Reflective learning model in improving student critical thinking skills

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ABSTRACT: This study aims to investigate the effect of a reflective learning model on students' critical thinking skills. The authors employed an experimental method and used a one group pre-test and post-test design. The participants were 32 randomly selected college students enrolling in the 2014 academic year, majoring in agrotechnology, and had completed their first semester. This study administered a critical thinking skill test to measure participants' critical thinking skills. The skills involved a conceptual thinking skill, a concept application skill, an analytical skill, and a skill to synthesise and evaluate materials. The results showed a significant difference ($p < 0.001$) between the pre-test ($M = 30.97$) and the post-test ($M = 36.06$). This suggests that the reflective learning model was statistically effective in improving students' critical thinking skills. Reflective learning is considered to be an appropriate learning method for engineering students in higher education, but little evidence has been published in scientific journals. Therefore, this research provides an early investigation of the effect of reflective learning on critical learning skills among engineering students.

Keywords: Reflective learning, critical thinking, skills, vocational education

INTRODUCTION

Students' learning activity is marked by an increase in participation while acquiring knowledge. This activity lasts and runs naturally; it is comfortable and encourages curiosity. The desirable learning condition is a non-boring learning situation, because the students are actively involved in sharing in a learning experience and defining problems derived from a course discussion, so that each of them can evaluate the nature of the learning.

By the time the students start their new learning experience, the new students in particular need to adapt to the learning process. This adaptation can take various forms, such as adapting to the higher education learning system, getting to know the other students, and becoming familiar with campus and student life comprehensively. New students need systematic and integrated guidance about accommodative learning to sharpen their thinking skills.

Thinking skills need to be a priority for students as an initial stage in adapting to the learning style at university. The new students' thinking skills need to be sharpened as early as possible by familiarising them and giving them a learning strategy, which encourages them to think *why* and *how*, instead of merely asking *what*. The point is that the thinking process of *why* and *how* causes the students to learn how to think critically, acquire knowledge meaningfully and apply the knowledge instead of merely knowing, analysing and synthesising the knowledge to real life situations, so that the students can co-evaluate what they have already understood and what they have not. The most important thing is that the students can internalise what have been learned into daily life practice.

To facilitate the intended learning, it is necessary to have a learning model, from which a learning scenario, which involves a reflection, and a learning activity can be constructed. One of the learning models is a reflective learning model. The reflective learning model is a learning model that places emphasis on a thinking process based on self- reflection, past experience and future intention [1]. This learning model emphasises academic imagination about the things being observed and measured [2]. This causes the students to have a better sense about the phenomena or the events in their surrounding areas.

According to Bain, reflective learning is characterised by various levels of reflective thinking known as the 5Rs frames, which are: 1) reporting; 2) responding; 3) relating; 4) reasoning; and 5) reconstructing [3]. The reporting level is related to having the skill to describe the situation, phenomena, symptoms or problems. The responding level is related to

having the skill to develop an emotional response towards the problems. The relating level is related to having the skill to connect the various phenomena with theories, which serve as a foundation of the phenomena or symptoms. The reasoning level is related to having the skill to explain an event based on the facts and the analogies systematically in accordance to the methodological concepts of problem-solving. Finally, the reconstructing level is related to having the skill to develop action plans in solving a problem-based on a theoretical perspective and experience.

Reflective learning places the students as the learning subjects who always think actively and work using cognitive, affective and psychomotor domains. Thinking with the purpose of sharpening logical skills is a scope within the cognitive domain. This aspect is also an object of this study, which is to know how to identify the potency of the conceptual thinking skill characterised by having the skill to re-explain a problem, to apply the concepts that are characterised by having the skill to show and play a positive role in the class, such as organising classes and joining discussions according to the guidance given, even if the educators are not in the classroom.

The next skill is the skill to analyse a concept characterised by having the skill to conduct associative argumentation of developing problems. Synthetical thinking skill is characterised by the skill to conclude reconstructively all events in a discussion. The skill to evaluate is characterised by the skill to evaluate ongoing learning process quality, including the skill to arrange further recommendations for the sake of the next learning improvement [4].

The reflective learning model is conducted by a scenario, which is based on a number of the learning skills proposed by Anderson and Krathwohl [4], and Drost [5], which involve: 1) context introduction; 2) sharing experience; 3) reflection; 4) action; and 5) evaluation. Learning during the stage of knowing the context, the students are prepared to know themselves by combining a sequence of questions: *who am I*, *who we are*, *what is our problem*, *how do we solve it*, and *let us discuss together*. It is a key in self-suggesting in learning. During the sharing experience stage, the students are given a chance to share their own learning experiences including the difficulties, obstacles, achievements and opportunities as a whole. These are discussed until they find a compromise and a similar perspective that good learning comes from a strong will by considering past learning experiences, while observing others' experiences, if it has been more successful or others' struggles to be successful in learning. In the reflection stage, the students are prepared to understand the real nature of learning.

The key learning point is an improvement of the good behaviour in cognitive, affective and psychomotor aspects. At this stage, the students are prepared to be able to use critical thinking skills. Pikkert and Foster explain that critical thinking is the skill to use logic in constructing various materials in various situations, not only memorising or recalling, but also conducting meta-problems, and assimilating and isolating various strategies in finding solutions [6]. Dantas-Whitney defines critical thinking as a learning process, which involves active-reflective thinking [7].

Similar to Fisher, critical thinking means thinking actively, persistently and carefully in choosing an argumentation and organising a conclusion [8]. According to Syah, question construction, which encourages curiosity characterised by critical thinking usually begins by asking *why?*, *what happened?*, *what if?*, and not beginning with *what?* or *where?* [9]. In the action and evaluation stage, students conduct more reflective learning practices, learn to discuss, deliver good ideas to discuss a problem, and also come to a strategic and constructive conclusion.

According to Bassham et al, the word *critical* often evokes a negative meaning and seems like *looking for another's mistake*, although the term *critical* may mean *...involving or conducting a skilful judgment and observation* [10]. In this definition, critical thinking means thinking clearly and smart. Precisely, critical thinking is a common term given to various cognitive skills and intellectual dispositions that need to be identified effectively, analyse and evaluate an argument, find a hypothesis and various problems including organising and delivering reasons, which can ensure and support a conclusion reflectively.

The reflective learning method is expected to improve the students' critical thinking skills. The practice of critical thinking skills involve ability to think conceptually, as well as applying, analysing, synthesising and evaluating learning material. Thus, the purpose of this study was to find out the influence of a reflective learning model on the students' critical thinking skill.

METHOD

This research employed quasi-experimental design. The research is pre-experimental, using a one-group pre-test and post-test design [11]. The participants were students who enrolled in 2014, majoring in agrotechnology and taking an introduction to education course during year 2014/2015. Thirty-two randomly selected students were chosen as the experimental group; in other words, the participants were assigned according to the available class [12]. Based on these characteristics, the pre-existing class was directly assigned to be an experimental group.

A reflective learning model was conducted at eight meetings. At the first meeting, a pre-test was held, followed by reflective learning for the next six meetings and ending with a post-test at the eighth and final meeting. The reflective learning began by forming six groups. Each group received a different topic to be discussed reflectively. The theme of reflective Group I was the educators as a factor in a successful education. The theme of reflective Group II was the

students as a factor in a successful education. The theme of reflective Group III was the materials as a component in a successful education. The theme of reflective Group IV was the learning environment as a factor in a successful education. The theme of reflective Group V was the family as a factor in a successful education. The theme of reflective Group VI was the education process foundation.

The reflective discussion scenario was performed by giving a particular role to each team member. Each presenting group appointed a moderator who would explain the rules of the discussion, introduce how the group would finish the papers, assign one or two members to be the presenters of the papers who deliver discussion material including shouting jargon as *an ice breaking intervention*. The discussion process was followed by scientific debate by giving the audience a chance to deliver arguments in the form of questions and statements.

This research used pre- and post-tests as an instrument to deepen material understanding in the discussion during the introduction to the education course. The instrument was in the form of an essay test. This instrument had a rubric of pre-test and post-test on a scale of 1-5. The scores from low to high showed the various quality of the students' critical thinking. There were eight items in both the pre-test and the post-test instruments. Each instrument had an evaluation rubric as follows: 1) understanding in contextual thinking; 2) understanding in making problem associations; 3) understanding in developing and identifying a problem; 4) understanding in analysing a problem; 5) understanding in synthesising a problem; 6) understanding in applying theory to solve a problem; 7) understanding in making evaluation of the discussion process and result; and 8) understanding in organising recommendations for improvement and further plans.

RESULTS

The results show a descriptive analysis of the participants' average critical thinking skill (Table 1). On average, the participants' pre-test score was 30.97 (SD = 3.78) and 36.06 (SD = 1.61) for the post-test. Thus, the difference between the pre-test and post-test was 5.09 or the scores improved by 16.44% on average. The minimum and the maximum scores also increased by nearly ten points for the minimum score and three points for the maximum score. The overall change in the pre- and post-test scores yielded a gain in mean score of 5.09 (SD = 2.33). The results showed that the critical thinking skills improved after the researchers had implemented the reflective learning method.

Table 1: Paired sample *t*-test.

	Min	Max	M	SD	Gain	*t*
Pre-test	23	36	30.97	3.78	M = 5.09	12.35*
Post-test	33	39	36.06	1.61	SD = 2.33	

Note: N= 32, *p < 0.001

The next step of the analysis was to perform inferential tests using a paired sample *t*-test. The result yielded significant differences between assessments ($t = 12.35$, $p < 0.001$). In other words, it was concluded that there was a significant improvement in the students' critical thinking skills after the reflective learning had been implemented. The *t*-test score showed that there was a difference between the situation before and after introducing the reflective learning approach. This shows that there was a significant improvement from medium or even low to higher critical thinking skills. It suggests that the reflective learning model was appropriate for preparing the students to think effectively and critically in viewing the surrounding problems. Figure 1 describes the participants' scores in both the pre- and post-tests.
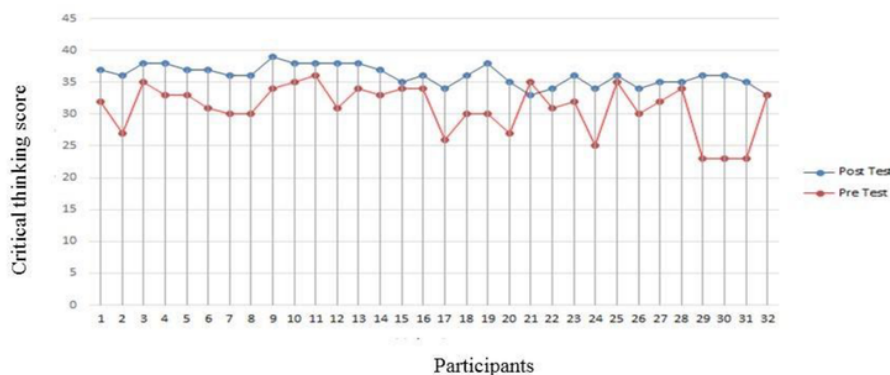

Figure 1: Pre-test and post-test scores.

DISCUSSION

This study aimed to test the effectiveness of a reflective learning model in improving critical thinking skills among students who enrolled in an agrotechnology programme. After administering the critical thinking measure, the authors

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obtained the scores for both pre- and post-tests. The mean score was 30.97 for the pre-test and increasing to 36.06 for the post-test. The difference between these two scores was statistically significant ($p < 0.001$). Given the results, the authors concluded that the reflective learning model improved the participants' critical thinking skills.

These results were in line with those of Naber who found that in general, students felt contented in learning and they were able to apply the concepts, to think analytically and to synthesise the materials [13]. In addition, Choy and Oo conducted a study with 60 teachers and found the implementation of critical thinking at the same time also encouraged teachers' critical thinking [14]. Colley et al also studied 74 new students in algebra classes at Worcester State University, the results showed that after the professors applied reflective learning, students changed the way they learned, so that they *solved algebra problems* and succeeded in the course [15]. Students felt that by having a reflection process earlier, they knew who they were as group members. Reflection conducted by new students in an early school year assisted students in achieving confidence and metacognitive skills.

This study contributes some new information related to the implementation of a critical thinking model for students enrolled in engineering studies. The students reached a self-conscious level to think reflectively, based on an experiment, which would be reflected in an action plan in order to make improvements in learning behaviour. As explained by Kolb, individuals learn through observation [16]. It emphasises observing before evaluating, paying attention to an event based on various perspectives, and always paying attention to the meaning of the observed things. In a learning process, individuals will use their mind and feelings to arrange their opinions and, then, synchronise what has been thought and what has been said with what has been done [17].

The discussion of the research results showed that reflective learning could be an alternative approach in training the students' creativity, especially the new students in a new school year. The students in a new school year need to adapt their learning from a high school learning style to a higher education learning style. A university learning model demands that students have a reflective learning modality, so they can sharpen their innovative, critical and constructive logical thinking in studying and developing knowledge. Reflective learning can be one of the learning approaches, which can be applied by any teacher, especially around the department of agrotechnology education. Eventually, students will get used to learning in the reflective situation.

CONCLUSIONS

The study found significant effects from implementing a critical thinking model in the learning process. The participants' critical thinking skills were significantly improved after eight weeks of the intervention. The critical thinking model improved the participants' skills that include conceptual thinking skills, applying concept skills, analysing skills and synthesising material skills.

This study contributed new evidence supporting the current literature regarding the implementation of critical thinking skills in higher education. The concept of critical thinking skills is paramount in developing students' ability in a new learning environment (e.g. higher education), where the students shift their learning to the next level of thinking.

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