

# The development exair based on brain-based learning and whole brain teaching (exair-brain learning) and its effect on learning outcome for senior high school

A E Lidiastuti<sup>1</sup>, H Susilo<sup>1</sup> and U Lestari<sup>1</sup>

<sup>1</sup> Biology, Universitas Negeri Malang, Malang, Indonesia

Corresponding author: herawati.susilo.fmipa@um.ac.id

**Abstract.** This research aims to create learning model of exair based on brain-based learning and whole brain teaching (Exair-Brain Learning) for senior high school. The method using Reeves model development with has 4 stages. The first stage is analysis of practical problems by researchers, the second stage is development of prototype solutions, the third stage is iterative cycles of testing, and the last stage is reflection to produce. The result first stage learning still does not use how the brain works optimally in the process learning. The result second stage is prototypes learning model of Exair based on brain-based learning combine whole brain teaching (Exair-Brain Learning). The result of third stage validation learning model and limited trial in student senior high school in SMA Islam Malang class XIPA 2 (36 students). The result learning outcome on limited trial has increased (56.06, 66.67, 88.89). Learning outcomes are obtained from quizzes. Validation consists of developing models, and learning media (Syllabus, lesson plan, UKBM). The result on validation development learning model 100% and the category is very valid. The result on validation learning media (syllabus 100%, lesson plan 97.61%, and UKBM 98.02%) category is very valid. The Exair-Brain Learning can improve student learning outcomes.

**Keywords:** *exair based on brain-based learning, whole brain teaching, learning outcome*

## 1. Introduction

The Industry Revolution 4.0 is unique from the perspective of innovation, where innovation is built primarily on the harmonization and integration of varieties discipline and discovery [1]. The demands of the industrial revolution 4.0 in education emphasize that students are capable of having 4C's abilities (critical thinking, collaborative, communication, and creativity). These abilities can be trained through learning. Good learning through a process by creating learning challenging, meaningful learning, and unjoyful learning [2]. A good learning process is through the use of how the brain works optimally. A good learning process is learning that pays attention to the learning environment. A conducive, active and enjoyable learning environment will help students in the learning process. This emphasizes students to be able to relax and be comfortable when study [3]. A comfortable learning environment aims to make the material taught can be understood by students well. Understanding the material can be absorbed by students well can be done through meaningful learning by involving the brain's potential work optimally.

There two factors influencing human intelligence of the brain: the number of neurons, and the number of connections among the neurons. Increasing inter-neural connections show that students'



understanding is increasingly complex. The ability of the human brain will be optimal if the functioning of the nerves of the brain is well connected. Moving, speaking, thinking and resting are forms of activity that can maximize the workings of the brain, while at the same time normalizing the functioning of the brain. These conditions can be utilized by teachers in the teaching and learning process. The reality that occurs, the teacher only thinks the material taught is conveyed, not how to learn the material to be conveyed. In general, teachers have not yet thought about a learning model that is in line with the brain's potential for students.

The potential of the brain that works optimally can improve learning outcomes. Models of brain-based learning and whole brain teaching can be successful in student learning processes [4]. Students who succeed in learning are supported by a learning environment that supports the learning process. A relaxed, fun and challenging learning environment for students can make it easier for students to achieve learning goals. One learning that creates a pleasant learning environment and maximizes all brain potential is the Exair learning model based on brain-based learning. Exair based on brain-based learning consists of example, auditory, thinking, and repetition components [5]. The four components accommodate the modality of students in learning and training students to be able to think at a higher level, one of which is critical thinking and integrating the characteristics of brain-based learning.

Exair based on brain-based learning after review turned out to have weaknesses including active greeting and movement. Active greetings and movements that are made will make students focus on teacher instructions and with the movement will help students to more easily remember important concepts. Models that have active greetings and movements in the learning process are whole brain teaching learning models. WBT is learning that is obtained from an explanation of the role of neurolinguistics about human left and right brain functions. The principle of harmony between the two hemispheres of the brain results in WBT emphasizing active learning [6]. The combination of exair based brain based learning and whole brain teaching (Exair-Brain Learning) models will create a fun, challenging and meaningful learning environment.

## 2. Research method

This type of research is research and development model development [7]. Product development is carried out in the form of development of learning models Exair based on Brain-Based Learning and Whole brain Teaching (Exair-Brain Learning) in learning biology. Development is done by applying Reeves design model. Reeves design model has a 4 stages (analysis of practical problems, development of prototype solutions, iterative cycles of testing, and reflection to produce). The stages carried out in the paper can be seen in the table 1.

**Table 1.** The stage of reeves model.

Stage	Activities
<i>Analysis of practical problems</i>	Looking for information about the problem Examine the theory underlying development Exair based on brain based learning combine whole brain teaching
<i>Development prototype of solutions</i>	Prototype of development model and learning media
<i>Iterative cycles of testing</i>	Validation Limited trial/small scale test
<i>Reflection to Produce "design principles" and Enhance Solution Implementation</i>	Reflection Implementation

Analysis of practical problem collect information related to learning problems, about the learning process carried out by the teacher and student abilities, development of prototype solutions to make prototypes of learning devices that are in accordance with the learning model designed, and reflection to produce to device validation and testing on a limited scale or limited trials. Testing on a limited scale carried out in SMA Islam Malang class X IPA 2 on the subject of Classification of Living Things

2019/2020. The criteria of validation can be seen in Table 2. Validation of learning model Exair based on brain-based learning and whole brain teaching (Exair-Brain Learning) can be measured by following equation:

$$V = \frac{T}{T_s} \times 100\%$$

Where:

V : percentage of validation

T : score obtained

Ts : score maximum

**Table 2.** Criteria of validity.

No.	Score	Criteria
1.	$81,25 \leq x \leq 100$	Very valid, or can be used with minor revision
2.	$62,5 \leq x < 81,25$	Valid, or can be used but needs revision
3.	$43,75 \leq x < 62,5$	Invalid, it is recommended not to use because it needs a major revision
4.	$25 \leq x < 43,75$	Invalid, or may not be used

### 3. Result and Discussion

The result stage of analysis practical problems is teachers used learning model with anonymous learning (explain material and give a task). It was appropriate with the results of observations made by Nurhidayah and Harsono [8] which states that the method often used by teachers to teach with anonymous method. It caused the method was classified as the method with the simplest, easiest preparation, especially in biology learning material in high schools which has a lot of material coverage. The impact of the use of these learning model is dominance of some students in learning while others are not excited. This is made clear from the results of interviews conducted with three biology teachers in high school Malang that not all students are enthusiastic. Biology learning emphasizes direct learning to develop competencies and students are able to understand concepts, scientific processes, with scientific work. Biology learning requires students to be active and independent, and have the discretion to develop all their potential (creativity, initiative, and taste), build knowledge, and competence through an active, interactive, and contextual learning process [9]. This can be obtained through meaningful learning for students by involving the maximum potential of the brain's work.

The result stage of development prototype is design of learning models and lessons media. Prototype of learning model is Exair based on brain based learning combined whole brain teaching, and its called Exair-Brain Learning. The learning model is validated by the learning model development expert. The result of validation model by learning model expert 100%. The result of validation model by user 100%. Exair-Brain Learning is learning model that emphasize the creation of a enjoy full learning environment, as well as maximizing the potential for brain work. Exair-Brain Learning have a potential to transform development; discipline, penetrate culture, collaborative, challenge, and transfer learning. Penetrate culture is important to do, this is so students continue to maintain the culture that exists in society. Culture in society such as courtesy, and respect [10]. This can be do in the learning process. Incorporating culture in exair-brain learning through student activities in the thinking phase. The thinking phase of students collaborating to solve problems through assignments. The culture of discipline can be seen when students can collect assignments on time. A culture of mutual respect can be seen when students listen to the opinions of peers who have different arguments. The culture of courtesy can be seen when students ask by using polite language, and raising their hands when asking.

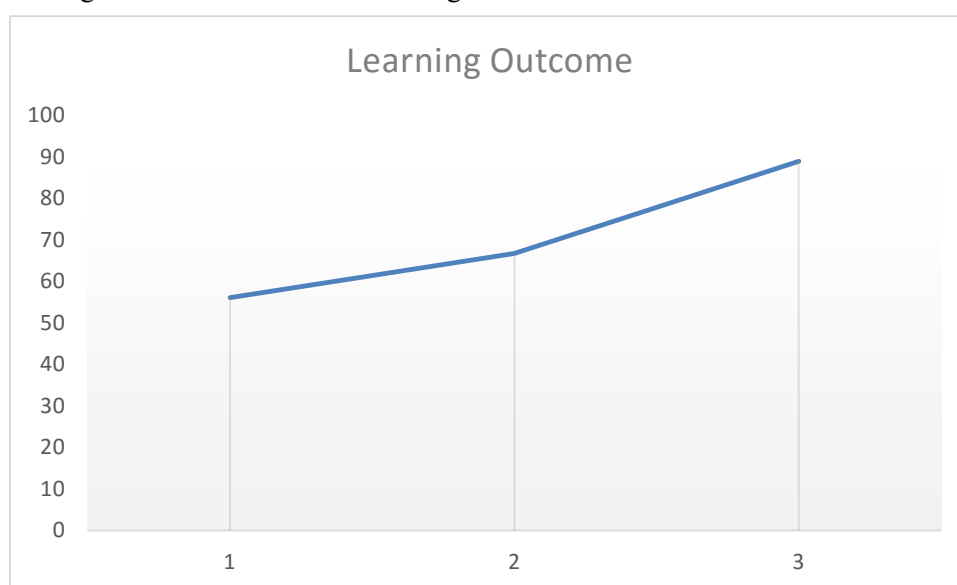
The result of iterative cycles of testing validation of the development of learning model, and the learning media that will be used for quasi-experimental implementation. The result of validation development model is 100% and the result of learning media is 97.61% for lesson plan category is very valid, 100% for syllabus category is very valid, and for UKBM is 98,02% category is very valid. Before

the model use for implementation, tests are carried out on a small scale to measure the applied model obtained from the average results of student grades. The result of outcome learning in a small scale test in table 3.

**Table 3.** The result of outcome learning in small scale test.

Quizzes	Score
1	56.06
2	66.67
3	88.89

Improved learning outcomes can be seen from figure 1.



**Figure 1.** The improved learning outcome in senior high school.

Student scores are obtained from quizzes conducted. Small-scale test functions to know the model used accordingly. The model of Exair based on brain-based learning and whole teaching (Exair-Brain Learning) for senior high school was appropriated with criterion quality, detail are as follow:

- **Brain Gym**

Brain gym is a series of simple motion exercises to facilitate learning activities and adjustments to daily demands. The movements in the brain gymnastics can access both hemispheres of the brain simultaneously, the brain hemisphere will be switched back on and be in an integrated condition. Brain gym is a series of simple motion exercises to facilitate learning activities and adjustments to everyday demands that aim to unite the mind and body [11]. Brain gyms has 26 movements that cover three dimensions of the brain, namely, lateral, focusing and concentration [12]. The lateral dimension for the left and right hemispheres which aims to practice left-right body coordination, the focusing dimension for the back of the brain, the brain stem with the front of the brain, while the focusing dimension is to balance the front and back positions (limbic system) and the cerebrum for coordination upper and lower body. The application of brain exercise in the learning process can be done at all levels of education, does not require expensive costs, and is easy to do. In addition, the application of brain exercise can be combined with all learning methods that teachers want to apply in class, so that with this combination is expected to improve student learning outcomes.

Several reasons were put forward for the need to do brain gymnastics, namely (1) people who have difficulty learning to try too hard, causing stress to the brain, (2) the mechanism of brain integration is weakened, so that certain parts of the brain lack functioning, (3) information received in the back of the

brain is difficult to express, so people feel less successful and stress that results in less enthusiasm for learning or work, and (4) people who lack learning and trying, static performance even decreases and feelings of unsuccessful increase, making it difficult to get out of the environment the negative [13].

- **Class-Yes**

The aims that students can focus on learning with saying “class” and student answer “yes”. When the teacher says class, students answer yes. This is done according to the teacher's intonation when saying. The purpose of “class-yes” is to motivate students to be more enthusiastic in learning. This stage can be done by answering the teacher's instructions in accordance with the intonation given. This can be done also by replacing “class-yes” in accordance with the material to be taught.

- **Example**

The stage is done by exploring student initial knowledge by giving examples that are in accordance with the material delivered with daily life. Cognitive theory focuses heavily on the conception that the acquisition and retention of new knowledge is a function of the cognitive structure that students have [14]. The learning process that begins by giving examples relating to everyday life makes students interested in learning material, because it relates to facts they know in life every day.

- **Auditory**

Consist of 2 stages, the first is “teach-ok”, and the second is “hand and eyes”. This stage is in accordance with the theory of information processing. The process of information in memory starts from the process of encoding information (encoding), followed by storing information and ending with re-disclosing information that has been stored in memory [15].

- **Thinking**

The stage is an application of cognitive learning theory where cognitive aspects of a process of change in perception and understanding can be measured and observed. This model is more oriented to the study of how students learn to think [16]. In addition to the application of cognitive theory, it is also the application of constructivist theory, namely by learning to identify and take decisions in groups so that it is packaged into a process of contracting, not just receiving. The theory of constructivism defines learning as a truly active activity, in which students build their own knowledge, find their own meaning, find out about what they are learning and infer new concepts and ideas with existing knowledge in themselves [17].

- **Repetition**

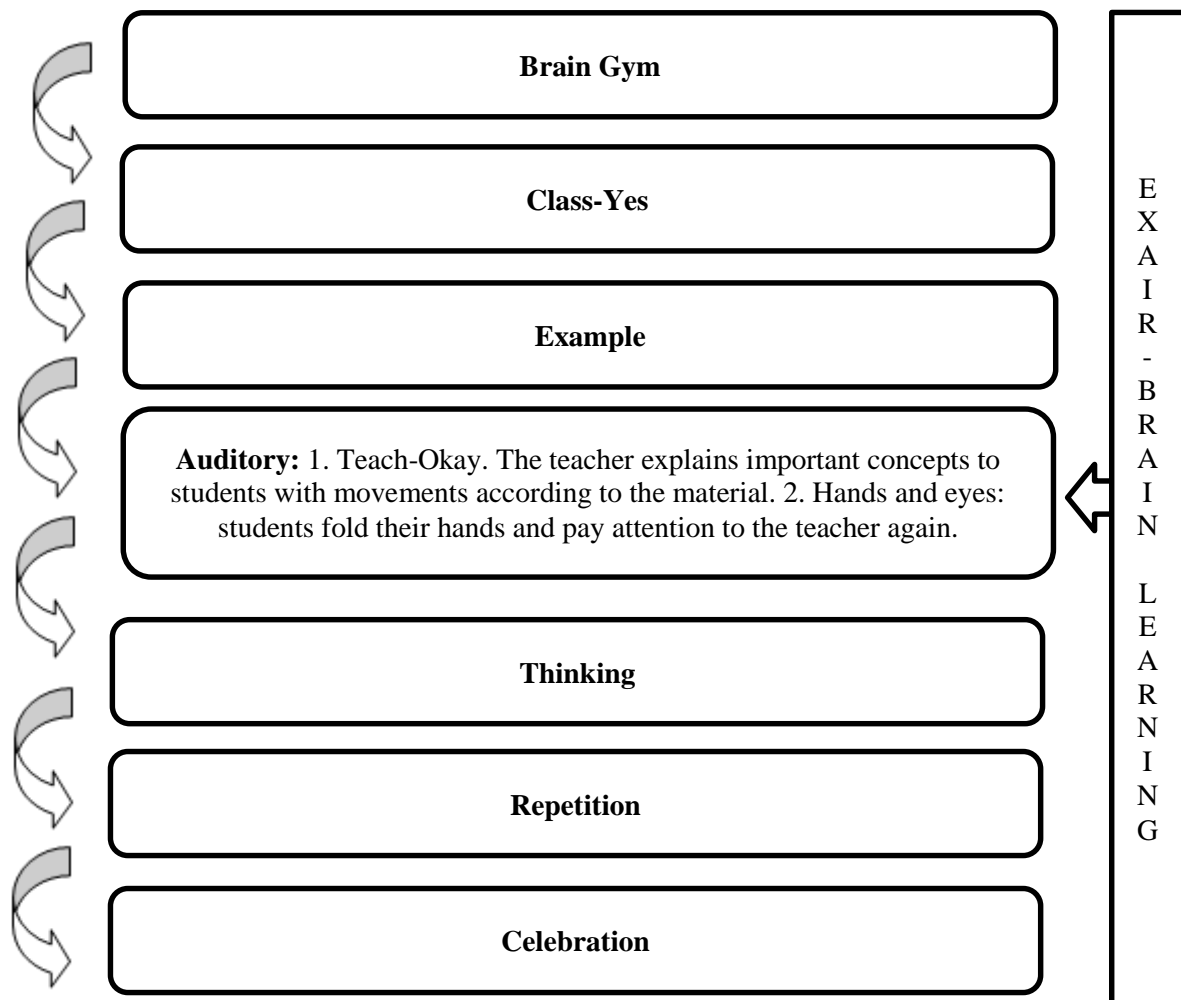
Give quizzes to students in an enjoyable way. This stage is the application of the theory of information processing learning, where information will be held long (long-term memory) if repeated. This repetition is given so that information that has been received by students can be held long in long-term memory (long-term memory). Information will go through three stages, namely sensory memory, short term memory and long term memory [18]. Information will be received through the senses then enter into short-term memory. If information is repeated it will last long in long-term memory. Information that gets special attention will enter through short-term memory. When information has been received in short-term memory, the brain will make sense of that information. Sensory memory, continuously receives stimuli from the environment through the receiver (receptor). Information will be stored in sensory memory of approximately 1-2 seconds for what is seen and 3 seconds for what is heard.

- **Celebration**

Give a reward for students who was active in process learning. Giving rewards must be based on the principle that the reward will motivate students to improve and strengthen behavior that is in accordance with the rules and norms, and strengthen students to avoid themselves from actions that are not desired by the community. In carrying out the awarding it is necessary to pay attention to the quality of behavior, type of action, age, and the situations and conditions in which the reward is given. Reward is an award given to students for behaving well, getting results or having successfully carried out the tasks given by the teacher well so that students are always motivated to repeat their actions. Celebration is one of the educational tools to educate students so they can feel happy, because their actions or work are rewarded. It aims to make children more active in their efforts

to improve or improve the achievements they have achieved. The gift giving is one form of educational tools in the learning process conducted by the teacher for students as a motivator, encouragement and motivation so that students further enhance the achievement of learning outcomes as expected. Details see in figure 2.

Model of Exair based on brain-based learning and whole brain teaching (Exair-Brain Learning) for senior high school can be seen from figure 2.



**Figure 2.** The syntax of exair-brain learning.

#### 4. Conclusion

The result of research can improve learning model. It showed learning model of Exair based on brain-based learning combine whole brain teaching (Exair-Brain Learning) for senior high school were appropriated and fit the quality of educational media, this is because:

- Joyful learning is an emerging trend it is still a “new frontier”. Learning emphasizes brain work and a pleasant learning environment makes students happy in learning so that student learning outcomes are good.
- Developing joyful learning models and make maximum use the brain work potential can be challenging in the midst of an era 4.0.

- The development learning model exair based on brain-based learning combined whole brain teaching (Exair-Brain Learning) have the potential to transform development of students; discipline, penetrate culture, collaborative, challenges; and construct transfer learning.
- The results of small scale test have led to improved learning outcome on students, taking score from 56.60, 66.67, and 88.89.

## References

- [1] Kohnova L 2018 *Int. Scientific Conf.* **4** 64-75
- [2] Vallori A B 2014 *J. of Education and Human Development* **3** 199-209
- [3] Oecd 2009 *Creating Effective Teaching and Learning Environments: First Result from TALIS* Retrieved from <https://www.oecd.org/berlin/43024880.pdf>
- [4] Handayani S and Aloysius D C 2017 *Int. J. of Science and Applied Science* **2** 153-161 <http://doi.org/10.20961/ijsascs.v1i2.5142>
- [5] Lidiastuti A L, J Prihatin, and M Iqbal 2019 *Proc. ICEGE (Jember)* vol 243 (Bristol: IOP Publishing) p 1-8 <http://doi.org/10.1088/1755-1315/243/1/012094>
- [6] Yagcioglu O 2014 *Proc. ERPA (Turkey)* vol 152 (Amsterdam: Elsevier) 258-262 <http://doi.org/10.1016/j.sbspro.2014.09.190>
- [7] Mc Kenney F and Reeves T 2015 *Educational Design Research* (New York: Springer) pp 131-140 [http://doi.org/10.1007/978-1-4614-3185-5\\_11](http://doi.org/10.1007/978-1-4614-3185-5_11)
- [8] Harsono 2008 *J. Pendidikan Karakter dan Profesi Kesehatan Indonesia* **1** 1-5
- [9] Saleh S and Subramaniam L 2017 *J. of Social Sciences* 1-5 <https://doi.org/10.1016/j.kjss.2017.12.025>
- [10] Kapadia R H 2013 *J. of Social and Behavioural Sciences* **3** 97-105
- [11] Schunk D H 2012 *Learning Theories An Educational Perspective* (USA: Pearson)
- [12] Dennison P E and Dennison G E 2005 *Brain Gym Simple Activities for Whole Brain Learning* (USA: Edu-Kinesthetics)
- [13] Erisen Y, Sahin M, and Celikoz N 2016 *Learning Cognitive Learning Theory* (Ankara: Cozum Egitim Yayincilik)
- [14] Dennison P E and Dennison GE 2005 *Brain Gym Simple Activities for Whole Brain Learning*. (USA: Edu-Kinesthetics)
- [15] Gulpinar M 2005 *The Principle of Brain-Based Learning and Constructivist Models in Education* (Turkey: Educational Science)
- [16] Bada S G 2015 *J. of Research & Method in Education* **5** 66-70 <http://doi.org/10.9790/7388-05616670>
- [17] Salem A S M 2017 *Engaging ESP Students with Brain-Based Learning for Improved Listening Skills, Vocabulary Re-tension and Motivation English Language Teaching* **12** p 182-195
- [18] Lee C L 2010 *J. of Educational Technology* **9** 10-21

## Acknowledgment

The author would like to thank all those who have helped, especially for headmaster and biology teacher at SMA Islam Malang who helped.