

# The Effect of Brainstorming Implementation on Students' Engagement in Learning about Probability in Math Classes Grade XI IPA at SMA ABC Cikarang

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## ABSTRACT

*This research aims to discover the effect of brainstorming implementation on students' engagement in learning about probability. The method used in this research was quasi-experimental with non-equivalent control group design. The sampling technique was census. The data was collected through questionnaire and analyzed by using non-parametric tests; they were Mann-Whitney U-test and Wilcoxon Signed-Rank test with alpha level 0.05. The result showed that: 1) there was no significant difference on students' engagement between before and after treatment in the group that was taught without brainstorming; 2) there was significant difference on students' engagement between before and after treatment in the group that is taught with brainstorming; and 3) there was no significant difference on students' engagement between the group that is taught with brainstorming and the group that is taught without brainstorming. The result of this research indicates that brainstorming*



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*implementation gives a positive effect on students' engagement in learning about probability in math classes grade XI IPA at SMA ABC Cikarang.*

**Keywords:** *brainstorming implementation, students' engagement*

### INTRODUCTION

This study departs from three main facts. First, the low students' engagement has become one of the problems that are faced and struggled by teacher in the classroom. Some educators consider engaging disengaged pupils to be one of the biggest challenges facing educators, as between 25% and over 66% of students are considered to be disengaged (Harris, 2008; as cited in Parsons & Taylor, 2011, pp. 5-6). Second, mathematics is a lesson that is considered as hard to be learned by students. Conservative estimates indicated that 25% to 35% of students struggle with mathematics knowledge and application skills in general education classrooms, indicating the presence of mathematics difficulty (Mazzocco, 2007; as cited in Hott & Isbell, 2014, p. 1). Three, one of the mathematics' topics in senior school is the probability. Recent research (Shaughnessy & Ciancetta, 2002; Watson & Kelly, 2003; as cited in Jones, 2006, p. 2) has revealed a great deal of instability and misunderstanding in students' conceptions of variation in both statistical and probabilistic environments. Based on those three facts above, one big problem appears that is the low of students' engagement in learning probability in math classes. This problem agrees with statement of Skilling, Bobis & Martin (2015, p.1) in their conference paper that student disengagement in mathematics is a significant issue for education.

Based on the problem stated above, the researcher considered doing a research by applying brainstorming in the class. Brainstorming is a technique in which people are encouraged to come up with creative ideas in a group, play off each other's ideas, and say practically whatever comes to mind that seems relevant to a particular issue. Participants are usually told to hold off from criticizing others' ideas at least until the end of the brainstorming session to encourage the free flow of ideas (Santrock, 2011, p. 314).

Thus, the researcher is interested to do an experiment research by applying brainstorming method and seeing its effect on students' engagement. The statements of the problem of this research could be formulated into three ideas as follows:



1. Is there any difference on students' engagement between before and after treatment in the group that is taught without brainstorming?
2. Is there any difference on students' engagement between before and after treatment in the group that is taught with brainstorming?
3. Is there any difference on students' engagement between the group that is taught with brainstorming and the group that is taught without brainstorming?

### **Students' Engagement**

Engagement has been a common term used in education, especially in teaching-learning process. It is widely recognized as critical in learning process (Reading, 2007, p. 1). Engagement is defined as a combination of students' time on task and their willingness to participate in activities (Stovall, 2003; as cited in Beer *et al.*, 2010, p. 2). According to Newman (1992; as cited in Miller, 2011, p. 2), students' engagement occurs when students make a psychological investment in learning and try hard to learn what school offers. Engaged students take pride not only in earning the formal indicators of success (e.g., grades) but in understanding the material and incorporating it into their lives. While, Theresa Akey (2006; as cited in Winter & Foster, n.d., p. 1) defines engagement as:

“...the level of participation and intrinsic interest that a student shows in school. Engagement in schoolwork involves both behaviors (such as persistence, effort, attention) and attitudes (such as motivation, positive learning values, enthusiasm, interest, and pride in success). Thus, engaged students seek out activities, inside and outside the classroom, that lead to success or learning. They also display curiosity, a desire to know more and positive emotional responses to learning and school.”

### **Brainstorming**

Santrock (2011, p. 314) defined brainstorming in a similar way that brainstorming is a technique in which people are encouraged to come up with creative ideas in a group, play off each other's ideas, and say practically whatever comes to mind that seems relevant to a particular issue. Participants are usually told to hold off from criticizing others' ideas at least until the end of the brainstorming session to encourage the free flow of ideas. In its application, brainstorming is often used in the early to middle stages of a certain event (Wilson, 2013, p. 5). It can be a good start for a design.



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Osborn stated that the few fiascoes have been due to the failure of leadership (2009, p. 121). That is the essential part of the brainstorming. A facilitator is responsible for the process and procedures, structures and prepares the environment, reinforces roles and ground rules for the session, focuses the resources of the group, and is sensitive to a variety of group dynamics (Isaksen, 1998, p. 14). Brainstorming has guidelines. Osborn (2009, pp. 123-124) wrote in his book "*Unlocking Your Creative Power*" that leader should understand the rule and explain it to all present at the start. Those guidelines are:

1. Judicial judgment is ruled out.
2. Wildness is welcomed.
3. Quantity is wanted.
4. Combination and improvement are sought.

Besides, there are more things should be noticed. In brainstorming session, Wilson in book "*Brainstorming and Beyond*" (2013, p. 16) recommends that focus on one major topic or one aspect of a problem is better for brainstorming. It should be specific rather than general (Osborn, 2009, p. 123) Then, Tracy (2003, p. 175) stated that the ideal duration of brainstorming is 15 to 30 minutes. Whereas, based on Ellis' statement (2011, p. 225), both short and long brainstorms can be powerful.

Brainstorming can be applied for individual, small group, or whole class activity (McCune & Alexander, 2015, p. 92). Wilson (2013, p. 9) recommends that three to ten participants are good for brainstorming. If participants are more than ten, then it will be better if brainstorming is held in the group.

Then, one should be aware is the atmosphere of brainstorming. The condition of brainstorming is not like group discussion (Userfit Tools, 1996, p. 12). It should be a condition that makes participants enjoy and feel free to express their idea. Osborn (2009, p. 124) stated, "*The leader should put them into their own words because a brainstorm session should always be kept informal*". Then, one of successful leaders said that it is good if the leader can make the participants of brainstorming feel like they are playing a game (Osborn, 2009, p. 125).

### METHODOLOGY

In this research, researcher adopted a quantitative method in the form of *experimental research*. The design was *quasi-experimental design* in the form



of *Non-equivalent Control-Group Design*. Schematically, this design could be drawn as follows:

Table 1. The Research Design

Source: (Riadi, 2014, p. 14)

Group	Pretest	Treatment	Posttest
Experimental	O <sub>1</sub>	X	O <sub>2</sub>
Control	O <sub>3</sub>	Y	O <sub>4</sub>

Place of the research was at SMA ABC Cikarang. The population of this research was all students of XI IPA SMA ABC Cikarang Year Academic 2015/2016 which consisted of 22 students of XI IPA1 and 22 students of XI IPA 2. The total was 44 students.

The sample of this research was all students of XI IPA SMA ABC Cikarang Year Academic 2015/2016. The students of XI IPA 1 were as a control group and the students of XI IPA 2 were as an experimental group.

In this research, questionnaire was applied as instrument to collect the data about students' engagement. This questionnaire was arranged by using Likert's scale. The questionnaire provided 5 choices for respondent, those were: strongly agree, agree, neither agree or disagree, disagree, and strongly disagree.

The aim of this questionnaire was to gather information about the initial condition of students' engagement and to get information about the change of students' engagement after got a treatment. In this research, the questionnaire would be analyzed and the result would reveal the effect of brainstorming implementation on students' engagement.

## FINDINGS AND DISCUSSION

### Hypothesis Tests

#### 1. Wilcoxon Signed-Rank Test Results

This test was conducted in order to reveal the difference between the results of pretest and posttest in control and experimental group. It was conducted at the level of significance 0.05 through SPSS 20 for Windows. The hypotheses were:

H<sub>0</sub>: there is no significant difference on students' engagement between the results of pretest and posttest in control or experimental group



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$H_1$ : there is significant difference on students' engagement between the results of pretest and posttest in control or experimental group

If the probability value  $\geq \alpha$ , then the null hypothesis was accepted; and if the probability value  $< \alpha$ , then the null hypothesis was rejected.

The result of Wilcoxon Signed-Rank test for pretest and posttest scores in control group could be seen in the tables below.

Table 2. Test Statistics of Wilcoxon Signed-Rank Test in the Control Group

Wilcoxon Signed-Rank Test	
Sig. (2-tailed)	0.486
Conclusion	$H_0$ is accepted

Table 2 showed that the probability value (0.486) was less than alpha level (0.05). It means that statistically the null hypothesis was accepted. In other words, it could be said that there was no significant difference on students' engagement between the results of pretest and posttest in control group.

The result of Wilcoxon Signed-Rank test for pretest and posttest scores in experimental group could be seen in the tables below.

Table 3. Test Statistics of Wilcoxon Signed-Rank Test in the Experimental Group

Wilcoxon Signed-Rank Test	
Sig. (2-tailed)	0.004
Conclusion	$H_0$ is rejected

Table 3 showed that the probability value (0.004) was less than alpha level (0.05). It means that the null hypothesis was rejected. In other words, it could be said that there is significant difference on students' engagement between the results of pretest and posttest in experimental group.

### 2. Mann-Whitney U-test

This test was conducted in order to reveal the difference on students' engagement between experimental and control group in pretest and posttest's results. It was conducted at the level of significance 0.05 through SPSS 20 for Windows. The hypotheses were:

$H_0$ : there is no significant difference on students' engagement between control and experimental group in the pretest or posttest's results

$H_1$ : there is significant difference on students' engagement between control and experimental group in the pretest or posttest's results



If the probability value  $\geq \alpha$ , then the null hypothesis was accepted; and if the probability value  $< \alpha$ , then the null hypothesis was rejected.

The result of Mann-Whitney U-test for pretest scores in the experimental and control group could be seen in the tables below.

Table 4. Test Statistics of Mann Whitney U-test for Pretest Scores

Mann-Whitney U-test	
Sig. (2-tailed)	0.142
Conclusion	$H_0$ is accepted

Table 4 above showed that the probability value (0.142) was greater than alpha level (0.05). It means that the null hypothesis was accepted. In other words, it could be said that there was no significant difference on students' engagement between control and experimental group in the pretest's results.

The result of Mann-Whitney U-test for posttest scores in the experimental and the control group could be seen in the tables below.

Table 5. Test Statistics of Mann Whitney U-test for Posttest Scores

Mann-Whitney U-test	
Sig. (2-tailed)	0.888
Conclusion	$H_0$ is accepted

Table 5 above showed that the probability value (0.888) was greater than alpha level (0.05). It means that the null hypothesis was accepted. In other words, it could be said that there was no significant difference on students' engagement between control and experimental group in the posttest's results.

### Data Description

Based on the data of questionnaire as pretest and posttest in the control and experimental group, the description of the groups could be presented in the table and the chart below.

Table 6. Data Description

Information	Pretest		Posttest	
	Control Group	Experimental Group	Control Group	Experimental Group
N	22	22	22	22



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Sum	2110	2011	2095	2129
Mean (Statistic)	95.9091	91.4091	95.2273	96.7727
Std. Deviation	9.50142	9.46502	8.22269	8.77188

From the table above, it could be seen that in pretest (before treatment), the mean score of the control group (95.9091) was higher than the mean score of the experimental group (91.4091). It indicated that at the beginning (before treatment), both groups were not in the equal condition.

Then, it also could be seen that in posttest (after treatment), the mean score of the control group (95.2273) was almost the same compared with the mean score of the experimental group (96.7727). It indicated that after treatment, the students' engagement of both groups were equal.

Besides, it could be seen that the mean score of the control group in pretest result was 95.9091. Then, after teaching without brainstorming was implemented, the mean score descended to 95.2273. It showed a decrease with differences 0.6818. It indicated that non-brainstorming implementation did not give any difference on students' engagement.

Meanwhile, the mean score of the experimental group in pretest result was 91.4091. Then, after the group got brainstorming implementation, the mean score ascended to 96.7727. It shows an increase with differences 5.3636. It indicated that brainstorming implementation gave a positive effect on students' engagement.

### Discussion

Based on findings above, it can be seen that generally brainstorming implementation gave a positive effect on students' engagement. This condition agreed with the statement expressed by Light et al. (2009, p. 95) that, "*Brainstorming can be a particularly effective way of engaging students as the production of their ideas and solutions is separated from the often limiting impact of immediate intellectual criticism*". In addition, there might be some factors that influence the level of engagement of students. New Zealand Curriculum (2012) stated that the factors which impacted on how well students were engaged in learning were: 1) the nature of relationship with the teacher and other students in the class; 2) the perceived relevance of the learning material; 3) the level of knowledge and skills that students bring into each learning situation; 4) the intrinsic interest of the subject or activity to a particular student; 5) the extent to which there is variety in the teaching approaches; 6) the nature and extent of teacher feedback on students'





progress; 7) the extent to which students are able to take responsibility for their own learning. So, those factors caused the difference on level of engagement in learning.

## CONCLUSION

There are three conclusions that can be gotten from this study.

Based on the result of Wilcoxon Signed-Rank test between the pretest and posttest results in the control group, the probability value is 0.486. Because the probability is greater than alpha level ( $0.486 > 0.05$ ), then  $H_0$  is accepted in which there is no significant difference on students' engagement between the results of pretest and posttest in the control group. In other word, it can be concluded that there is no significant difference on students' engagement between before and after treatment in the control group that is taught without brainstorming.

Based on the result of Wilcoxon Signed-Rank test between the pretest and posttest scores in the experimental group, the probability value is 0.004. Because the probability is less than alpha level ( $0.004 < 0.05$ ), then  $H_1$  is accepted, there is significant difference on students' engagement between the results of pretest and posttest in experimental group. Thus, it can be concluded that there is significant difference on students' engagement between before and after treatment in the group that is taught with brainstorming.

Based on the result Mann-Whitney U-test between control and experimental group in posttest scores, the probability value is 0.888. Because the probability value is greater than alpha level ( $0.888 > 0.05$ ), then  $H_0$  is accepted in which there is no significant difference on students' engagement in the posttest's results between the control group and the experimental group. Thus, it can be concluded that there is no significant difference on students' engagement between the group that is taught with brainstorming and the group that is taught without brainstorming.

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