

# Critical Thinking Skill based on IQ and Gender in High School

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**Abstract:** Critical thinking skills are one of the necessary skills in learning so that students can become independent learners. The research method used is quasi experiment with pretest - posttest experiment and control group in MAN 1 Bandung with a sample is class XI, uses 8 questions essay test for critical thinking and 30 questions multiple choices for IQ. The result based ANOVA with SPSS program, average score on each level of IQ and gender group student is homogeneous. In experimental class, IQ influencing critical thinking skill, gender influencing critical thinking skills, critical thinking skills due to gender influence depending on IQ, it shows by the value of sig. in high, average, and low IQ more than 0.05. In the control class IQ influencing critical thinking skills, gender influencing critical thinking skills, and critical thinking skills due to IQ influence is independent of IQ. This research can provide information that students' critical thinking skills do not always depend on the level of IQ and gender, but are dependent on the treatment provided. By knowing the influence of IQ level and gender on critical thinking skill, it can be seen the right type of worksheet used in learning.

## 1 INTRODUCTION

Education in general aims to give each learner with the ability to be able to adapt to his environment to become an independent person and have the skills to be able to solve any problems that arise. This is in line with that stated by (Demirhan and Köklükaya, 2014) which states it is very important every individual develop habits of independent and critical thinking skill. One of basic aims of education is to educate every individual who are able to have critical thinking skill. These critical thinking skills can be processed through a learning process that can engage learners with real problems and applications in everyday life. Critical thinking skill can help individual more adaptable and flexible to get information with the rapid development (Dwyer et al., 2014)

The thinking skills of each learner will differ depending on the characteristics of each individual. The characteristics of this individual that can cause a person's intelligence is different, so that this can then distinguish the thinking patterns of students in solving any problems that arise. (Stanovich and West, 2014) says every individual differences in IQ test performance usually thought to reflect variation in

ability for complex cognition. Such ability is itself thought to differentiate as a kind of cognitive energy, capacity, or "strength" variable. The result of research (Westbrook and Sellers, 1967) there is a relationship between critical thinking skill with intelligence.

The relationship between critical thinking based on IQ and gender can happened. (Korkmaz, 2012) said that multiple intelligence and critical thinking dispositions and level increase, the skill and performance students parallel increase too. That's why on intelligence sex different in human adults impact to degree of self-reported liberalism in their life (Woodley, 2010)

This difference in characteristics, intelligence, and capabilities leads to the need for learning facilities in the form of student worksheets required. Student worksheets can assist students in understanding the problem, trying to find the right solution for problem solving, proving the solution, and being able to deduce the results obtained through the solution. Intelligence can involve creative and critical thinking skill to evaluating if the idea was good or not (Sternberg, 2015). Worksheets are defined as important tools including the steps of this process specified what the students should do next,

help the students themselves set up their information in their own minds and at the same time provide the whole class to participate in the given activity (Celikler and Aksan, 2012).

It is referred that worksheets make the students active in learning environment showing the way of getting the findings in a controlled way by making observation, forming hypothesis and doing experiments around the specific topic (Pablo Fernández-Berrocal, 2012).

Strengthening the knowledge aspects for learners in the learning process, the need for a learning strategy that can build the knowledge of learners in a self-directed manner. Building knowledge in-depth can improve the thinking skills and scientific attitudes of learners. This can start from a problem that is closely related to the phenomenon of everyday life. This learning strategy is called problem-based learning

Problem-based learning guides learners to useful facts and concepts that would not otherwise have been encountered. Finally, problem-based learning helps cultivate strategic learners and problem solvers who can work with the local community as innovators and embracers of productive, progressive education (Etherington, 2011). The findings of the study indicated that PBL is just as efficient as the conventional teaching strategy in enhancing Form Four students' mathematics performance (Abdullah et al., 2010).

Students' thinking ability has always been likened to, but in reality there are often different values. As a results teachers held a remedial so that students come to the standard value that must be achieved. The process of finding out why there are remedial and student characteristics such as what typically often experience remedial it can usually be analyzed based on IQ (Intelligence Quotients). This is in accordance with that proposed by (Elliott and Resing, 2015) that the original function of IQ testing was to ascertain whether a child was capable of profiting from schooling, there are many who now claim that cognitive assessment offers a range of diagnostic and prescriptive functions which can help teachers in delivering effective educational programs.

High order thinking can help students to get a solution to solve the problem in their life. Creative and critical thinking skill are two of high order thinking. (Russo, 2004) based on his research said that there has a significant interaction between student performance with IQ overtime with verbal, and there was an increase for average student in IQ on their performance.

This study aims to determine the effect of problem-based learning student worksheet on students' thinking ability on dynamic fluid material reviewed based on IQ classification and gender so that it will be seen whether there is influence of IQ and gender in critical thinking skill and determining the most dominant student of learning by using this worksheet will be at a certain IQ level and gender.

## 2 METODOLOGY

The method used in this research is a quasi-experimental method with static group comparison design (Fraenkel and Wallen, 2003). The number of students in the control class is 28 and the experimental class is 30 in this design. The experimental group and the control group are not randomly selected. Data obtained from this research is in the form of post test data obtained from critical thinking skill test using written test with 8 problem description which have been taken from 16 problems made and have the best feasibility. IQ determination using multiple choice questions as many as 30 questions.

The learning process uses a Student Worksheet containing worksheets based on Problem Based Learning model, with Dynamic Fluid material.

All data were tested for normality and homogeneity then calculated its effect with two path ANOVA test using SPSS program.

## 3 RESULTS AND DISCUSSION

The results of this study using ANOVA test, which previously tested the normality and homogeneity of data both for the control class and experimental class. Table 1 presents the results of normality calculations for the experimental class.

Table 1: Tests of Normality experiment class.

IQ	Shapiro-Wilk		
	Stat.	df	Sig.
High	.959	5	.803
Average	.951	21	.353
Low	.945	4	.683

The significance value for the three experimental grade IQ levels shows a value greater than 0.05 so that the experiment class data is normally distributed. The

results of control class normality are presented in Table 2.

Table 2: Tests of Normality control class.

IQ	Shapiro-Wilk		
	Stat.	df	Sig.
High	.907	3	.407
Average	.904	22	.136
Low	.923	3	.464

Table 2 presents the significance for all three levels of control class IQ showing values greater than 0.05 so that control class data are also normally distributed.

Table 3: Tukey HSD Homogeneous Experiment Class.

IQ	N	Subset
		1
Low	4	71.8775
Average	21	76.5976
High	5	79.2120
Sig.		.051

Table 3 show homogeneity results for the experimental and control classes, whose significance value is greater than 0.05 so that the data is homogeneous.

Table 4: Tukey HSD Homogeneous Control Class.

IQ	N	Subset	
		1	2
Low	3	61.4600	
Average	22	68.8945	68.8945
High	3		80.2100
Sig.		.581	.296

Table 4 show homogeneity results for the control classes, whose significance value is greater than 0.05 so that the data is homogeneous.

Next analysis is the value of ANOVA for IQ and gender impact on critical thinking skills in the experimental class. To see the affect of gender and IQ to critical thinking skill there is three partition, gender affect to critical thinking skill, IQ affect to critical thinking skill and due IQ and gender affect to critical thinking skill.

Table 5: ANOVA Experiment Class.

Variable	Gender	Mean	SD	Significance		
				High	Avg	Low
High IQ	Boy-1	71.06	5.10	0.567		0.103
	Girl-4	81.25	6.34			
Average IQ	Boy-6	76.42	4.06	0.567		0.228
	Girl-15	76.47	5.65			
Low IQ	Boy-1	71.88	3.13	0.103	0.228	
	Girl-3	71.88	2.55			
Total	Boy-8	75.18	4.13			
	Girl-22	76.85	5.76			
	Total-30	76.40	5.36			

Table 5. shows that the value of gender, IQ, and gender with IQ greater than 0.05. Sig. High IQ to average and lower is more than 0.05, sig. average IQ to high and lower is more than 0.05 and sig lower IQ to high and average is more than 0.05. It is means that critical thinking skills are influenced by IQ and gender. IQ and gender both influence each other in determining students' critical thinking skills through the use of worksheet based problem based learning. This research can provide information that students' critical thinking skills can depend on IQ and are influenced by gender, so IQ can influence students' critical thinking skills, as explained by (Kafadar et al., 2015) The statistical analyses demonstrated that the IQ Up Cognitive Training Program affects the cognitive development of children positively. Lower and higher IQ associated with level offending thinking, so the result is have a relationship with curve linier (Mears and Cochran, 2013) . (Chandra, 2013) based on their research said that IQ influenced to academic performance but not gender not influenced.

Table 6: ANOVA Control Class.

Variable	Gender	Mean	SD	Significance		
				High	Avg	Low
High IQ	Boy-2	71.87	4.42	0.222		0.104
	Girl-1	96.88	14.77			
Average IQ	Boy-4	82.35	12.85	0.222		0.508
	Girl-18	65.97	10.98			
Low IQ	Boy-3	61.46	6.50	0.104	0.508	
	Girl-3	61.46	6.50			
Total	Boy-6	78.65	11.43			
	Girl-22	66.76	12.22			
	Total-28	69.31	12.84			

The significance value of IQ and gender influence to students' critical thinking skill in the control class is greater than 0.05, it shows by table 6. It means that IQ and gender influence to students' critical thinking skills, whereas critical thinking skills due to IQ influence are independent of gender and critical thinking skills because gender influence is independent of IQ.

However, the overall use of problem-based learning worksheets in learning can provide an improvement in the critical thinking skills of students both influenced by IQ, gender, or both. This is in accordance with what is said by (Bakırcı et al., 2011) Considering the analysis results, it was concluded that use of worksheets and simulation technique together has positive effects on students' hypothetical, correlation and combinational thinking skills.

## 4 CONCLUSIONS

IQ and gender influence students' critical thinking skills through using worksheet based problem-based learning. IQ and gender affect to increase critical thinking skill but indirect. The impact of this research is even critical thinking skill affected both by IQ and gender but we must separately the individual differences in performance cognitive so does the critical thinking because the conceptual and empirically different. Why, because does not high IQ have a good on performance critical thinking but majority was good. It is like (Cho, 2010) said that high IQ not always predict high performance and selection good strategy. So we can development the right worksheet to use in learning.

Suggest for next research is see intelligence based on multiple intelligence because it more various intelligence.

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