
Brain Based Learning Using Media Crossword Puzzle Enhances Students Understanding of Concepts and Thinking Skills

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Abstract

This study aims to determine the effect of brain based learning models assisted by crossword puzzles on the understanding of concepts and critical thinking skills in science. This research is a quasi-experimental study (quasi-experimental), with a non-equivalent post-test only control group design. The population of this study was the entire class V of SDN Cluster VIII Buleleng District in the academic year 2019/2020 consisting of 5 classes in five elementary schools with 129 students. Samples were taken with a random sampling technique of 2 classes. Data on understanding concepts and critical thinking skills in science is collected using the test method in the form of an essay test. Data were analyzed with the MANOVA test using SPSS 17 for Windows. The results showed that 1) there was a positive influence on the brain based learning model with the help of crossword puzzles on the understanding of the science concept (F count of 276,585; sig = 0,000 <0.05); 2) there is a positive influence of the brain based learning learning model assisted by the crossword puzzle media on critical thinking skills in science (F count is 238,963; sig = 0,000 <0.05); 3) there is a positive influence on brain based learning models assisted by the crossword puzzle media on the understanding of concepts and critical thinking skills in science (F count of 231.064; sig = 0.0001 <0.05). The brain based learning model with the help of crossword media can be applied to science learning in elementary schools as an effort to increase students' understanding of concepts and critical thinking skills maximally in science lessons.

Keywords: brain-based learning; crossword puzzles; understanding the concepts; critical thinking skills

Introduction

Natural science (IPA) is a learning concept that has a very broad relationship related to human life. Natural science (IPA) is a learning concept that has a very broad relationship related to human life (Sari, 2012). Science learning is useful for the life and work of children in the future, training children to think critically, and have educational values to shape the child's personality as a whole. Science education should be carried out well in the learning process at school given the importance of science learning as has been revealed above, science learning is said to be successful if all the specified learning objectives can be achieved, which is revealed in the science learning outcomes (Suadi, 2019). Thus in achieving the goals of the Natural Sciences there needs to be a good interaction when learning takes place, both student interaction with the teacher, students with students, or students with their environment. Interaction in science learning will determine students' success in exploring and constructing their knowledge. In the community environment as a source of student learning there are guidelines for

conducting good interactions, if the guidelines are applied in learning then the interaction in learning will run better and in accordance with the needs of the local community environment. Therefore, it is important for educators to be able to carry out learning in accordance with the character of students and the demands of the community environment that are considered good applied in learning.

However, phenomena that occur on the ground today are still many implementation of science learning that has not been able to pay attention to the characteristics of elementary school-age children who have not been able to think abstractly and like physical activity. Tursinawati (2013) states Science Learning is only focused on the concept and does not pay attention to the importance of planting scientific skills and scientific attitudes in students. This makes many students gain knowledge they do not understand and meaning that makes it difficult for them to relate it to what is happening in their daily lives (Rosarina et al., 2016). In addition, seen from the results of science learning students in Indonesia in the low category is PISA. Programmed for International Student Assessment (PISA) study developed by the Organization for Economic Cooperation and Development (OECD). PISA results in 2018 indicate that the ability of science performance in Indonesia is ranked 74 out of 79 countries with a score of 396. This shows that the quality of learning in Indonesia, especially in science or science learning content needs to be improved in various fields. Science learning is ideally taught through a process of scientific attitude from students by studying natural phenomena that are seen directly so that students become active in the learning process of science, so that students can later understand the concept of learning taught by the teacher through direct learning (Dewi et al., 2017).

Based on interviews conducted with each guardian of class V at SDN Cluster VIII Buleleng District revealed several problems namely students not participating in the learning process and not being enthusiastic in participating in learning science. This is because in the learning process is still teacher-centered seen from the beginning of learning only teachers who play an active role without the reciprocal interaction of students. In addition, the teacher stated that the understanding of students' science concepts was still low. At the end of the lesson, when asked by the teacher, there are still many students who do not understand the material that has been learned.

Apart from interviews, observations also showed similar results, namely the learning process of science has not been student-centered. Students have difficulty in understanding the material and the questions related to the material being learned because they do not enjoy the material being learned. These conditions resulted in the understanding of concepts owned by

students is less than optimal. In addition, students are not given the opportunity to work on problems with higher levels such as analysis questions that can practice critical skills in students.

Based on the explanation of the problems above, the teacher needs to provide innovation in learning. The innovation is the use of learning models that can bring about an atmosphere of active learning so that it is meaningful for students so as to improve understanding of concepts and critical thinking skills of students. Then the learning model that is thought to influence the understanding of concepts and critical thinking skills in science is a brain based learning model. The brain based learning model is a learning model that considers how the brain works when retrieving, processing, and interpreting information absorbed. Brain based learning is a learning approach that is based on the structure and function of the human brain (Nahdi & Id, 2015). Brain-based learning model (brain based learning) is a learning model that can direct students to connect knowledge that has been previously owned with the material to be learned (Mangentang et al., 2018). Winter (2019) States learning will be more effective in real life related to life experiences using brain based learning models. In line with this Yasar (2017) revealed that brain-based learning is a student-centered approach that is considered to help teachers improve students' cognitive structures and facilitate their learning. The advantages of brain based learning models according to Purnama (2016) namely creating an active and meaningful learning situation for students, creating a learning environment that challenges students' thinking abilities, creating a pleasant learning environment.

Several studies have found that the brain based learning model influences learning outcomes. Made Suarsana et al. (2018) in his research revealed that motivation arises for students to understand the concept of learning so that it will be achieved also optimize students' conceptual understanding of mathematics. (Kosar, 2018) The research concludes that the brain based learning model can help participants retain the knowledge they know so far. Research conducted by Sani et al. (2019) shows that brain based learning models can improve students' mastery of concepts on the topic of electrical circuits. (Shabatat & Al-Tarawneh, 2016) also argues that the brain based learning model is based on the generation of ideas on topics, where students are allowed to think freely without intervention by the teacher. Brain based learning models are applied with small groups or as a whole class.

The application of the brain based learning model is even more effective when combined with innovative media. The medium in question is the medium of crossword puzzles. The crossword puzzle media is very suitable to be used to help apply the learning model of brain based learning. Zaim (2018) states that crosswords are a learning medium that

can be used to practice thinking skills and vocabulary mastery. In line with this Utami (2015) mentions that performing crosswords regularly may improve one's Semantic Verbal Fluency. Other than that, Erfan (2018) stated crossword is a word game that provides instructions for students identifying the right vocabulary mounted into an empty box.

The brain based learning model when combined with the use of crossword puzzles will make learning more interesting, meaningful for students and can create active learning situations. This is very suitable for elementary school children who are in the phase of playing while learning. According to Nahdi & Id (2015) by playing crosswords can train students' understanding of concepts and critical thinking skills because in the game of this crossword puzzle where we have to fill empty spaces (in the form of white cities) with letters that form a word based on instructions. The instructions can be divided into horizontal line and vertical line depending on the direction of the words that must be filled. Completing these crosswords indirectly is also useful for increasing knowledge. The media of crossword puzzles has the advantage of being able to improve thinking skills and make students learn to concentrate in learning (Rahma & Effendy, 2017).

In addition, according to Mirzandani (2012) the benefits of the crossword media is to increase the activity and student learning outcomes because filling in the crossword puzzles makes the mind clear, relaxed and makes memory stronger so that memory can increase. The purpose and focus of this research is to examine whether there is a significant influence of the brain based learning model with the help of crossword media on the understanding of concepts and critical thinking skills of Natural Sciences students.

Materials and Methods

This research is a quasi-experimental study, considering that not all variables (symptoms that arise) and the experimental conditions can be tightly controlled and controlled. The experimental design used is a non-equivalent post test only control group design. The population in this study was the entire class V SDN Cluster VIII Buleleng District in the academic year 2019/2020, consisting of 5 classes in five elementary schools with 129 students.

In this study, the sample selection technique used to select the experimental class and the control class is to use a cluster random sampling technique. Five classes will be randomized to determine which classes will be used as control and experiment classes. Based on the lottery, the experimental class and the control class were obtained at SDN Cluster VIII

of Buleleng District, namely all fifth grade students at SDN 1 Paket Agung as the experimental group and all grade V at SDN 2 Paket Agung as the control group.

There are two data in this research, namely the understanding of concepts and critical thinking skills of Natural Sciences. Data about students' understanding of concepts was collected with a concept understanding test in the form of essay questions which amounted to 6 questions with indicators of understanding the concepts used namely explaining, comparing, giving examples, interpreting. Whereas data on critical thinking skills were collected with a critical thinking skills test in the form of essay questions which amounted to 5 questions with indicators of critical thinking skills used that were providing simple explanations, analyzing arguments, focusing questions, providing definitions, determining the source of information. Data were analyzed descriptively and inferentially. Before an inferential test is performed, the prerequisite tests for the normality of data distribution, the variance homogeneity test, and the correlation test between dependent variables are carried out. Testing the normality of data distribution using the Kolmogrov Test and the Shapiro-Wilks Test. Test criteria: the data has a normal distribution of data if the significance value obtained is greater than 0.05. Normality test can be done using SPSS 17.00 for windows. Homogeneity Test Variance between groups using the Levene "test of Equality of Error Variance. Test criteria: the data has the same variance (homogeneous) if the significance number obtained is greater than 0.05 in other words if the sample variance is not the same (not homogeneous). Homogeneity variance test using SPSS 17.00 for windows. Testing correlation between dependent variables using Pearson (Pearson's product moment). Test criteria: the data is said to be not correlated if the significance value of the analysis results shows more than 0.05. Correlation test between dependent variables using SPSS 17.00 for windows.

Results and Discussion

The results of hypothesis testing in this study prove that: **First**, there is an effect of brain based learning models assisted by crossword puzzle media on understanding the concept of science. The results of the calculation of hypothesis 1 using the MANOVA test assisted by SPSS 17.0 for windows can be seen in Table 1.

Table 1. Hypothesis Test 1 Data Understanding Concepts Science

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Pemahaman_Konsep_Eks	771.570 ^a	1	771.570	276.585	.000

Based on the analysis of the MANOVA test, the data understanding of the concept of science taught by the brain based learning model is assisted by a crossword puzzle media and the brain based learning model is not assisted by the crossword puzzle media producing an F of 276,585, $df = 1$, and $Sig = 0,000$, which means significance <0.05 , it can be concluded that the null hypothesis (H_0) is rejected, the alternative hypothesis (H_1) is accepted. So there is the influence of the brain based learning learning model assisted by the crossword puzzle media on the understanding of the science concepts of Class V SDN Cluster VIII Bulelen District in the academic year 2019/2020.

Second, the results of the analysis show that there is an influence of the brain-based learning model assisted by the crossword puzzle media for critical thinking skills. The results of the calculation of hypothesis 2 using MANOVA with SPSS 17.0 for windows can be seen in Table 2

Table 2. Hypothesis Test 2 Data on Critical Thinking Skills Science

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Keterampilan_Berpikir_Kritis_Eks	721.500 ^b	1	721.500	238.963	.000

Based on the results of the analysis with the MANOVA test, science critical thinking skills data learned with a brain based learning model is assisted by a crossword puzzle media and not a brain based learning model is assisted by a crossword puzzle media producing an F of 238,963, $df = 1$, and $Sig = 0,000$ which means significance <0.05 , so it can be concluded that the null hypothesis (H_0) is rejected, the alternative hypothesis (H_1) is accepted. This means that there is an influence of the brain based learning model assisted by the crossword puzzle media on critical thinking skills of the fifth grade Natural Sciences Elementary School VII Cluster Buleleng District in the academic year 2019/2020.

Third, the results of the analysis show that there is an influence of the brain based learning model with the media of crossword puzzles towards the understanding of concepts and critical thinking skills in science. The results of calculation of hypothesis 3 using MANOVA (Multivariate Analysis of Variance) assisted by SPSS 17.0 for windows can be seen in Table 3.

Descriptive research results describe the results of the calculation of the mean, standard deviation, range, score / maximum value, score / value, minimum. Based on the descriptive analysis conducted there are four scores indicating that descriptively the group of students who were taught using the brain-based learning model with the help of crossword

puzzles was higher than the group of students who were studied with groups of students who were not taught the brain-based learning model of media-assisted learning crossword puzzle.

Table 3. Summarizes The Results of The Analysis of Understanding Concepts and Critical Thinking Skills Science

		F				
Effect		Value		Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.996	10313.614 ^a	2.000	78.000	.000
	Wilks' Lambda	.004	10313.614 ^a	2.000	78.000	.000
	Hotelling's Trace	264.452	10313.614 ^a	2.000	78.000	.000
	Roy's Largest Root	264.452	10313.614 ^a	2.000	78.000	.000
Kelas	Pillai's Trace	.856	231.064 ^a	2.000	78.000	.000
	Wilks' Lambda	.144	231.064 ^a	2.000	78.000	.000
	Hotelling's Trace	5.925	231.064 ^a	2.000	78.000	.000
	Roy's Largest Root	5.925	231.064 ^a	2.000	78.000	.000

Based on the first hypothesis test in this study, the coefficient value $F = 276,585$ was obtained with a significant = 0,000 (<0.05) if the significance level <0.05 then the first hypothesis was accepted meaning that there was an influence of the brain based learning learning model on students' understanding of concepts. Based on the second hypothesis test in this study, the coefficient value $F = 238.963$ was obtained with a significant = 0,000 (<0.05) if the significance level <0.05 then the second hypothesis was accepted meaning that there was an influence of the brain based learning learning model assisted by the crossword puzzle media students' critical thinking skills. Based on the results of the third hypothesis test in this study, the value of F Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root was 231,064, all of which had a significance of 0,000 and were smaller than 0.05 (0,000 <0.05). This shows that there is a positive influence of the brain based learning model with the help of the crossword puzzle on the understanding of concepts and critical thinking skills of students.

From the results of the analysis conducted and proved directly through observation when the learning process takes place, in the experimental class given treatment in the form of brain-based learning models assisted by crossword media students become more active and enthusiastic in exploring information and finding concepts by themselves. Understanding of student concepts becomes more improved because in learning students listen and gain hands-on experience and make their own analysis related to the material being studied. In addition, the application of the brain based learning model provides opportunities for students to think in solving problems they find in the learning process. This is because many learning activities

in the brain based learning model can support the development of students' critical thinking skills. Some learning activities that support include when students are guided by the teacher discussing in groups to understand the material being taught. This way of learning can require students to be more active in learning. In addition, in learning brain based learning students are given a project, in the form of worksheets, crossword puzzles, whose function is to facilitate students building their knowledge and understanding based on their own learning experiences. Learning activities that students who use a brain based learning model are assisted by crossword puzzles.

The results of the study were supported by Adiansha et al. (2018) Brain based learning is learning that is aligned with the workings of the brain that are scientifically designed for learning, not focused in order, but rather prioritize the fun and love of students to learn so that students can easily absorb the material being studied. In the brain-based learning model the crossword-assisted media emphasizes the involvement of student activities in finding learning experiences by experiencing themselves to be able to apply knowledge.

Lestari (2014) also suggested strategies in learning brain based learning, namely creating a learning environment that challenges students' thinking abilities that are adapted to the way the brain works naturally. One of the media that challenges students 'thinking ability is the media of crossword puzzles with the media of crosswords can be accustomed to developing thinking skills in the context of strengthening the potential of students' brains. This can underlie that the brain-based learning model assisted by crossword media can improve students' critical science thinking skills. The brain based learning model is assisted by this crossword media students are required to put the information obtained into the brain and retrieve the information back if needed, because brain based learning is a recording technique that is able to develop thoughts and improve student memory so students are able to issue its potential and later able to stimulate the brain's work effectively and efficiently.

The strength of the brain based learning model is seen from creating active and meaningful learning situations for students (Purnama, 2016). Students as learners are stimulated to be able to build their knowledge through an active learning process. Building a learning situation that makes all members of the student body move optimally. One example is students actively asking and discussing in the learning process. Referring to the above success of students is determined by how they are able to build knowledge and understanding of a learning material based on their own experiences.

The results of this study are strengthened by research conducted by Mustiada et al. (2014) which obtained the results that the brain based learning model can influence the

learning outcomes of science in class V students of the first semester of elementary school in Bontihing Village. as well as with Rachmaeni (2019) found that the brain based learning model assisted by the crossword puzzle can influence the students' mathematical abilities. Febriana (2019) there is a positive influence on the brain based learning model for the ability to think creatively and social attitudes of students. Gede et al.(2020) found that the application of brain-based learning can improve mathematical problem solving skills in class V. Research Sari & Darhim (2020) shows that there are significant differences between those learned with the brain based learning model and those learned with the conventional model. as well as research conducted by Nur (2016) which shows there are significant differences between students who are taught with a brain based learning model and students who are taught with conventional learning.

These findings have several implications, namely: (1) the ability to understand concepts is very important to be trained for students, because students must know how material concepts are learned so that later they can easily understand the material being taught. (2) related to the findings obtained can strengthen the findings that already exist in the use of brain based learning models combined with the media of crossword puzzles can influence the understanding of concepts and critical thinking skills of science so that the findings of this study can complement the research using the brain based learning model (3) relating to learning that exercises critical thinking skills, the application of the brain based learning model must pay attention to three main issues, learning activities and evaluation. The problem used must be actual or trusted. Learning activities start from orientation, directing students in learning, observing students, presenting their work, evaluating learning. Contribution of the results of this study to the scientific field as a reference for other researchers to conduct research in the same variable or different variables. The potential for the development of research on brain-based learning models assisted by crossword puzzles can be developed by teachers who continue to use the brain-based learning models assisted by crossword puzzles with several modifications to suit the subject matter, school conditions and students. Limitations of this study that might be possible on a broader study are in the subjects studied because the subjects studied are only limited to science.

Conclusion

Based on the results of testing the hypotheses and discussion, the conclusions of this study are as follows: 1) There is an influence of the brain based learning model with the help of crossword puzzles on the understanding of science concepts of fifth grade students of SDN

Cluster VIII Buleleng District in 2019/2020, 2) There is an influence of the brain based learning model assisted by the crossword puzzle media on critical thinking skills of the fifth grade students of SDN Cluster VIII Buleleng District in the academic year 2019/2020, 3) There is an influence of the brain based learning learning model assisted by the crossword puzzle media towards understanding concepts and critical thinking skills of science students in class V SDN Cluster VIII Buleleng District in the academic year 2019/2020.

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