

Effect of Case Study and Concept Map on Critical Thinking Skills and Dispositions in Indonesian College Students

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Effect of Case Study and Concept Map on Critical Thinking Skills and Dispositions in Indonesian College Students

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Abstract

It has been long pointed that Indonesian education system embraces active learning to enhance critical thinking. However, active learning techniques are not yet optimally introduced in Indonesian education settings. Studies have shown case studies combined with the concept map method improving students' critical thinking. However, there is a lack of evidence related to this method in the Indonesian education system. The presented study examined the effect of a case study combined with the concept map on improving critical thinking skills in Indonesian first-year college students. Three groups attended classes with the same class objectives and contents, consisting of eight weekly meetings. The only difference among the groups was the educational strategy; case study combined with concept map (CSCM), case study alone (CS), and traditional lecture style with no specific active learning techniques (Control). Results indicated that the CSCM method is most effective in improving critical thinking skills. Although CSCM was also most effective on improving critical thinking disposition, differences among groups were not statistically significant.

Keywords: *critical thinking, case study, concept map, Indonesia, college student*

Introduction

Indonesia is a nation of islands, with about 13,446 islands (Geospatial Information Agency of Indonesia, 2017), including the islands of Java, Sumatra, Kalimantan, Sulawesi, Lesser Sunda Islands, and Papua (or Irian Jaya). Indonesia has a population of 266 million people (World Population Review, 2018) encompassing major linguistic, religious, tribal, and cultural differences. As in a developing country, education plays an important role in empowering the human resources (Johan & Harlan, 2014). However, considering that there are more than 55 million students in total at all levels of education (The Economist, 2014), in 33 provinces with different backgrounds, promoting better quality in education is challenging.

Another problem is many university graduates' competences do not match the competences and qualifications required by the current job market (Moeliodihardjo, 2010). Results of a survey of employers carried out by the World Bank in 2008 showed that two-thirds of them complained that finding employees for professional and managerial positions that require higher skills and critical thinking was very difficult (Gropello, Kruse & Tandon, 2011). Therefore, the development of students' critical thinking is considered as one of big concerns in education. Critical thinking helps students to learn and transform their knowledge in their future life, which meets the challenges of their environment (Krasteva, 2008)

The emphasis on critical thinking in today's global educational policy results from rapid social changes in recent decades, therefore, it is essential to change teaching and learning to focus on improving critical thinking (Nedelová & Šukolová, 2017). Critical thinking is a variety of skills which includes the component skills of analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems (Lai, 2011). Therefore, students having the critical thinking ability would manage to solve problems in job settings or real-life problems. A certain degree of difficulty in finding qualified workers with critical thinking skills might be a sign that the education sector is not providing students with appropriate skills. To overcome this problem, education systems need to provide students with the chance to get involved in learning activity, i.e., meaningful and relevant learning.

To prepare talented Indonesian youth to compete in the global market, what the nation needs is an education reform that strongly emphasizes empowering student creativity and allows students to think critically. Teachers should provide opportunities for students to engage in the upper levels of Bloom's taxonomy, where critical thinking is required (Duron, Limbach & Waugh, 2006). However, in Indonesia's reality many teachers still use the authoritarian lecturing approach,

which relies on memorizing texts. The application of traditional methods of learning does not accommodate students to facilitate meaningful learning, i.e., the three highest levels of operation in Bloom's taxonomy (analysis, synthesis, and evaluation).

Some studies mentioned linking critical thinking skills to the content of the learning process (Duplass & Ziedler, 2002; Wong, 2007). Active learning is a process that encourages students to learn actively by finding the meaningful core of a subject through their own exploration, creating their own ideas, solving problems through active learning. Such learning will lead students to be critical thinkers and better arguers (Bean, 2011). By employing critical thinking in the learning method, students can perceive phenomena from different perspectives and feel free to discuss their ideas as well as being respectful towards other friends' ideas (Kaya, Şen, & Keçeci, 2011). One of the strategies that can be applied to cultivate critical thinking skills and help to bridge the gap between theoretical knowledge and practice is case study. Case study is an educational strategy in which students reflect on situations presented in cases, analyze data and make decisions (Prince & Felder, 2006). Case study requires time, energy, and personal commitment, which requires accurate practices for reading angles relevant to the exploration of problems and to suggesting solutions (Minniti, Melo, Oliveira & Salles, 2017). Therefore, a case study leads to improve critical thinking skills (Nelson & Crow, 2014; Youngblood & Beitz, 2001).

Case study is a popular teaching strategy in the western education systems. Some research showed effectiveness of case study in helping students to understand complex and complicated issues (Kunselman and Johnson, 2004), in facilitating students to remember details and facts (Beyea, 2004), and in improving examination performance (Sanders-Smith, Bonahue, & Soutullo, 2016). Several studies also support the application of case study as a teaching strategy for developing critical thinking skills and critical thinking disposition (Huang, Hsia, & Ling, 2012; Jonassen & Serrano, 2002). It is also shown that the concept map could be employed as an effective tool in improving critical thinking skills (Wahl and Thompson, 2013, Yue, Zhang, Zhang, & Jin, 2017). Concept map is one of the active learning methods in which students organize and represent knowledge by diagramming concepts and data relevant to the subject matter (Novak, 1997).

Although case study is commonly known in Indonesia, there is little empirical research concerning its effectiveness especially in relation to critical thinking. Several studies have shown that case study becomes more effective in developing critical thinking skills and critical thinking dispositions if it is combined with the concept map technique (Huang et al, 2012; Jonassen & Serrano, 2002). In Huang et al. (2012), nurses who worked in cooperation to solve a case study using a concept map showed greater improvement in critical thinking skills than those who did not use a concept map. The purpose of the presented study was to examine the effect of a case study with concept map on critical thinking skills and critical thinking disposition in Indonesian college students. In the presented study, students were assigned to one of the following three groups: case study with concept map, case study alone, and traditional lecture without any active learning methods. If the findings of Huang et al. (2012) were replicated in an Indonesian educational situation, it was expected that the effect of case study on improving critical thinking skills would be enhanced if it was combined with concept map.

Methodology

Participants

The accessible population for this study consisted of first-year students of Medan State University that enrolled for the subject *Introduction to Psychology* in the Education Faculty. The participants were 75 first-year undergraduate students divided into Case study with Concept Maps (CSCM), Case Study (CS) and Control Group.

Procedure

The experiment was conducted in the early semester of the first year with pre-test and post-test design with three groups. All the groups had the same class objectives and contents in eight meetings. However, there was a difference regarding the entrance exam among the three classes in this experiment. There were two classes that had passed the national entrance exam, and there was one class that had passed

the university entrance exam. There is a different difficulty level in the entrance exam. In general, the national exam required higher test score than the national entrance exam. To highlight the treatment effect, we chose the class with university entrance exam as the group that had the case study with concept maps, the group was expected to show the greatest improvement among the three groups. All the groups received an assessment of critical thinking skills by The Cornell Critical Thinking Level Z in pretest and in posttest.

Intervention

The intervention of case study with concept map teaching was conducted in an eight-week course of Introduction to Psychology. All the groups were presented 68 *Nani Barorah Nasution* with the comparable syllabus and course contents. The three groups attended classes with the same class objectives and contents in eight meetings. The only difference was the educational strategy; Case Study Combined with Concept Maps(CSCM) was used for the first group, only Case Study (CS) was used for the second group, and the third group was a Control Group, which only had the regular class with no specific active learning techniques. The treatment for the CSCM group was divided into several steps:

1. At the beginning, the students participated in FreeMind application training, therefore they had knowledge and experience on how to manage the application and apply it to a case.
2. At the third meeting (the second meeting is pretest), the students were divided into six groups consisting of four to five students. The instructor asked each group to pick one topic from among eight topics for their presentation. Then, each group prepared a presentation to present at every meeting, one topic for each meeting. This is one of the case examples: A lady was dying because she was very sick. There was one drug that doctors said might save her, made by a man, and it cost 200 dollars. The lady's husband (Heinz) just quit his job and he got only 100 dollars. He came to the man who made the drug and said his wife was dying and asked him to sell the medicine cheaper or let him pay later. However, the man said "No, I made the drug and I'm going to make money from it" So Heinz broke into the store and stole the drug. Did Heinz do the right/wrong thing? Support your answer with an opinion.
3. In each meeting, the activity consisted of :
 - a. Starting by group presentation (25min) on a topic,
 - b. Then discussing the topic (15min), the students could ask few questions to the presenter group
 - c. The instructor gave a case to solve. At first, the instructor divided the group into pro group (3min) and contra groups (3min), then they were given the case to study. Furthermore, the instructor asked the students to think logically, critically to solve the case (30min). The CSCM group used the Freemind application to help them visualize the connection and mind mapping to solve the case. Case example: Does punishment help to shape children's behavior? The students were asked to support their opinions with theories.
 - d. Each group explained their answers (2min). After hearing other groups' opinions, the instructor asked the groups if they thought that their explanation of the topic was sufficient or if they preferred to change their opinions. Each group had one minute to explain their views after the group hearing stage (about 20min in total)
 - e. Reflection and discussion (10min).

Meanwhile, for the CS group, they also had almost similar activity in each meeting, the difference was that the case study group had not had any kind of training before the class started also they did not use the Freemind application as a tool to visualize their ideas. Furthermore, we did not give the Control Group any special treatment, only regular lecturing class was given.

Data Collection

A demographic questionnaire developed for this study asked the respondents for information concerning their sex and age.

²⁴ The Cornell Level Z Critical Thinking. The Cornell Critical Thinking Test (CCTT) Level Z was used to measure the development of critical thinking skills in undergraduate students. The CCTT Level Z is

based upon the conception of critical thinking described in various stages of refinement and emphasis by Robert H Ennis. The test contains 52 items, all of which are in a forced-choice format. It measures critical thinking in the areas of induction, deduction, observation, credibility, assumptions, and meaning (Ennis et al., 2005).

Procedure and Data Analysis

Descriptive and inferential statistics were obtained using SPSS version 13. Written informed consent was obtained from all the participants, subsequent to the explanation of the study purposes and procedures. All the participants were informed that the data collected by the researchers in the study would remain confidential and they would be free to withdraw from the study at any time without effects on the final score. Descriptive statistical analysis of the demographic data was performed and then statistical analysis of variance (ANOVA) was used. In all analyses, a p -value of 0.05 was considered statistically significant.

Result

The CSCM group consisted of 20 female and 5 male participants, with the average age of 18.4, the CS group consisted of 17 female and 7 male participants, with the average age of 18.28, and the Control Group consisted of 21 female and 4 male participants, with the average age of 18.04. Based on Figure 2, in pretest for the Cornell Critical Thinking Level Z, the Control Group ($M = 31.04$) scored higher than the CS ($M = 30.68$) and CSCM groups ($M = 29.28$). Unlike in the pretest, the CSCM group showed improvement in the score of the Cornell CTT 70 *Nani Barorah Nasution*

Level Z ($M = 33.76$) compared to the others. Even though the CS also showed some improvement, the increase was not really big. Table 1 summarizes the analysis of the simple main effect on the interaction of Group*Time, whose result showed that there was a difference between the groups in the pretest ($F[2, 144]=7.634, p<.01$) and posttest ($F[2, 144]=7.220, p<.01$). In the pretest, critical thinking skill score was significantly poorer for the CSCM than CS and Control groups ($ps<.05$). However, the difference between the CS and Control groups was not significant ($p>.05$). By contrast, the critical thinking skill score was significantly higher in the CSCM group than in the CS and Control groups ($ps<.05$), and the difference between the CS and Control groups was not significant ($p>.05$).

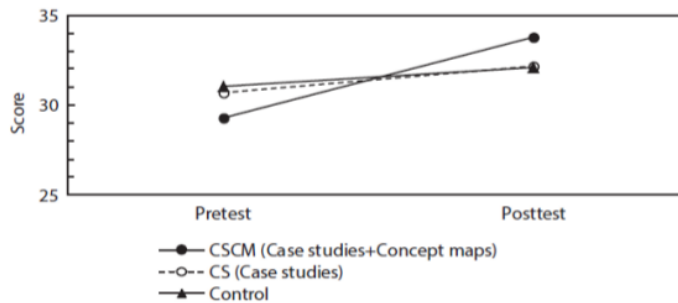


Figure 1. Mean score of the Cornell Critical Thinking Test

Table 2 summarizes the comparisons of the overall and subscales of the Cornell CT Level Z. The CSCM group demonstrated a significant overall difference, especially in induction and meaning from pretest to posttest. Furthermore, for the Case Study group, even though they showed some increase in each subscale, the result is not really significant.

Table 2. Comparisons of the overall and subscales of the Cornell CT Level Z

Variable	Control Group		Case Study Group		CSCM		p
	Mean	SD	Mean	SD	Mean	SD	
Overall							
Pretest	31.04	1.51	31.04	1.51	29.28	1.46	.000
Posttest	32.28	1.49	32.2	1.5	33.76	2.44	
Induction							
Pretest	9.96	1.02	10.28	1.10	9.36	0.70	.000
Posttest	10.52	0.92	10.76	1.20	11.56	1.26	
Deduction							
Pretest	6.6	0.71	6.32	0.75	6.04	0.73	.053
Posttest	6.64	0.81	6.6	0.82	6.72	0.61	
Observation & Credibility							
Pretest	2.32	0.48	2.2	0.41	2.08	0.40	.613
Posttest	2.56	0.51	2.36	0.57	2.4	0.50	
Meaning							
Pretest	6.28	0.74	6.08	0.81	5.76	0.60	.012
Posttest	6.52	0.82	6.36	0.91	6.68	0.80	
Assumptions							
Pretest	5.88	0.60	6.16	0.69	6.04	0.73	.238
Posttest	6.04	0.61	6.2	0.82	6.4	0.93	

The distribution of UFEMI scores in pretest for the Case Study group ($M = 102.76$) was higher than the Control (100.24) and CSCM groups (107.72), whereas, for the posttest, the CSCM group showed the highest improvement compared to the other groups. However, in total, all the groups showed

improvement in the posttest. Meanwhile, the ANOVA of Group (3)*Test (2) showed the significant main effect of Test ($F[1, 72]=43.47, p<.01$). However, the main effect of Group ($F[2, 72]=1.26, p=.289$) and interaction of Group*Test ($F[2, 72]=1.68, p=.94$) were not significant. These results suggest that participating in any type of learning activity might increase students' critical thinking disposition. Nevertheless, the active learning technique might not have any advantage for this purpose.

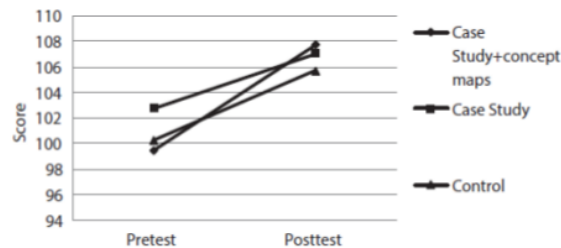


Figure 2. Mean score of UF EMI

Table 3 that summarizes the comparisons of the overall and subscales of UF EMI. The CSCM group demonstrated a significant overall difference, surprisingly the other two groups also showed some significant improvement in all the subscales. Meanwhile, for each subscale there was no significant difference between all the groups.

Table 3. Comparisons of the overall and subscales of UF EMI

Variable	Control Group		Case Study Group		CSCM		p
	Mean	SD	Mean	SD	Mean	SD	
Overall							
Pretest	96.64	6.83	99.16	9.27	95.95	7.62	.194
Posttest	101.6	1.77	103.02	2.57	103.68	2.89	
Engagement							
Pretest	41.64	3.65	43.56	4.83	40.8	3.59	.311
Posttest	44.28	1.57	45.48	1.90	44.72	2.23	
Maturity							
Pretest	31.96	2.26	32.28	3.03	32.12	2.85	.689
Posttest	33.2	2.06	32.96	1.57	33.55	1.66	
Innovativeness							
Pretest	26.64	3.25	26.92	2.81	26.56	3.34	.293
Posttest	28.2	1.73	28.6	2.39	29.48	2.18	

Discussion

The research provided evidence supporting the effectiveness of case study combined with concept map in improving critical thinking skills among students. This finding is consistent with those of previous studies, which observed improvements in critical thinking due to educational experimental programs (Huang, Hsia, & Ling, 2012; Wheeler, 2003). After following the eight-week treatment, the students in the CSCM showed improvement in each of the Cornell Critical Thinking Level Z subscales, especially for induction and meaning. We assumed that case study combined with concept mapping encouraged innovative thinking to help students make a visual scheme to solve a case by creating a meaningful construct that combined theory, new information to their existing conceptual framework to find conclusions that were supposed to follow necessarily from the factual data. Whenever new information can be associated and accommodated, organization with the learner's existing knowledge structure will drive to meaningful learning (Romance & Vitale, 2013; Soylu & Aydın, 2006). As mentioned before, one of the purposes of the presented research was to help students to build critical thinking through a meaningful learning process. Case study combined with concept maps involve

constructive activities, where students are asked to evaluate, analyze, remember and make comparisons. Hence, students feel fully engaged in the learning process. However, the short term of instruction was necessitated by the semester system and the time allotted to pretests and posttests, so we were not able to set follow-up assessment on the research. Therefore, we could not reach a conclusion whether the effect of this case study method combined with concept map on critical thinking is persistent or will decrease if this method is no longer applied. Further explanation needs verification.

On the other hand, the case study group showed a less significant change, which is contrary to previous research (Bayona & Castaneda, 2017, Huang et., al 2012, Popil 2011), which found that the case method is effective in improving critical thinking. However, in Huang's et al. (2012) findings, even though case study showed improvement, there was no baseline group to compare and assess the effect of that intervention. Nevertheless, some other study showed that using case study actually decreases the ability to think critically (Carter & Welch, 2016). We assumed the result might be due to the lack of experience and knowledge about case study activity among students. As the participants were first year college students, they might not be familiar with the case study method. Thus, when a case was to be solved, students might be confused as to how to manage the case. Another reason might be related to individual differences, i.e., some students might feel involved in the case study activity, while others might feel not interested in it. However, research on the influence of individual characteristics on case study is scarce and some authors call for more research on specific processes that could influence the learning associated with case study (Burgoyne & Mumford, 2001). Therefore, further investigation needs to be conducted to examine this matter.

Based on the UF-EMI result, the case study combined with concept map group and the case study group significantly improved in critical thinking disposition, which is consistent with previous research (Huang, et., al, 2012; Hong & Yu, 2017). The control group also showed significant improvement in the posttest. According to Huang's et al. (2012) findings, the critical thinking disposition of both case study combined with concept maps and case study groups improved. However, since no control group served as a benchmark, it was difficult to assume what causes the difference in the results between groups. We assumed this might be caused by UF-EMI reflecting not only improvement of critical thinking disposition but also social desirability. Thus, students might have a tendency to show themselves to be desirable on the instrument. Therefore, there might be a chance that the students did not answer based on their personal character.

In the experimental settings, the researcher administered the Cornell critical thinking test first and then UF-EMI, because of the students' complaints about the difficulty of the Cornell Critical Thinking Level Z and not enough time to finish all the items. Based on this condition, students might feel that they failed on the Cornell Critical Thinking Level Z, this might drive them to think that they should fill the UF-EMI with good judgement, therefore it will fill the gap score of the Cornell Critical Thinking Level Z. Even though the researcher already warned the students at the beginning that the Cornell Critical Thinking Level Z score and UF-EMI results were not related to final score, some students might still think that the results of both tests would influence their final score.

As mentioned in the method of case study activity, students are required to solve a case where some active learning activities might involve discussion, sharing ideas, collecting data, this activity might help to develop students' critical thinking disposition. However, it might be insufficient to increase critical thinking skills. Further examination is needed to clarify the underlying mechanisms and determinants of changes in UF-EMI. Furthermore, it is important to assess the performance of each student's activity when conducting activities related to case study and concept mapping. Therefore, the result will be more specific on how case study can contribute to an increase in critical thinking skills and disposition in each student.

Conclusions

The presented study was conducted in natural educational settings in an Indonesian college with many variables typically found in a community college course, including a regular student with a heavy schedule and a lot of duties. Despite these challenges, the findings of the study concerning the effectiveness of case study with concept maps for critical thinking in improving students' abilities and disposition to think critically are valid. Training students to think critically is among the principal tasks of the education system. Critical thinking abilities such as analyzing complex issues and situations and

generating solutions, making connections and transferring insights to new contexts, and developing standards for decision making are necessary to succeed in business and society.

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