



Literature Study of the Application of Brain Based Learning (BBL) Learning Models to Environmental Science Literacy

Lina Sugiyarti¹; Agung Purwanto²; Mohamad Syarif Sumantri³

¹ Basic Education, Postgraduate, Universitas Negeri Jakarta, Indonesia

² Population and Environmental Education, Universitas Negeri Jakarta, Indonesia

³ Basic Education, Postgraduate, Universitas Negeri Jakarta, Indonesia

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Abstract

This study aims to examine the application of the Brain Based Learning (BBL) learning model for environmental science literacy. This study uses qualitative research with data collection techniques using literature studies by examining various written sources in previous research articles. The results of this study conclude that the Brain Based Learning (BBL) learning model contributes and influences to increase environmental science literacy. The low scientific literacy of students in learning is due to the fact that science learning tends to be boring and does not combine attractive learning models with environmental approaches as meaningful learning.

Keywords: *Brain Based Learning (BBL); Literature study; Science literature; Environmental Insights*

Introduction

Science is a subject that is highly considered in some schools and is often the benchmark of student achievement. As one of the important subjects, science or IPA is also one of the subjects held in the national exam in Indonesia. According to Yunus, et al. (2017), science comes from the word natural science or science, namely natural sciences whose studies include chemistry, biology, physics, and other related sciences, such as geology and astronomy. In addition, science is a way of investigation that tries hard to get data to information about the world and the universe based on observations through proven hypotheses (Toharudin et al., 2011). In line with this statement, Rutherford and Ahgren stated that the framework of scientific thought "penetrates" between disciplines as a general theme consisting of systems, models, immutability, patterns of change, scale and evolution (Liliasari, 2007). Through this theme, science becomes a place for students to develop their thinking skills.

The essence of science refers to the following: (1) characteristics that distinguish science from other ways of knowing it; (2) characteristics that distinguish basic science, applied science, and technology; (3) scientific process and agreement as a professional activity; and (4) standards that define

acceptable scientific explanation and evidence (Rustaman, 2010). Science by its essence is not only oriented to a product produced, but also to the acquisition of the resulting product, and through this a positive attitude is formed in the process of forming science.

In studying science, one thing that cannot be separated from the process is the level of scientific literacy for individuals as learners. The definition of literacy is a language skill that includes reading, speaking, speaking, writing, and listening. In accordance with its development, the meaning of literacy has now become broader which includes various sciences so that there are terms scientific literacy, information literacy, mathematical literacy, and so on. In line with the development of information and communication technology, the definition of literacy is a developing concept, which allows teachers to see cultural and linguistic diversity, as a valuable resource for students to engage with new digital media, not as consumers, but as critical producers and creative (Yunus, et al., 2012). By having different backgrounds and abilities, this becomes a challenge for teachers in designing more meaningful learning. Through literacy, students can motivate themselves to be more creative, able to solve problems and explore themselves, and influence the world. Thus literacy learning is very effective in shaping and increasing student learning independence, through mastery of strategies and skills that can be used by students to learn independently.

The existence of literacy makes a new term, namely scientific literacy. Scientific literacy consists of two groups of viewpoints, namely: (1) a point of view that supports the main role of science as a science (science literacy), and (2) a point of view that sees the use of scientific literacy for society (Holbrook & Rumnikmae, 2009). Through scientific literacy, individuals who study science are expected to be able to develop life skills. This means that by studying science not only learning about science but also provision to study other specialists in the field of science.

Another similar definition is the capacity to use scientific knowledge, to identify problems and draw evidence-based conclusions in order to understand and help make decisions about the natural world (natural world) and the changes made to that world through human activity (OECD, 2000). This definition implies that scientific literacy is more directed at how science and an understanding of science become a solution in making decisions for any existing problems through scientific activities accompanied by evidence in identifying problems and their conclusions.

Then PISA developed and defined scientific literacy as: (1) scientific knowledge and the use of scientific knowledge to identify questions, acquire new knowledge, explain scientific phenomena, and draw evidence-based conclusions about issues related to science; (2) understanding the characteristics of science as a form of human knowledge and investigation; (3) awareness of how science and technology shape matter, intellect and culture; and (4) willingness to be involved in science issues and scientific ideas as reflective citizens (OECD, 2007). Based on the understanding of this concept, studying science must be oriented to technology that has characteristics, knowledge, and is associated with developing issues and is related to science itself. This is intended to form a cultured, intellectual generation.

To be able to achieve the goal of studying science as the study of nature and often associated with technology, an insight into the environment is needed. In linking science, literacy, and environmental insight, a term that connects the three is environmental science literacy. Insights according to the Big Indonesian Dictionary (KBBI) are reviews, views and conceptions of point of view. Environmentally friendly is the use of natural and human resources by harmonizing human activities with the ability of natural resources to sustain them (Regional Development Planning Agency, 2015). It can be concluded that environmental insight is a perspective that combines the environment including resources to maintain the balance of nature and living things in a sustainable manner.

As a learning resource in studying science, the environment can be used for learning media. According to the Indonesian General Dictionary (KUBI), the environment is defined as a circular circle. In Law Number 32 of 2009, the environment or the environment is the unity of space with all objects, forces, conditions and living things, including humans and their behavior that affect nature itself, the continuity of life and the welfare of humans and other living creatures. Other literature says the environment or the environment is the sum of all living and inanimate objects and all conditions that exist in the space we occupy (Supardi, 2003). Another opinion defines the environment or the environment as a "space" where both living and non-living things are in one unit, and interact with each other both physically and non-physically, thus affecting the survival of these living things, especially humans (Soemartono, Gatot P. 1996). Based on the above definition, it can be concluded that the environment is a unified space in which there are living things (biotic) and non-living things (abiotic).

Environmental learning is learning that uses learning objects as real experiences, observes directly, obtains data accurately and can learn independently or in groups (Juairiah, 2014). Another definition of environmental learning is learning that uses the environment as a learning resource. Learning that uses the environment as a learning resource is contextual learning (Kristyowati Reny, et al. 2019). Learning with the concept of learning in which the teacher presents the real world into the classroom and guides students to make a relationship between the knowledge they have and its application in everyday life, however, students acquire not much direct knowledge but are gradually limited from their own construction as a provision. to solve problems in everyday life (Hosnan, 2014). In its implementation, the environment must be designed in such a way as to achieve the expected learning objectives. In addition, the teacher must also be able to invite students to study in the environment around the students in addition to learning that is only done in the classroom through direct school assignments and the environment around the student's home environment.

The process of learning that is environmentally sound consists of education about the environment which provides knowledge related to the environment, both physical and non-physical. Education for the environment is knowledge and insight about the environment to be applied in everyday life and education in the environment, namely insight and knowledge about the environment that comes from the surrounding life (Palmer in Syukri, 2013). Based on this description, it can be concluded that environmentally friendly learning includes understanding, skills and attitudes about the learning system provided by teachers in schools without reducing the meaning of learning for students.

In accordance with the explanation of environmental science literacy, environmental-based scientific literacy is a learning design that makes science a solution for decision making of all problems related to science and makes the abiotic and biotic environment a learning resource for meaningful learning so that students can maintain sustainability and natural balance.

Environmental science literacy learning can be applied directly, namely by inviting students to learn to make direct observations, identify statements, conduct experiments and conclude experimental results based on the results of observations made. In carrying out environmental science literacy learning, it needs to be balanced using the right learning model so that students' scientific literacy can increase.

Selection of the right learning model can affect the science learning objectives to be achieved. In addition, to be able to influence students' scientific literacy so that it can increase, the appropriate learning model is the Brain Based Learning (BBL) learning model. The Brain Based Learning (BBL) learning model is an effort to develop students' brain abilities to develop and optimize their potential (Solihat, 2017). The BBL learning model can optimize the understanding process of students because the process in this learning model is brain-based so that it can hone students' scientific literacy levels. According to Jansen (2011), Brain Based Learning (BBL) is learning according to the way the brain is naturally designed for learning. Another opinion about Brain Based Learning (BBL) is a learning model that is

more directed at how the brain works, where the use of the left brain and right brain is more balanced (Mariyam, 2017).

The theory or philosophical foundation that supports the Brain Based Learning (BBL) learning model, namely the flow of behavioral psychology (behaviorism) proposed by David Ausubel, Edward L. Thorndike and Jean Piaget. Ausubel's theory is famous for meaningful learning and the importance of repetition before learning begins (Ruseffendi in Nurhadyani in Herlina, 2016). Thorndike's theory, among other things, reveals the law of exercise (the law of exercise) which basically shows that the relationship between stimulus and response will be stronger when it is continuously trained and repeated, on the other hand, the relationship between stimulus response will be weaker if it never gets weaker if it is never repeated (Hudoyo) in Nurhadyani in Herlina, 2016). Through learning with the Brain Based Learning (BBL) learning model, it is hoped that students can optimize how the brain works so that learning becomes more meaningful and the subject matter received will be easy to understand.

The purpose of the Brain Based Learning (BBL) learning model is to develop five natural brain learning systems including emotional, social, cognitive, physical and reflective learning (Given in Mustiada, Agung & Antari, 2014). Important components when the brain learns, namely the emotional brain which can generate the desire to learn, the social brain which plays a role in building a vision to see what is possible, the cognitive brain which fosters the intention to develop knowledge and skills, the kinesthetic brain that encourages actions to turn dreams into reality, and the brain reflective which is the ability to think at a high level that will produce wisdom that will make someone able and willing to self-reflect (Jayanti, 2011). Thus, it can be concluded that the Brain Based Learning (BBL) learning model is a learning model that is able to optimize how the brain works, can strengthen students' conceptual understanding in understanding subject matter, and learning that is designed creatively so that it becomes meaningful learning for students.

The strategies of the Brain Based Learning (BBL) learning model according to Asep Sapa'at (2012) are: 1) creating a learning environment that challenges the thinking skills of students; 2) create a pleasant learning environment; 3) create an active and meaningful learning situation for students. The principle of the Brain Based Learning (BBL) learning model according to Caine & Caine (2003) states that the learning process using BBL involves a brain work process in which each student is unique so that the most effective way of learning is in accordance with the learning style and the workings of their brain. -Each, the more often they are trained the better the brain's performance can even develop the thinking skills of students and the potential of students if they are continuously stimulated optimally by involving the right brain and left brain work systems.

The learning steps using the Brain Based Learning (BBL) model generally consist of pre-preparation, preparation, initiation and acquisition, elaboration, incubation and memory coding, verification, celebration and integration. The stages of implementing the learning are carried out sequentially, and an explanation of the stages of implementing the learning is described in Table 1 below.

Table 1. Learning Syntax Using the Brain Based Learning (BBL) Model

Steps of Learning Implementation	Activities
Pre-exposure	- Determine the theme or sub-theme of learning activities
Preparation	- Convey the objectives of learning - Associating material with everyday life or with previous material
Initiation and acquisition	- Preparing students for learning activities by distributing worksheets
Elaboration	- Assist students in conducting discussions during the learning process - Provide material reinforcement to students
Incubation and memory encoding	- Provides opportunities for students to recall or repeat material that has been studied
Verification	- Give questions to students to recall the material that has been studied - Returning to the topic of learning and guiding students to analyze
Celebration and integration	- Provide rewards or awards to students who are active during the learning process

By using the Brain Based Learning (BBL) learning model, there are several advantages according to Jansen (2008). The advantages of using the Brain Based Learning (BBL) learning model include:

- 1) Creating a challenging learning environment: able to train students in challenging situations and conditions, because in the learning process it is designed so that each student can provide ideas from the results of their respective thoughts.
- 2) Creating meaningful learning: students can think and share ideas so that each individual is able to learn by way of exploration (Duman, 2010).
- 3) Creating fun teaching and learning activities: training students' creativity and thoroughness in solving existing problems effectively, and can create a pleasant and conducive learning atmosphere.

Based on the explanation of the relationship between the Brain Based Learning (BBL) learning model and environmental science literacy, this research will explore information to determine the application of the Brain Based Learning (BBL) learning model to environmental science literacy compiled from the findings in several articles. previous research.

Method

This research is a qualitative research using descriptive analysis techniques. Qualitative research aims to gain an understanding of the results of the analysis of the reality which is the focus of research. This research is included in the category of library research or library research. Some of the sources taken in literature study research are books and journals. The process carried out in the literature study, namely: 1) collection of sources; 2) analysis; 3) drawing conclusions.

The data source used in this research is secondary data. Secondary data is data that has been collected, analyzed and concluded in depth by researchers (Sukardi, 2017).

The data collection technique in this research is to determine the location of the search for various articles or data sources both offline through the library and online in the form of google scholar, bookzz, and so on. The data that has been collected is then analyzed by reading at the symbolic and semantic levels. The data analysis technique in the study consisted of three stages, including the following:

- 1) Descriptive analysis: an attempt to collect and compile data, then an analysis of the data is carried out (Surachman, 2000). Various quotations of data obtained or results from previous research as an illustration to be examined again.
- 2) Content analysis: a technique used to draw conclusions through efforts to find message characteristics and is carried out objectively and systematically (Moleong, 2018). In this case, steps are taken to compare the content, as well as to analyze objectively, systematically, and generally so that new findings will be found that will be used as conclusions.
- 3) Critical analysis: more on interpretation because with interpretation we get the world inside, enter into the text and address the meaning behind it (Eriyanto, 2005). Critical analysis is to determine the value that is believed to be drawing conclusions that have been interpreted by means of existing data.

Results and Discussion

The results and discussion related to the findings of this study are based on the findings of several relevant research articles, namely those using the Brain Based Learning (BBL) learning model variable and environmental science literacy. Several articles were analyzed and then concluded new conclusions. The following is a further explanation regarding the results and discussion of the research.

Relevant Research Analysis Related to Brain Based Learning (BBL) Learning Model and Environmental Science Literacy

The following are various relevant studies that have been analyzed from various levels of education by considering the appropriate topic after being selected from various types of articles including:

Finding 1

The research entitled "Learning Science Literacy Through Environmental Utilization" (Kristyowati, Reni, Agung Purwanto, 2019). The results of this study indicate that the literature study related to the title of this study discusses and concludes that learning scientific literacy by utilizing the environment brings students to do activities outside the classroom through direct observation. Through direct observation of the environment, students can identify questions, conduct experiments and conclude experiments based on what they observe. Learning by utilizing the environment can be carried out using various models, methods, or learning approaches so that it can provide students with the correct understanding of scientific literacy.

Finding 2

Research conducted by Izza Ratna Kumala (2016) entitled "Application of Brain Based Learning (BBL) Learning Model to Improve Students' Science Literacy Ability on Buffer Solution Material". Based on these results it can be stated that the Brain Based Learning (BBL) learning model is able to improve scientific literacy skills. This is because the BBL learning model can maximize the use of the left and right brain. The balanced use of the left and right brain is able to improve students' literacy skills because the left brain functions for the competency aspect, while the right brain functions to visualize the information obtained so that it affects the knowledge that will be stored in long term memory. In addition, learning using the BBL model with an attractive learning design can increase student creativity.

Finding 3

Research conducted by Khadija A. Al-Balushi & Sulaiman M. Al-Balushi (2018) entitled "Effectiveness of Brain Based Learning for Grade Eught Students' Direct and Postponed Retention in Science" shows the results between pre-test and post-test achievement. student learning has a difference that has increased from 5.80 to 5.95 with a standard deviation of 1.94 and 2.38 respectively. The difference from the research conducted was the research design used which consisted of three research groups (one control class and two experimental classes). In addition, data collection techniques are also carried out in stages.

Finding 4

Further findings from research entitled "The development of Collaborative Learning Talking Chips on Brain-Based Learning (BBL) for The Junior High School" (Nuri Balemén & Melike Özer Keskin, 2018). There is a difference from the research conducted, namely the research method used is Research and Development (R & D) and the level in the research is the junior high school level. The results showed that 0.78 of the Brain Based Learning (BBL) learning model was effectively used in science learning. In addition, the teacher's response to answering the questionnaire was 98%, and students were 96%.

Finding 5

For further findings, the research entitled "The Role of Brain Based Learning Models in Neural System Learning in Improving Students' Scientific Literacy" (Saadah Kuni, Isnaeni Wiwi, 2019). The results of the analysis of this study state that the Brain Based Learning (BBL) learning model can effectively improve students' scientific literacy. The conclusions from the research results of Saadah, et al. (2019) these are: 1) The results of the critical thinking ability test of students using the Brain Based Learning (BBL) model in learning the nervous system in MAN 1 Semarang Regency $\geq 75\%$ of students achieve scores above the minimum completeness criteria, namely ≥ 70 ; 2) there are differences in students' critical thinking abilities before being given treatment and after being treated with the Brain Based Learning (BBL) model; 3) the student's curiosity ability $\geq 75\%$ of the students achieved a value above the minimum completeness criteria, namely $\geq 85\%$. Thus, the BBL learning model is optimally able to increase student motivation so as to make learning innovative and able to increase students' scientific literacy.

Finding 6

In finding 6, the research entitled "Development of a Brain Based Learning (BBL) Learning Model for Biology Learning" was conducted by Annisatuz Zahro Haryulinda (2020). Based on this research, it was found that the BBL learning model was effectively used in Biology for class X SMA students. This is evidenced by the existence of an N-gain value of 0.81 in the high category of learning outcomes, 82 psychomotor (good category), and 85 critical thinking skills (very good). Student response to learning using the BBL model is 86 with the average category which is very good. Thus, the BBL learning model can be used as an alternative choice for learning that is valid, practical, and also effective to use.

Finding 7

In finding 7, research from Situmorang Risya Pramana (2016) entitled "Integration of Science Literacy Students in Science Learning". The result of this study is that the integration process carried out through the analysis of the components of scientific literacy in science learning tools can be done by linking elements of basic competencies. The process of integrating scientific literacy through basic competencies can be analyzed from determining indicators, learning model subject matter, and the type of evaluation used. Science subject teachers should be able to design student activities by means of demonstration and experimental activities that can bring out scientific literacy in each subject of competence to be achieved. This is because the overall content of science material has the potential to bring up aspects of scientific literacy. In addition, measuring aspects of scientific literacy through assessment can be done by developing questions with the characteristics of scientific literacy including content, process and application.

Finding 8

Furthermore, in finding 8, research by Syofyan Harlinda & Amir Trisia Lusiana (2020) entitled "The Application of Science Literacy in Science Learning for Prospective Elementary School Teachers". The results of this study, namely the application of scientific literacy in science learning using the SCL simulation method with the stages of contact, curiosity, elaboration, decision making, nexus and evaluation, obtained an average result of 82.3% with excellent category results of 60% and good 40%. It takes a consistent application of scientific literacy in learning so that 21st century skills can be trained and become the basis for students to build a nation in the future.

Finding 9

Research conducted by Hadith Siti Namiran, et al. (2017) entitled "The Influence of the Brain Based Learning (BBL) Model and Self-Regulation on Improving Student Concepts on Colloid Material". Based on the results of this study, it can be concluded that several findings are: (1) there are differences in the conceptual understanding of students taught by the Brain Based Learning (BBL) model and the Team Game Tournament (TGT) model; (2) there is an interaction effect between learning models and self-regulation on students' conceptual understanding; (3) understanding the concept of students who have high self-regulation is better taught using the Brain Based Learning (BBL) model than students who are taught with the Team Game Tournament (TGT) model; (4) understanding the concept of students who have low self-regulation is better taught with the Team Game Tournament (TGT) model than students who are taught with the Brain Based Learning (BBL) model. It can be concluded that the understanding of the concepts of students who have high self-regulation is better than understanding the concepts of

students who have low self-regulation, because they are easy to adjust in learning and always think about motivation to get maximum results.

Finding 10

In further findings, the research entitled "Improving Student Science Process Skills with the Brain Based Learning (BBL) Approach" (Helmahria, Hamid Abdul and Sunarti. 2017). The results of this study were an increase in teacher activity, students, science process skills and student learning outcomes. In addition, the students' affective has increased from good enough to good. Students respond positively to Chemistry learning with the BBL model approach to the buffer solution material.

The Relationship between Brain Based Learning (BBL) Learning Model and Environmental Science Literacy

Learning science has an important role in fostering a caring attitude towards the environment and is also one of the important subjects at the basic education level to hone students' scientific thinking skills. In developing students' thinking skills, it is necessary to have scientific literacy which is controlled by students, because scientific literacy can be empowered to hone the potential of a child's brain optimally.

However, currently science learning in Indonesia still has many obstacles and is one of the subjects that students tend to avoid. A study from the Program for International Student Assessment (PISA) explains that in the last few years the average score of the component of scientific literacy among children in Indonesia is ranked 63rd out of 64 countries.

The facts from the results of the PISA study indicate that science learning should be done in the right way, for example to increase student interest in science lessons by using the right learning model. One learning model that can be applied in class is to use Brain Based Learning (BBL). Learning using Brain Based Learning (BBL) can train students' brains to be able to think scientifically (Budiargo, 2016). With a scientific way of thinking, using the Brain Based Learning (BBL) learning model can improve students' scientific literacy skills and contribute to scientific literacy.

Science literacy is the student's ability to use scientific concepts to be applied in everyday life, explain scientific phenomena, and describe these phenomena according to existing scientific evidence (Kumala, 2020). Through the Brain Based Learning (BBL) learning model, it can also be designed using learning stages that allow students to do practicum. It is very important in learning science to have practicum activities to answer various aspects of scientific questions, so that students can find answers independently through the 4th stage, namely elaboration on the Brain Based Learning (BBL) model.

Challenges and Solutions in Applying the Brain Based Learning (BBL) Learning Model to Improve Environmental Science Students' Literacy

In carrying out the learning process using the Brain Based Learning (BBL) model there are challenges that must be considered by the teacher so that the teaching and learning process continues to run smoothly and learning objectives can be achieved. The challenges and solutions that need to be addressed include:

- 1) Allocation of time, it takes more time because in its implementation there are several learning steps that must be carried out, besides that the process must also be conveyed by the teacher to students. The solution that teachers can do is to estimate the right time, for example by designing a really detailed lesson plan.

- 2) The learning environment is less supportive of an environmentally sound learning process, because not all schools have sufficient land as a means of infrastructure during the learning process. An alternative that can be done as a solution is to use an artificial environment or you can use existing facilities such as a projector to present the natural atmosphere in the classroom.
- 3) The learning atmosphere is not suitable, for example the teacher does not divide the study groups evenly. The solution that can be applied is to divide the groups fairly by paying attention to each individual student character.

Conclusion

Based on several previous studies summarized in various articles related to the topic of using the Brain Based Learning (BBL) learning model on environmental science literacy, it is known that the Brain Based Learning (BBL) learning model contributes and influences to improve environmental science literacy.

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