



The Effect of Brainstorming on Students' Creative Thinking Skill in Learning Nutrition

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ABSTRACT This research investigated the effect of brainstorming on students' creative thinking skills in learning nutrition. The method that was used in this research is quasi experimental with pretest posttest design. The sample was taken by purposive sampling technique where one group was assigned as experimental group ($n=25$ students) and the other one group was assigned as control group ($n=25$ students). The population was 7th grade students in Islamic International School in Bandung. The quantitative data in this research was obtained from objective test and verbal TTCT (Torrance Test of Creative Thinking), while the qualitative data was obtained from observation sheet. The findings of the study showed that there are statistical significant differences between experimental and control group in creative thinking skills test with the score of 0.000. The result is in the favor of the experimental group, indicating the effectiveness of brainstorming in developing students' creative thinking skills in learning nutrition.

Keywords Brainstorming, Students' Creative thinking skills, Nutrition.

1. INTRODUCTION

The world keeps on developing, in the scientific, economic and social aspects of life as well as the communication revolution results from the knowledge advancement and globalization. As a response to those developments and challenges it was crucial to prepare a generation that capable to face those challenges through changing the traditional methods of learning and teaching as well as focusing on providing students with the suitable training on different thinking styles. Individuals cannot be prepared for present and future through pouring information into them through the traditional teaching methods that depend on the teacher in the first place.

This must be done through guiding students towards achieving knowledge understanding in relation with everyday problems since we live in the era of openness between communities requiring us to employ information and investing it in solving problems in the environment leading to the development of the ability of thinking as well as developing innovation and creativity (Al-Khatib, 2012). One of such strategies is the constructivist approach which lay emphasis on the active role of the learner in constructing knowledge as well as making sense of

information (Owo, Idode & Ikwut, 2016). According to Orji & Ekpo (2013) constructivism is a theory that believes in human generation of knowledge and meaning from the interaction between their experience and ideas.

The constructivist approach to teaching stresses on meaningful learning and knowledge building through two processes: 1) the learners' internal (cognitive) process. In this process, new knowledge is derived from previous knowledge by the transformation, organization and reorganization of previous knowledge. (2) The interaction between both the learners' internal and external processes. Here new knowledge is constructed as a consequence of the relationship or interaction between cognitive experience or prior knowledge and the external (i.e. environmental or social) factors.

The external or social factor here can be in the form of social interactions with knowledgeable adults or peers who render help or scaffolding. During scaffolding, previous knowledge is activated. In any of these processes, prior

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knowledge is required for meaningful learning to take place (Owo, Idode & Ikwut, 2016).

Brainstorming as one of the constructivist techniques was originally introduced by an American advertising executive, Alex Osborn (1953) as a technique of generating ideas from a group of people in an attempt to solve a problem. He established this strategy when he realized that the traditional modes of business meetings were unable to create new ideas. He also proposed the following four rules for effective brainstorming: (i) No criticism of ideas: During brainstorming, judgment or criticism of ideas is excluded until the end of the session. (ii) Encouraging large quantities of ideas: Quantity of ideas is the major goal of brainstorming. The more ideas the group or participants generate, the more the chance of having good ideas among them. (iii) Building on each other's ideas: Combination and improvement of ideas are very necessary. Participants should be very free to associate, build and elaborate their own ideas based on ideas from others. (iv) Encourage every idea: Take every idea (both silly and intelligent ones) as valid, and encourage the participants to share their ideas (Owo, Idode & Ikwut, 2016).

Brainstorming can be viewed as a technique in which an individual or a group engages in critical thinking to generate wide-ranging ideas and creative solution toward solving a problem. This strategy is now widely applied in different fields of human endeavor including education (Owo, Idode & Ikwut, 2016). Brainstorming provides a free and open environment that encourages everyone to participate. Quirky ideas are welcomed and built upon, and all participants are encouraged to contribute fully, helping them develop a rich array of creative solutions.

When used during problem solving, brainstorming brings team members' diverse experience into play. It increases the richness of idea explored, which means that you can often find better solutions to the problems that you face. What's more, because brainstorming is fun, it helps team members bond, as they solve problems in a positive, rewarding environment. While brainstorming can be effective, it's important to approach it with an open mind and a spirit of non-judgment (Al-Mutairi, 2015).

Creative thinking skills are something that rarely considered as important in learning science. Teacher usually put logic as a the most essensial point and assume that creativity is not important in learning science. Creative thinking is known as a compound mental activity aiming to direct a strong desire to look for solutions or reaching original solutions that were not known before (Jarwan, 2008). Al-Khatib (2012) defined it as the multiple thinking that includes the breaking up of old ideas, making new connections, enlarging the limits of knowledge and the onset of wonderful ideas.

Many researchers assume that people are creative, but their degree of creativity are different from one to another (Siswono, 2010). In exercising to learn creatively, students

can improve their creative thinking skills. The role of teacher is to provide the teaching and learning process that facilitates students to practice and improve their creative thinking skills.

2. METHOD

The research method that was used in this research is Quasi Experiments. Cresswell (2012) stated that in education, many experimental situations occurred in which researchers need to use intact groups. Quasi-experiments include assignment, but not random assignment of participants to groups. This is because the experimenter cannot artificially create groups for the experiment (Creswell, 2012). The design that was used in this research is pre-test post-test design.

The location of this research was an Islamic International Junior High School in Bandung. This school is located in urban area of Bandung. This school use English as their main language and Bahasa Indonesia (in Indonesian language, civics education, and social studies subject) and also Arabic (in Arabic language subject). This school use the mix of Cambridge IGCSE and *Kurikulum 2013* as its curriculum.

The population of this research was 7th grade students. The samples are 7th grade students from two classes, where one of them was assigned as experimental and the other as control group.

The sampling technique that was used in this research is Purposive Sampling. Purposive sampling was based on previous knowledge of a population and the specific purpose of the research, investigator use personal judgment to select a sample. Researchers do not simply study whoever is available but rather use their judgment to select a sample that they believe, based on prior information, will provide the data they need. (Fraenkel, Wallen & Hyun, 2007).

In this research, the concept of nutrition is limited based on Cambridge IGCSE Curriculum. The subtopics include (1) Nutrients, (2) Chemical test for nutrients, (3) The use of microorganism in industry, (4) Food additives.

There are two instruments that were used in this research; those are verbal TTCT and observation sheet. The TTCT was used to measure students' creative thinking skills that include fluency, flexibility, and originality. There are six questions that represent their creative thinking skills in asking, guessing causes, guessing consequences, product improvement, unusual uses and just suppose. The score range is from 0 to 3.

The second instrument which is the observation sheet contains the stages of activities which have to be done by the researcher in implementing brainstorming which has been adapted according to activities related with nutrition. The function of the observation sheet this research was to make sure that the researcher follows the appropriate steps while implimenting the brainstorming during the research

and also acts as a guideline for the researcher. Observation sheet was in the form of checklist with 'yes' and 'no' column. The observation sheet was filled by the observer who was the science teacher of the school.

3. RESULT AND DISCUSSION

The results show quantitative and qualitative data. The pre-test and the post-test are conducted to determine students' creative thinking skill before and after treatments. Qualitative analysis will describe how the implementation of brainstorming in the classroom.

3.1 The Implementation of Brainstorming

The research was done in six meeting, where the first and last meetings were used for pretest and posttest. Before the first treatment, students were given the pretest in order to know their prior knowledge of nutrition as well as their creative thinking skill on the same concept. After 4 meetings of treatment, students were given the posttest to know the effect of brainstorming towards students' creative thinking skills in learning nutrition. In the beginning of each meeting, students were presented with daily life phenomenon that was related to the topic as a stimulus for students to create ideas through brainstorming.

The implementation of brainstorming was investigated by the observation sheet during the lesson. The percentage of brainstorming implementation is presented in Table 1.

According to Table 1 about the percentage of brainstorming implementation, teacher and students implemented or done all activities that has been determined in the lesson plan. The average of implementation percentage is 100% which according to Arikunto (2013) is categorized as very good.

From meeting one to meeting four, students showed an improvement of confidence. This finding is in line with result from Unin and Bearing (2016), that brainstorming contributes to the increase in students' motivation, confidence, and participation as reflected by the positive students' behavior during classroom observations. This was because active participation also led to an increase in the students' level of self-esteem or self-confidence.

According to the explanation above, it can be concluded that brainstorming can improve students'

Table 1 The implementation of brainstorming

Mee- ting	Topic	Imple- mentation	Criteria
1	Nutrients	100%	
2	Chemical Test for Nutrients	100%	All activities implemented
3	Microorganism in Industry	100%	
4	Food Additive	100%	

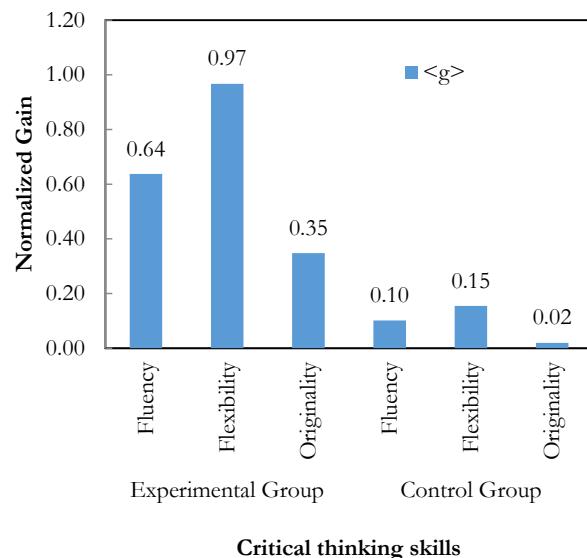


Figure 1 The improvement of creative thinking skills in each aspect

creative thinking skill. Indicated by the more meeting they have, the more ideas they generated, and the more confident they were in delivering their ideas. This result supported the research from Al-Khatib (2012) that brainstorming is an effective strategy in developing creative thinking skills. This may be attributed to the nature of brainstorming strategy as a collective discussion strategy that encourage students to generate the highest number of ideas that are varied and creative in a spontaneous and free open climate that is not critical and doesn't limit the freedom of launching ideas.

This finding is consistent with the research from AlMutairi (2015) which showed a same result. Brainstorming can enhance students' creative thinking skill, especially in the term of generating creative ideas because it is attributed to the advantages of this strategy that are accepted among students. Some of those advantages are the preparing element and making students ready to participate in the sessions as well as joy environment that provide students with free climate that doesn't contain any critics and interference.

3.2 Students' Creative Thinking Skills

Students' creative thinking skill was measured by verbal TTCT that consisted of six questions which represent their ability in asking question, guessing causes, guessing consequences, improving product, determining unusual uses and the last was 'just suppose'. All those questions were aimed to measured fluency, flexibility and originality aspects of creative thinking skill. Pretest was used to identify students' creative thinking skill in nutrition concept before the brainstorming treatment. After students were given the treatment, students were faced with posttest to measure their improvement of creative thinking skill in learning nutrition.

Table 2 The statistic test for students' creative thinking skills

Component	Pretest		Posttest	
	Control Group	Experimental Group	Control Group	Experimental Group
N	25	25	25	25
Average Score	20.52	14.45	29.26	69.56
Standard Deviation	8.40	7.74	10.00	8.04
Maximum Score	40,74	38,9	48,15	85,19
Minimum Score	3,7	5,6	9,26	46,3
Kolmogorov-Smirnov Normality Test				
Signification (sig. α = 0.05)	0.2	0.2	0.2	0.09
Conclusion	Normally Distributed	Normally Distributed	Normally Distributed	Normally Distributed
Levene's Homogeneity Test				
Signification (sig. α = 0.05)	0.708		0.170	
Conclusion	Homogenous		Homogenous	
Hypothesis Test				
Signification (sig. α = 0.05)	0.000	Independent Sample T-Test sig (2-tailed) < 0.05 H ₀ rejected, H ₁ accepted		
Conclusion		H ₁ accepted, there is significant difference		

The statistic test was done in order to identify the difference of students' creative thinking skill between experimental and control group after the treatments. Table 2 is the statistical test result of students' creative thinking skill for both experimental and control group.

From Table 2, it can be concluded that there is a significant difference of students' creative thinking skill in learning nutrition between groups that was taught using brainstorming and common discussion method, where group that was trained using brainstorming show a better performance. Figure 1 also shows a better explanation regarding the improvement of each creative thinking skills (fluency, flexibility, and originality) of students. The effect of brainstorming in developing creative thinking as a whole and in its sub skills may be attributed to the advantages of this strategy that are accepted among students. Some of those advantages are the preparing element and making students ready to participate in the sessions as well as joy environment that provide students with a free climate that does not contain any critics and interference.

The result is in line with the research finding from Taleb, Hamza, & Wefky (2013) that there is a statistical significant difference between the performance of the experimental group that has been taught by brainstorming strategy and the control which has been taught by traditional method even in the total score of the test or its sub skills. This may be attributed to the nature of brainstorming strategy which help in developing multiple thinking that includes the breaking up of old ideas, making new connections, enlarging the limits of knowledge and the onset of wonderful ideas. As well as, one of the important reasons for this result is the acceptance of this strategy

among students and preparing element and making students ready to participate in the sessions as well as joy environment that provides students with a free climate that doesn't contain any critics and interference.

The finding was also consistent with the result from Sdouh (2013), that there was statistical different of students' creative thinking skill of those who learned by using brainstorming and those who were using computer education, where students that trained through brainstorming performed better. This may be attributed to approve the activities of creative thinking skills with the principles of brainstorming strategies based on problem-solving and decision-making and thinking about the reasons and causes to give an accurate explanation and judgment objectively away from bias and favoritism.

Aiamy & Haghani (2012) concluded that brainstorming was more effective in improving students' creative thinking skill compared to traditional and synectics method. They think of brainstorming as one of the best group decision making methods, that an individual in the group produces responses twice those by an individual alone. Variety is a rule of brainstorming which operates the creative part of brain so that it should dominate its judgmental thinking.

The latest finding from Mathari (2015) also proved that brainstorming can significantly improve students' creative thinking skill in learning science. It was because brainstorming demand students to actively getting involved in the teaching and learning process. With their active involvement, they can enriched their knowledge individually as well as in group set in solving problem that was given to them as creatively as possible.

4. CONCLUSION

Research of the comparison between pre and post brainstorming has been conducted systematically, based on the research result it is acquired some conclusions as follows. The implementation of brainstorming in learning nutrition reach the implementation percentage of 100% which means that all activity in the lesson plan are all being implemented during the learning process and considered as very good.

There is significant difference between experimental and control group in the term of creative thinking skill. Experimental group that was trained by brainstorming got a medium gain which means that brainstorming improve students' creative thinking skill in medium category. The gain in fluency and originality aspects categorized as medium, means that brainstorming can improve students' fluency and originality skill in medium level, while gain in flexibility aspect categorized as high means that brainstorming can highly improve students' flexibility skill.

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