង់ សំអូន** បានចុះធ្វើកម្មសិក្សាស្រាវជ្រាវប្រមូលទិន្នន័យតាមមជ្ឈមណ្ឌល ក្រោមការគ្រប់គ្រងរបស់លោកនាយកតាមការគួរ ។

សូម **លោកនាយក** ទទួលនូវការគោរពអនុវត្តដ៏ខ្ពង់ខ្ពស់ពីខ្ញុំ។

ជ្រោមជ្រែងក្រសួងអប់រំ យុវជន និងកីឡា
ប្រធានមន្ទីរការិយាល័យ

យក់ ឌុយ

ចម្លងជូន
-ក្រសួងការបរទេស និងសហប្រតិបត្តិការអន្តរជាតិ
-ស្ថានទូតព្រះរាជាណាចក្រថៃ ប្រចាំព្រះរាជាណាចក្រកម្ពុជា
-មន្ទីរអប់រំ យុវជន និងកីឡារាជធានីភ្នំពេញ
-មន្ទីរអប់រំ យុវជន និងកីឡាខេត្តតាកែវ
"ដើម្បីជូនជ្រាបជាព័ត៌មាន"
-សាមីជន"ដើម្បីអនុវត្ត"
-កាលប្បវត្តិ-ឯកសារ នា.ទអ

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ខ្ញុំបាទឈ្មោះ **វង់ សំអូន** ជានិស្សិតដែលបានប្រឡងជាប់អាហារូបករណ៍អាស៊ាន ដើម្បីបន្តការសិក្សាថ្នាក់បណ្ឌិត លើជំនាញ ការអភិវឌ្ឍន៍កម្មវិធីសិក្សារយៈពេល ០៣ឆ្នាំ ចាប់ពីឆ្នាំ២០១៣-២០១៦ នៅសាកលវិទ្យាល័យ ណារ៉េសួន នៃព្រះរាជាណាចក្រថៃឡង់ដ៏។ បច្ចុប្បន្ន ខ្ញុំបាទ កំពុងធ្វើការសិក្សាស្រាវជ្រាវនៅលើប្រធានបទ "ការបង្កើតវិធីសាស្ត្របង្រៀនដើម្បីជួយពង្រឹងការគិតប្រកបដោយវិចារណញ្ញាណដល់គរុសិស្ស" នៅមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគតាកែវ។

សូមគោរពជូន
លោក នាយកមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគតាកែវ

តាមរយៈ : ប្រធានការិយាល័យសិក្សា នៃមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគតាកែវ

កម្មវត្ថុ : សំណើសុំការអនុញ្ញាតដឹកនាំគរុសិស្សភាសាអង់គ្លេស (ថ្នាក់ B1) ចុះបង្រៀនសាកល្បងនៅសាលាគរុកោសល្យខេត្តតាកែវ រយៈពេល ០៤ ថ្ងៃ (៨ម៉ោង)ចាប់ពីថ្ងៃទី ៦-៩ ខែកក្កដា ឆ្នាំ២០១៥

យោង : លិខិតប្រកាសលទ្ធផលអាហារូបករណ៍ចុះថ្ងៃទី០១ ខែកក្កដា ឆ្នាំ២០១៣ របស់សាកលវិទ្យាល័យណារ៉េសួន

: លិខិតសុំធ្វើកម្មសិក្សាចុះថ្ងៃទី១៥ ខែមិថុនា ឆ្នាំ២០១៥ របស់ក្រសួងអប់រំ យុវជន និងកីឡា

អាស្រ័យដូចបានជម្រាបជូនខាងលើសូម **លោកនាយក** មេត្តាពិនិត្យ និងជួយសម្រួលដោយក្តីអនុគ្រោះ។

តាកែវ ថ្ងៃទី ០៣កក្កដា ២០១៥
ហត្ថលេខា

ពិនិត្យ និងសម្រេច
នាយកមជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគ

បានឃើញ និងឯកភាព
ប្រធានការិយាល័យសិក្សា

វង់ សំអូន

ចាន់ ភណ្ណារី

ព្រះរាជាណាចក្រកម្ពុជា

ជាតិ សាសនា ព្រះមហាក្សត្រ

មន្ទីរអប់រំ យុវជន និងកីឡា

ខេត្តតាកែវ

មជ្ឈមណ្ឌលគរុកោសល្យគូមិតាគ

សេចាម្រាស៉ាសម្ពាហ៍

បង្រៀនដោយ លោក ហ៉ាត សាវ៉ន គ្រូបង្រៀនកម្រិតខត្តម

ឯកទេស ៖ អក្សរសាស្ត្រអង់គ្លេស មុខវិជ្ជាបង្រៀន៖ អក្សរសាស្ត្រអង់គ្លេស

ឆ្នាំទី២៖ ពីថ្ងៃទី ០១ ខែមីនា ឆ្នាំ២០១៥ ដល់ ថ្ងៃទី ៣១ ខែសីហា ឆ្នាំ២០១៥

ឆ្នាំទី១៖ ពីថ្ងៃទី ០១ ខែ មេសា ឆ្នាំ២០១៥ ដល់ ថ្ងៃទី ៣១ ខែ សីហា ឆ្នាំ២០១៥

ម៉ោង	បន្ទ	អន្តារ	ពុធ	ព្រហស្បតិ	សុក្រ	សៅរ៍
០៧ . ០៨			B1		B1	
០៨ . ០៩			B1		B1	
០៩ . ១០			E1	B2	B2	
១០ . ១១			E1	B2	B2	
១៣ . ១៤		C1	B1			
១៤ . ១៥		C1	B1	A2	B1	
១៥ . ១៦			A2	A2	B1	
១៦ . ១៧			A2	ត្រូវធ្វេសប្រជុំ គរុសិស្សពលកម្ម		

កំណត់សម្គាល់:

តាកែវ, ថ្ងៃទី ២៣ ខែកុម្ភៈ ឆ្នាំ ២០១៥

ជ.ប្រធានការិយាល័យសិក្សា ហត្ថលេខាគ្រូខទ្មេស

. សរុបម៉ោងបង្រៀន: ២០ម៉ោង

. ម៉ោងទទួលបន្ទកថ្នាក់: ម៉ោង

. សរុបម៉ោងកម្រិតថ្នាក់: ម៉ោង

. សរុបម៉ោងកំណត់: ១៤ ម៉ោង

. សរុបម៉ោងលើស: ០៦ ម៉ោង

. សរុបម៉ោងបវត្តការ៉: ម៉ោង

ឧត្តរាយ៉ាន៉ង ឯកភាព

តាកែវ, ថ្ងៃទី ...ខែ...ឆ្នាំ ២០១៥

នាយកមជ្ឈមណ្ឌល

សុត្រ-ស៊ីណា

សោ-សារេត

ព្រះរាជាណាចក្រកម្ពុជា

ជាតិ សាសនា ព្រះមហាក្សត្រ

មន្ទីរអប់រំ យុវជន និងកីឡា

ខេត្តតាកែវ

មជ្ឈមណ្ឌលគរុកោសល្យភូមិភាគ

សៀវភៅសន្លាក់

បង្រៀនដោយ លោក សុត្រ ស៊ីណា ក្រុមបង្រៀនកម្រិតឧត្តម

ឯកទេស : អក្សរសាស្ត្រអង់គ្លេស មុខវិជ្ជាបង្រៀន: ភាសាអង់គ្លេស

ឆ្នាំទី២: ពីថ្ងៃទី ០១ ខែមីនា ឆ្នាំ២០១៥ ដល់ ថ្ងៃទី ៣១ ខែសីហា ឆ្នាំ២០១៥

ឆ្នាំទី១: ពីថ្ងៃទី ០១ ខែ មេសា ឆ្នាំ២០១៥ ដល់ ថ្ងៃទី ៣១ ខែ សីហា ឆ្នាំ២០១៥

ម៉ោង	ចន្ទ	អង្គារ	ពុធ	ព្រហស្បតិ៍	សុក្រ	សៅរ៍
០៧ . ០៨				A1		
០៨ . ០៩				A1		
០៩ . ១០						
១០ . ១១						
១៣ . ១៤		A1				
១៤ . ១៥		A1		B1		
១៥ . ១៦		B1		B1		
១៦ . ១៧		B1		ក្រុងចេសប្រជុំ គរុសិស្សឈរក្ប		

កំណត់សម្គាល់:

តាកែវ, ថ្ងៃទី២៧...ខែកុម្ភៈ ឆ្នាំ ២០១៥

ជ.ប្រធានការិយាល័យសិក្សា ហត្ថលេខាគ្រូបន្ទេស

ស៊ូត្រ-ស៊ីណា

. សរុបម៉ោងបង្រៀន: ០៨ម៉ោង

. ម៉ោងទទួលបន្ទុកថ្នាក់: ម៉ាង

. សរុបម៉ោងកម្រិតថ្នាក់: ម៉ោង

. សរុបម៉ោងកំណាត់: ១០ ម៉ោង

. សរុបម៉ោងលើស: ០៨ ម៉ោង

. សរុបម៉ោងបរត្តការី: ម៉ោង

តាកែវ, ថ្ងៃទី...ខែ...ឆ្នាំ ២០១៥

នាយកមជ្ឈមណ្ឌល

សោ-សារ៉េត