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Interaction of Learning Models and Student's Condition in Improving Critical Thinking Skills at Accounting Vocational School

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ABSTRACT

This research was aimed at examining the interaction of learning models, Problem Based Learning (PBL) and Inquiry Based Learning (IBL) with Student's Condition, Gender Factor and Academic Achievement, to improve Critical Thinking Skills (CTS). It was conducted through a "quasi-experiment", with Accounting Vocational students as the object of the experiment in three types of schools, namely public school, privately-owned schools accredited "A" and "B". The experimental design used was factorial of 2x3x3 with three ways ANOVA. The results showed that gender factors had no interaction with learning models while academic achievement interacted with learning models in improving CTS. In the PBL learning model, students with low achievement have a higher level of improvement compared with IBL. Both model learning, gender and academic achievement interact with CTS. Therefore, the student's condition, namely gender and academic achievement must be the focus in applying IBL and PBL to improve CTS of students at Vocational School of Accounting.

Keywords: Academic achievement, critical thinking, gender, inquiry based learning, Problem Based Learning, quasi experiment

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INTRODUCTION

High-level of critical thinking skills must be encouraged among students to enable them to get a better job and to improve the quality of their life (Thomas, 1992). In addition, this pool of human resources would enable the country to compete with other nations. Learning process is expected to build the capacity of students' knowledge

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by improving high-level thinking, such as critical thinking. By thinking critically, employees can make sound decisions, assess and solve problems (Hassoubah, 2004). In Indonesia, the high level thinking ability of students is still low. This is indicated by the survey data from TIMSS (*Trends in International Mathematics and Science Study*) in 2011 that 95% of Indonesian students are only able to work on the problem to the middle level, while the survey conducted by PISA (*Program for International Student Assesment)* in 2012 shows only 5% of Indonesian students can achieve high-level thinking skills and 95% only to the middle level or at the level of application. Therefore, the future challenge is to further develop critical thinking skills.

Critical thinking in accounting is very important and economic thinking is about making difficult choices. Therefore, critical economic thinking is all about being aware of how you think about economic issues so that you can make the best decision possible (Leyden, 2011). The ability to have critical think critically on economic learning is shown in basic competencies. Critical thinking is a competence to analyse, synthesize and evaluate and considered a high-level thinking. Accounting, which includes economics, has the same characteristics that students are required to have in analysing, synthesising and evaluating.

Problem Based Learning (PBL) can improve students' thinking ability. It is a motivational, challenging, and fun learning approach (Norman & Smith, 2000). It is a process of working toward an understanding or process towards solving a problem (Barrows & Tamblyn, 1980). PBL was first introduced at McMaster University in Canada in 1965 at a medical school. Since then, PBL has been popularised and adopted in the curriculum of several higher education institutes around the world (Kolmos et al., 2007). It is a learning approach in which the students learn by solving problems contextually in social teams. The students rely on their knowledge of a problem, identify the information they need to know to solve the problem and strategies to solve it (Stanford University Newsletter, 2001). There are several studies on the effectiveness of PBL on critical thinking skills (Savery, 2006). The ability to think critically is an important skill to identify problems and set parameters on the development of solutions that can be built through PBL. In the field of framing Problem Based Learning is effective in improving the ability of critical thinking (Şendağ & Odabaşı, 2009).

Constructivist theories of learning emphasise on the need of learners to investigate the environment and construct knowledge that is personally meaningful in providing theoretical basis for PBL (Arend, 2008). Inquiry Based Learning is adopts a constructivist approach where followers question, gather and analyse information, create solutions, make decisions, justify conclusions and act. In other words, students build their own understanding of the existing reality (Fattahi & Haghverdi, 2015; Khalid & Azeem, 2012).

Apart from Problem Based Learning

and Inquiry Based Learning, there are some predictors that may influence individually critical thinking ability that is gender, age and academic achievement (Masek & Yamin, 2011). The students' critical thinking skills are influenced by their personal characteristics, such as age, gender and academic achievement. Therefore, besides the learning methods, individual aspects are also reviewed (Torres & Cano, 1995). In this study, two predictors are gender and academic achievement. This research aims at investigating the interaction between Problem Based Learning, Inquiry Based Learning and Gender on students' critical thinking skills; interaction between Problem Based Learning Method, Inquiry Based Learning Method and Academic Achievement on students' critical thinking skills; and interaction between Problem Based Learning Method, Inquiry Based Learning Method, Gender and Academic Achievement on students' critical thinking skills.

LITERATURE REVIEW

Literature has shown that women score higher than the men in critical thinking skills. Women are also rated higher than men in the ability to make conclusions. This means that women have greater ability to identify the elements needed to draw conclusions, to construct hypotheses, and to consider relevant information (Fendiani & Tandiono, 2016). The findings of this study can be explained as follows. In women, brain regions associated with language function work harder which results in female having higher language ability than men. Language is a tool used to express thoughts. The ability to use language with good grammar is an indicator of high thinking ability (Ricketts & Rudd, 2004). Women have greater ability to express their opinions to others (Guiler, Ross, & Durndell, 2005). Men are better at manipulating visual images and numerical abilities, while women are generally better at tests of verbal skills (Halpern & La May, 2000; Halpern, 2004). The findings of this study are not in line with the results of others that show no significant differences between men and women in the aspect of intelligence in general, although in certain aspects there are differences between boys and girls (Rubin, 1993). Likewise, there is no difference in critical thinking skills between boys and girls (Myers & Dyer, 2006).

Gender is a significant variable in influencing critical thinking where women have the greatest disposition to critical thinking than men (Rudd, Baker, & Hover, 2000). Therefore, there is a link between gender and critical thinking skills in which women have great skills in critical thinking (Giancarlo & Facione, 2001). In terms of academic achievement, the Grade Point Average (GPA) has an influence on students' critical thinking ability. Nevertheless, findings of this study show a modest number of Grade Point Average variants that can explain the ability to think. Similarly, the GPA as a control variable has a certain contribution to critical thinking ability (Torres & Cano, 1995). Academic achievement has a positive relationship to critical thinking (Soodmand, Afsar, Rahimi,

& Rahimi, 2014). This research uses several factors, namely gender and student achievement. Gender factors and academic achievement in accounting skills have not received much scholarly attention.

MATERIALS AND METHODS

The object of this research was students of Public Vocational Schools Accredited 'A', Private Vocational Schools Accredited 'A' and 'B'. The method was quasi-experiment. The quasi-experiment has treatments, outcome measures, and experimental units, but does not use the random assignment. The population of the study was all 12th grade vocational school students in Bandung, Indonesia. The samples were male and female students of vocational high school, namely Public Vocational High School 1 Accredited A , Public Vocational High School 3 Accredited A , Private Vocational High School MVPR International Accredited A, Private Vocational High School Pasundan 1 Accredited A, Private Vocational High School Daarut Tauhid Accredited B, Private Vocational High School Puragabaya Accredited B. The total sample of the study was 182 students, of which 38 were males. Criteria for academic achievement used posttest scores, classified as high, moderate, and low. The design of this research was the factorial 2x2x3 design. The paradigm of factorial design is presented as follows (Table 1).

The instrument used was an observation sheet on the students' critical thinking skills, adopted from Ennis (1985) and Wade (2011).

Table 1
Factorial 2x3x2 design

Gender	Academic Achievement	Method	
		PBL	IBL
Male	High	PBL/M/H	IBL/M/H
	Moderate	PBL/M/M	IBL/M/M
	Low	PBL/M/L	IBL/M/L
Female	High	PBL/F/H	IBL/F/H
	Moderate	PBL/F/M	IBL/F/M
	Low	PBL/F/L	IBL/F/L

RESULTS AND DISCUSSION

Test shows non homogeneous data which means that the group has a variant that is not the same but is still used because the Anova is robust (Ghozali, 2011) (refer Table 2).

Meanwhile, the normality test result is shown in Table 3.

It is found the data is not distributed normally so that the hypotheses testing uses nonparametric with Mann-Whitney.

Table 2
Test of homogeneity of variances

CRITICAL THINKING SKILLS			
Levene Statistic	df1	df2	Sig.
15.014	1	352	.000

Table 3
Tests of normality

	Methods	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
CRITICAL THINKING SKILLS	PBL	.079	178	.009	.961	178	.000
	IBL	.139	176	.000	.861	176	.000

a. Lilliefors Significance Correction

The interaction results between-subject of the methods, gender, and academic achievement on the critical thinking skills is shown in Table 4.

The interaction test showed no interaction between methods and gender, which means there is no difference in critical thinking skills using either PBL or IBL

Table 4
Tests between-subjects effects

Dependent Variable: Critical Thinking Skills						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15635.515[a]	11	1421.410	9.181	.000	.228
Intercept	1909305.440	1	1909305.440	12332.589	.000	.973
Methods	2982.603	1	2982.603	19.265	.000	.053
Gender	148.199	1	148.199	.957	.329	.003
Academic Achievement	3976.918	2	1988.459	12.844	.000	.070
Methods* Gender	400.465	1	400.465	2.587	.109	.008
Methods*Academic Achievement	935.447	2	467.724	3.021	.050	.017
Gender**Academic Achievement	657.167	2	328.584	2.122	.121	.012
Methods* Gender*Academic Achievement	2688.856	2	1344.428	8.684	.000	.048
Error	52947.719	342	154.818			
Total	2472389.000	354				
Corrected Total	68583.234	353				

a. R Squared= .228 (Adjusted R Squared= .203)

based on gender. The result of this research is not in line with Torres and Cano (1995) who showed that students' critical thinking skills are influenced by their personal characteristics, such as age, gender and academic achievement. The absence of such interaction means that there is no difference in critical thinking skills of both male and female student groups using PBL and IBL methods. This result means the influence of PBL and IBL methods on students' critical thinking skills in accounting subjects is not dependent on gender. This is in line with the opinion of some scholars who claim there is *"...no relationship between gender and critical thinking"* (El Hassan & Madhum, 2007; Facione, 1990; Zoller, Ben-Chaim, & Ron, 2000). Characteristics of male and female students are different. Rudd et al. (2000) stated that gender was a significant variable in influencing critical thinking where women had the greatest disposition to think critically than men. In this research if only seen from gender with the used of PBL and IBL methods to the ability to think critically have the same effect.

There is an interaction between the two methods and academic achievement on students' critical thinking skills. It means that there is a difference in students' critical thinking skills that use the method of PBL and IBL with the academic achievement where in PBL, the low academic-achievement students have score high in critical thinking, whereas in IBL, the high academic achievement students have high score in critical thinking. The result of this research is in line with Giancarlo and Facione (2001) who stated that academic achievement based on GPA *(Grade Point Average)* influence students' critical thinking skills. Torres and Cano (1995) showed similar findings that GPA as a control variable had contributed to critical thinking skills. However, the results of this study contradict that of Soodmand et al. (2014) who showed academic achievement had a positive relationship to critical thinking.

Meanwhile, there is an interaction between the PBL, IBL, gender, and academic achievement on the students' critical thinking skills. It is found that in the method of PBL, female students with low academic achievement have the highest critical thinking skills but based on the method of IBL, the male students with low academic achievement have the highest critical thinking skills.

Vierra (2014) explained the relationship between gender and critical thinking is the subject of much debate and with little conclusive evidence. Some studies have pointed to a relationship that favoured men (Leach, 2011), while others who supported (Srinivasan & Cooks, 2005) and there was also a result that showed no relationship at all (El Hassan & Madhum, 2007).

Leach (2011) examined the relationship between students' critical thinking ability and gender. The study found that women had greater critical thinking abilities than men where "*female students receive grades nearly three points higher than their male counterparts"*.

The differences are due to differences in communication. According to Wood

(1994), this communication difference could distinguish the critical thinking ability of students by using PBL method where this method gives more emphasis on how to solve a problem in a group, working together and using information from various sources to provide solutions to the problem. The syntax is clear that the communication style and capability possessed by women are more suitable in Problem-based Learning method for critical thinking because it reguires cooperation, focus, attentiveness, selflessness and a desire to be with the other (Mason, 1994).

In terms of academic achievement, many studies generally highlight the strong relationship between critical thinking and academic achievement (Cabrera, 1992; Garett & Wulf, 1978; Steward & Al-Abdulla, 1989; Williams, Oliver, Allin, Winn, & Booher, 2003; Williams & Stockdale, 2003). Studies showed students who have low academic achievement also have a high average critical thinking. Karbalaei (2012) stated that a high academic achievement can encourage students to think critically both in knowledge and skills. This is inversely related in the present study where students who have low academic achievement have a high critical thinking ability. Problem Based Learning has an influence. Lee (2001) stated that PBL appeared to create powerful motivational effects. Furthermore, by learning collaboratively students benefit from interpersonal skills through dialogue and learning together. Therefore, students who have low academic achievement will be motivated to perform better. It can be concluded that the influence of PBL learning methods on students' critical thinking skills depends on gender, and PBL has influence only on females who have low academic achievement.

In this study, IBL influences male students' critical thinking who have high academic achievement. Theoretically, IBL can improve students' critical thinking skill, but in this finding, apart from the method of learning, there are also other factors that have relationship in critical thinking, namely gender and academic achievement. The difference is due to different communication factors between the two (male and female). The use of IBL method in this research point to the fact male students with high academic achievements have greater critical thinking ability. One of the characteristics of IBL method is developing systematic, logical and critical thinking (Hosnan, 2014). Wood (1994) stated that *"Men, on the other hand, are more competitive in their communication, and discussions are often a competition to prove a point of view. Thus, males may be perceived to have higher critical thinking skills"*. Karbalaei (2012) found a high academic achievement encouraged students to think critically both in knowledge and skills. From the above explanation it can be concluded that by using the method of Inquiry Based Learning, there are differences in critical thinking skills between men and women and the academic achievement of students where male students with high academic achievement have a high average value in critical thinking skills.

CONCLUSION

It is found that there is no interaction between methods and gender. It means that there is no difference in the critical thinking skills of the students who used the PBL and IBL based on gender. It is also found the interaction between both methods and academic achievement on critical thinking skills showed a difference of critical thinking skills of students who use the method of PBL and IBL with the academic achievement, whereas in PBL, students with low academic achievement have a high score in critical thinking skills. There is an interaction between methods, gender, and academic achievement, where the female students with low academic achievement have the highest score compared with other groups. It can be concluded that the influence of IBL learning method on students' critical thinking ability depends on gender, and academic achievement where IBL learning method is more effective in men who have high academic achievement. The method of IBL can be used regardless of gender, but the teachers may use the PBL to help female students who have low academic achievement improve their critical thinking skills. With the PBL, they have high critical thinking skills. These findings may encourage educators in Indonesia to employ both model of Problem Based Learning and Inquiry Based Learning to improve students' critical thinking ability.

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