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Optimizing the potential of children learning in science (clis) with brain gym: review on human circulatory concepts

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ABSTRACT

Learning innovation is an effort to improve the quality of learning. One form of innovations is the integration of brain gym learning techniques and various learning models, including the Children Learning in Science (CLIS) model. However, so far, there has never been a study of learning innovations through the integration of brain gym techniques with the CLIS model. This study aims at finding out the optimizing of the CLIS models with brain gym to empower students' human circulatory conception. This study is quasi-experimental research of pretest-posttest non-equivalent control group design. The population of this study was the students of class XI MIA SMA Negeri 7 Kupang, *consisting* of 173 students. The sample of this study were students of class XI MIA1 and XI MIA 2, *consisting* of 61 students. The instrument used was a test of human circulatory conception developed by Andriani (2017). The results showed that the increase in students' human circulatory conception in CLIS learning combined with a gym is 40.61% *was* higher than the increase in students' human circulatory conception in CLIS learning. It can be concluded that the application of a brain gym can optimize CLIS potential in empowering students' human circulatory conception.

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INTRODUCTION

The learning models can be defined as a pattern that is used as a guide for teachers to create positive interactions with students so that learning objectives can be achieved (Erita, 2016). Through the application of the right model, the teacher will be able to choose the right approach, method, learning technique and teaching material so as to create a learning environment that stimulates students to learn and will create positive learning interactions between teacher and student and students and with other students (Nurdyansyah & Fahyuni, 2016). Furthermore, Corebima (2016) explains that by selecting and applying an appropriate learning model, learning will be avoided from "No Name Learning" or "Anonymous Learning*"* pattern so that the learning becomes directed and can empower students' potential.

The learning model that can currently be applied is a learning model based on constructivism theory (Ahn, 2019; Li, 2017; Zulkarnaen, 2019). In constructivism learning, students are encouraged to be actively involved in conducting their own learning processes so that they are able to construct their own knowledge (Wang & Ma, 2017). Constructivism learning also provides opportunities for students to be able to think creatively and imaginatively in reflecting various learning theories and models so that the students understand the scientific ideas they learn and motivate them to find and use appropriate learning strategies in constructing their own knowledge (Fernando & Marikat, 2017).

Among the various models of constructivism-based learning, one model that can be applied in learning is the CLIS learning model. The CLIS model is a model that was first developed in 1988 by Driver. Referring to the constructivism theory, CLIS models are designed to be able to provide opportunities for students to be directly involved in learning. Students are encouraged to learn actively to collect information, construct their own knowledge, find meaning from that knowledge and make conclusions about new concepts and ideas based on the knowledge they have. In the implementation, CLIS learning is useful for developing students' ideas about a problem in learning and reconstructing ideas based on observations or experiments. It is expected that through hands-on/mind on activities conducted by students, their physical skills and thinking skills can be developed (Arum, 2018; Prabawa et al, 2018; Windarwati, 2017).

CLIS model consists of several stages: orientation stage, elicitation of ideas stage, restructuring of ideas stage, application of ideas stage and review change in ideas stage. In the orientation stage, students are encouraged to focus their attention, realize the importance of the topic of learning and realize the benefits of learning the topic. In the elicitation of ideas stage, students are encouraged to express their initial knowledge and this stage also allows teachers to explore student's knowledge. An important stage is the stage of restructuring ideas, where students are encouraged to construct their knowledge by clarifying activities and exchanging ideas. In the application of the ideas stage, students are encouraged to use ideas that were previously obtained in the third stage. The fourth stage has the benefit of reinforcing concepts constructed by students using new scenarios. Review change in ideas stage is a reflection towards the change of students' ideas by comparing their initial knowledge and final knowledge after (Arum, 2018; Prabawa et al, 2018; Windarwati, 2017).

From the characteristics of the stages of the CLIS learning model, it can be seen that with the application of CLIS, students are given a great opportunity to construct their knowledge so that the CLIS model is good for learning.To uncover the potential of CLIS learning models in learning, so far there has been a lot of researches conducted. Asmi et al, (2018), Indriyani & Desyandri (2019) and Renjani et al (2018) report that CLIS learning model has the potential to improve cognitive learning outcomes, critical thinking skills and students' science process skills. These studies reveal the fact that the application of CLIS allows students to actively manage their learning process. Students not only play a role to listen but are required to actively seek and learn information. Each stage of CLIS learning allows students to be directly involved individually or in groups to obtain and build concepts related to learning material.

Researches conducted have revealed the fact that the CLIS model can be implemented in learning to empower the cognitive aspects of students. However, innovation towards learning models

including CLIS models must be employed continuously. Nielsen, (2019) explains that the implementation of learning innovations allows for an increase in the effectiveness of learning so that learning can empower students' attitudes and abilities in accordance with current demands. Similarly, Kovacs (2017) explains that learning innovations are very important to be implemented so that learning becomes more interactive and in accordance with the 21st century's instructions. Learning innovations especially in CLIS learning can also be done to minimize the weaknesses of the CLIS model as explained by Windarwati (2017). The weakness is that the steps of the CLIS model are quite numerous so it is not easy to implement. If students and teachers are not ready to carry out every step of CLIS learning, the learning objectives will not be achieved.

One form of learning model innovations is a combination of learning models with learning techniques such as brain gym techniques. Cahyanto et al (2016) explained that in learning, a brain gym can be done easily and has great benefits including creating a cheerful and fun learning atmosphere and at the same time it can increase student learning abilities. Similarly, Abdul & Tahar (2018), Marpaung et al (2017) and Rehab (2017) explain that brain gym is a simple activity that aims to harmonize the work of the brain and work of the body. Simple movements in the brain gym can stimulate the brain to work in harmony. Students who do a brain gym will have good academic performance, motivation and focus balance.

So far, the effectiveness of the brain gym in learning has been reported by several studies such as Ocampo et al (2017) and Cahyanto et al (2016). However, information about the potential of a brain gym that is integrated with a learning model is still lacking. Facts about the brain gym that are integrated with the learning model so far have only been reported by Saleh & Mazlan (2019) which combines the learning of I-Think Maps and Brain Gym. Based on this description, this study was conducted as a form of learning innovation through a combination of CLIS and brain gym models. This study is limited to aspects of student's human circulatory conception.

The human circulatory system is a topic that is very important to be learned (Purba et al, 2017). human circulatory related to the study of the circulatory system and its functions, blood components, constituent components of the circulatory system, namely the heart, blood vessels and blood, the circulatory process consists of the process of large blood circulation and the process of small blood circulation and various diseases of the circulatory system in humans. In learning, human circulatory material is one of the material that is difficult to learn so it takes learning patterns that encourage children to be actively involved in learning so that misconceptions on human circulatory material can be avoided (Alkhawaldeh, 2012; Özgür, 2013). So, the purpose of this study aims at finding out the optimizing of the Children Learning In Science (CLIS) models with brain gym to empower students' human circulatory conception.

METHODS

Research Design

This study is quasi-experimental research of pretest-posttest nonequivalent control group design (Sugiyono, 2016). The design of the study can be seen in Table 1.

Table 1.
Quasi-experimental design of pretest-posttest nonequivalent control group design

Group	Pre test	Learning models	Post test
Children Learning In Science (CLIS)	O_1	X_1	O_2
Children Learning In Science (CLIS) combined brain gym	O_3	X_2	O_4

Notes:
O1, 03 = value of pre-test, 02, 04 = value of post-test, X_1 = Children learning in Science model (CLIS) X_2= Children learning in Science (CLIS) combined brain gym.

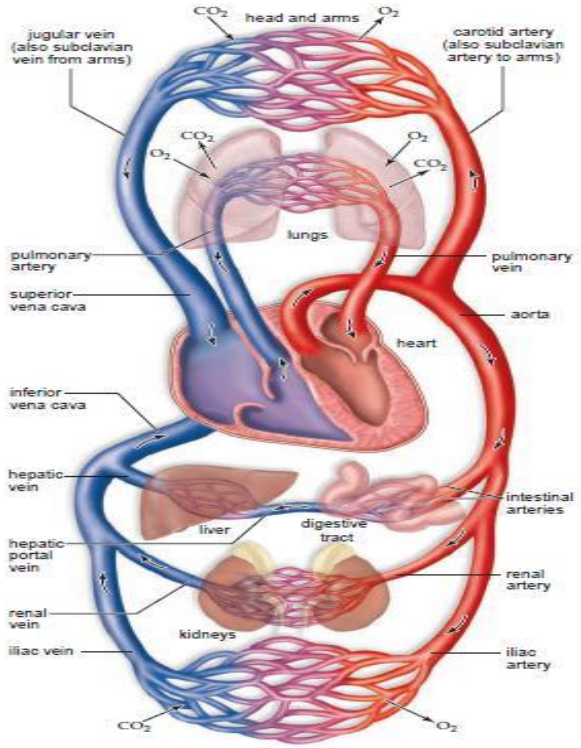
Population and Samples

The population of this study was the students of class XI MIA SMA Negeri 7 Kupang in the academic year 2018 / 2019 consisting of 173 students. The sample of this study were students of class XI MIA 1 and XI MIA 2. Students of class XI MIA 1 consisted of 12 male students and 18 female students. Students of class XI MIA 2 consisted of 14 male students and 17 female students The sampling technique used was purposive sampling, which is the sampling technique with certain considerations (Sugiyono, 2016). The hope is that students who become research samples have equivalent initial abilities. In this study, purposive sampling is based on on the value of student learning outcomes in the previous material where among the five classes, the value of student learning outcomes in class XI MIA 1 is equivalent to the value of students in class XI MIA2.

Instrument

The instrument is a tool used to collect research data. In this study, the instrument used was an essay test of human circulatory conception developed by Andriani (2017). Essay tests is used amounted to 5 described as follows.

1. Blood has a function as a means of transportation as well as a role in immunity, why is that? Explain!
2. When our skin is injured, does the process of blood clotting or the process of closing the wound that occurs first? Write systematically the process that happened!
3. Rendi got an accident and needs a blood transfusion. Rendi has blood type A, his friends who also took him to the hospital are Arif blood type O has blood pressure 110/60, Nina has blood type A with blood pressure 140/90, Bagas with blood type AB with blood pressure 110/70 , and Dara with blood type O with blood pressure 100/80. Who can be a blood donor for Rendi? Give the reason!
4. Look at the picture below!



The human circulatory system is called double circulation because it has two pathways or two cycles through the heart. Arterial blood vessels (red) carry blood out of the heart to organs, while veins (blue) carry blood back to the heart. Why are there different colors in the two vessels? Explain!

5. look at the the following statements
   a. Polycythemia is a problem of lack of erythrocyte production in a person's body. The patient's blood becomes thick.
   b. Anemia is a condition of lack of erythrocyte production, especially in the element hemoglobin.

c. Leukemia is caused by abnormal spinal cord and lymph tissue, so the production of leukocytes decreases.
d. Hemophilia is a disorder in which the patient has difficulty stopping bleeding, hemophilia is not genetic

Based on some of the statements above, which statement is correct? Give the reason

Procedure

This research consists of three stages. The first stage was the pretest stage which aims to determine the human circulatory conception of students before being taught with CLIS learning and CLIS learning combined with Brain Gym. The second stage was the stage where students of experimental class were taken CLIS learning combined with Brain Gym while students of control class were taken CLIS learning. Students in CLIS learning were taught according to CLIS learning steps consisting of orientation stage, elicitation of ideas stage, restructuring of ideas stage, application of ideas stage and review change in ideas stage. While students in CLIS learning combined with a brain gym were taught using a combination of CLIS learning stage and brain gym movements. Flowcharts procedure of research can be seen in Figure 1.

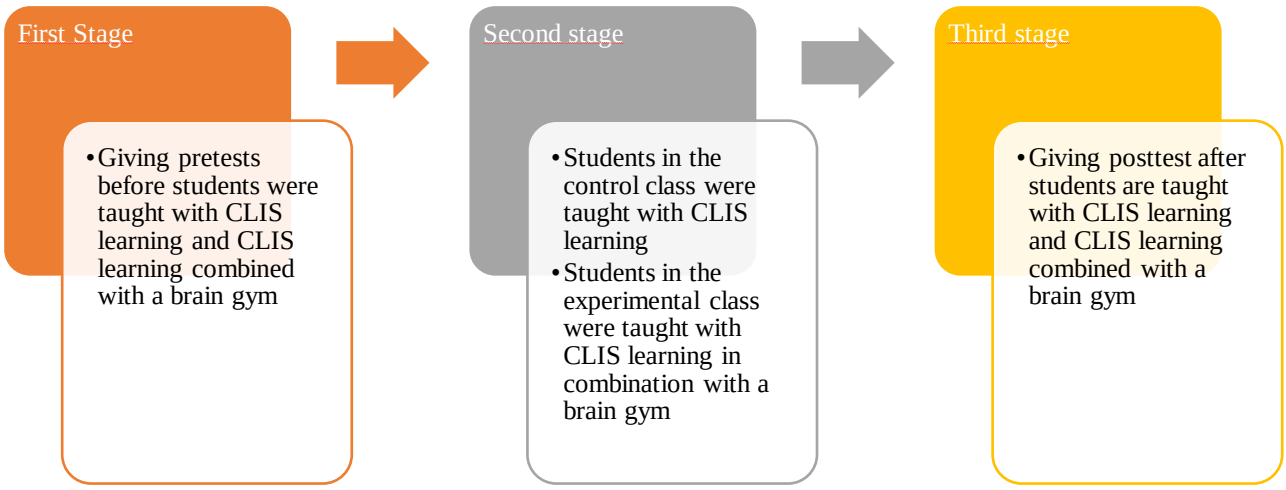


Figure 1. Research Procedure

Data Analysis

The data obtained were then tested for the normality and homogeneity of the data. The normality test used the Kolmogorov-Smirnov One-Sample Test and the homogeneity test used the Levene's Test of Equality of Error Variances. If analysis was known that the data met the assumption of normality and homogeneity, then the test was carried out with ANCOVA. Data analysis was carried out using IBM statistics 24 software with a significance level of 5%.

RESULT AND DISCUSSION

Data on a human circulatory conception of students taught by using Children Learning In Science (CLIS) and students taught by using Children Learning In Science (CLIS) combined with a brain gym are shown in Figure 2. The data in Figure 2 shows that there are differences in the human circulatory conception of students taught by using Children Learning In Science (CLIS) and students taught by using Children Learning In Science (CLIS) combined with a brain gym. Student's human circulatory conception in CLIS learning increased by 20.67 or 57.2% and student's human circulatory conception in CLIS learning combined with a brain gym increased by 31.5 or 69.7%. Furthermore, the results of normality and homogeneity test data can be seen in Table 2.

The data in Table 2 shows that the significance value obtained from the One-Sample Kolmogorov-Smirnov Test and Levene's Test is greater than 0.05 for both pre-test and post-test data. Therefore, it can be concluded that the data obtained from this study is normal and homogeneous data so that it can be analyzed using Ancova. Then, Ancova test results of this research data are presented in Table 3.

Table 2.
The Result of the Normality and Homogeneity Test of the Human Circulatory Concepts

Data	Statistical Test	Sig
Pre-test Human Circulatory Concepts	One-Sample Kolmogorov-Smirnov Test	0.176
	Levene's Test	0.570
Post-test Human Circulatory Concepts	One-Sample Kolmogorov-Smirnov Test	0.053
	Levene's Test	0.750

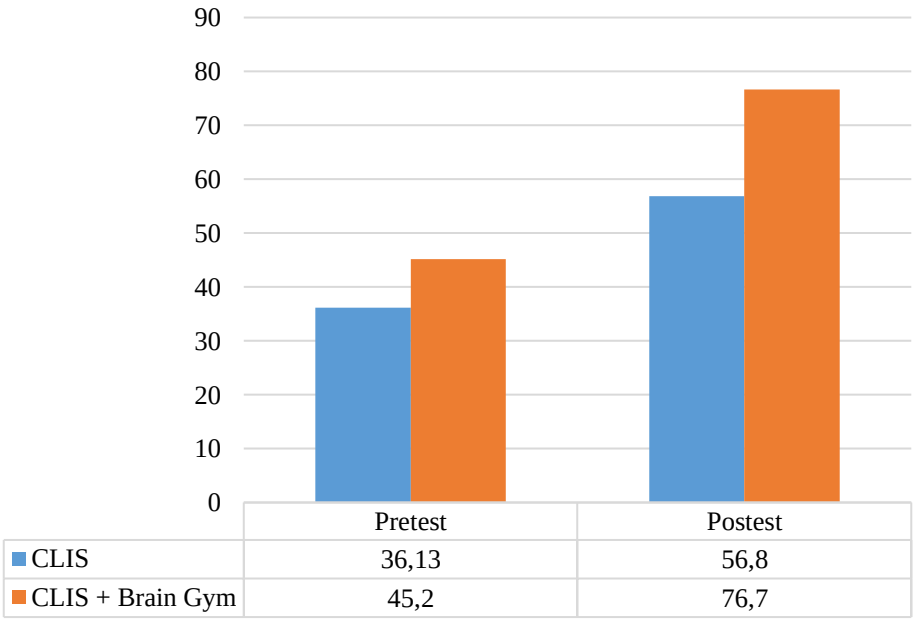


Figure 2. Profile of the Average Value of Pretest and Posttest Human Circulatory Concepts.

Table 3.
The Results of the Ancova Test of the Research Data

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6335.627[a]	2	3167.814	14.035	.000
Intercept	26701.508	1	26701.508	118.298	.000
Pretest	302.664	1	302.664	1.341	.252
Learning	4803.637	1	4803.637	21.282	.000
Error	13091.422	58	225.714		
Total	289650.000	61			
Corrected Total	19427.049	60			

a. R Squared = .326 (Adjusted R Squared = .303)

From the data of the anacova test in Table 3, it can be seen that the calculated F value of learning is 21,282 with a significance value of 0,000 or less than 0.05. It means that there are differences in human circulatory conception between students taught by using Children Learning In Science (CLIS) and students taught by using Children Learning In Science (CLIS) combined with a brain gym. Anacova test results show that there are differences in human circulatory conception between students

who take CLIS learning and CLIS learning combined with brain gym. While the descriptive analysis shows that the increase in students' human circulatory conception in CLIS learning is 20.67 and the increase in students' human circulatory conception in CLIS learning combined with brain gym is 31.5. This value shows that the increase in students 'human circulatory conception in CLIS learning combined with a gym is 40.61% higher than the increase in students' human circulatory conception in CLIS learning. From these facts, it can be seen that the brain gym technique can optimize CLIS learning potential in empowering human circulatory conception of the students.

The optimalization of CLIS learning potential, when combined with a brain gym, can occur because brain gym movements can maximize student's involvement to follow the CLIS learning stages. These stages include the orientation stage, the elicitation of ideas stage, the restructuring of ideas stage, the application of ideas stage and the review change in ideas stage. During the study, the brain gym was conducted in opening activities, main activities and closing activities with the frequency of brain gym implementation that was adjusted to the conditions of students and learning time.

Brain gym in the opening activities aims to create an initial atmosphere of learning that stimulates students' interest in learning. This opening activity is very important because if students have a positive attitude at the beginning of learning, then students have a great opportunity to carry out the learning process. Similarly, Ansar et al (2018), Chatib (2016), Puteri (2018) and Suhana (2016)explai n that in the initial learning activities, teachers are required to be able to create good learning situations that stimulate students' curiosity so that students motivated to take part in learning. Students who have good motivation will have a lot of energy to learn so they can be actively involved in the learning process (Argaw et al, 2017; Sardiman, 2016; Susetyarini et al, 2019; Widiansyah et al, 2018).

Brain gym in the main activities is done to overcome the boredom of students in following CLIS learning. The application of a brain gym to overcome student boredom has previously been reported by Priambodo (2016). During the study, the brain gym in the main activities was carried out when students finished working on the worksheets provided by the teacher, just before the teacher proceeded to the next material or interrupted the stages of CLIS learning. The intensity of the brain gym movements in the main activities is adjusted to the student's condition. Abdul & Tahar (2018) and Marpaung et al (2017) explain that the implementation of brain gym has a positive impact on students because brain gym movements can stimulate brain function and have a positive impact on students' physical. Similarly, Saleh & Mazlan (2019) reported that a brain gym that is carried out in the learning process can relieve the tension that might arise due to the many stages of learning so that students still have attention to the learning material.

Furthermore, the brain gym conducted in the closing activity on CLIS learning aims to relieve student's fatigue that might occur due to participation in learning. It is important to note because in the closing activities students must be in a condition that is ready to conclude a variety of material that has been studied. This is in line with Ganske (2017) which explains that the closing activity becomes one of the stages of learning that is very important to be remarked because at this stage students are given the opportunity to assimilate the lesson and interpret the importance of the lesson.

Facts about students 'human circulatory conception in CLIS learning combined with a brain gym that are higher than students in CLIS learning also show that brain gym, in particular, has the potential to empower students' cognitive learning outcomes. Darmawan & Sujoko (2016) and Hoque (2017) explain that human circulatory conception is related to mental processes carried out for thinking so students are able to process information, construct understanding and knowledge and be able to apply that knowledge to solve problems. The student's thought process is also influenced by the stimulus received by students during CLIS learning combined with a brain gym. This is in line with Marpaung (2017) that explains that stimulation by the brain gym movements in learning can stimulate children's thinking abilities so that students' intellectual abilities can be improved.

Human circulatory conception is related to students' intellectual aspects which are basically determined by the work of the brain. Brain gym is basically made to stimulate the work of the left

brain and right brain relaxes the front and back of the brain and stimulates the work of the systems that control emotions, namely the midbrain and cerebrum. It makes the application of brain gym techniques in learning known to empower the cognitive aspects of students so as to make the learning experience has better quality and learning outcomes can be improved (Cahyanto et al, 2016; Marpaung, 2017).

Unlike CLIS learning combined with brain gym techniques, several obstacles occur in CLIS learning without a brain gym. Students tend to get bored with following the stages in CLIS learning which are quite complex. Therefore, although CLIS learning has the potential to empower students' cognitive learning outcomes, if its application is not accompanied by the application of innovative techniques or methods to suppress boredom and encourage students to follow all stages of learning, the achievement of learning outcomes will not be optimal.

The boredom that occurs in the learning process shows that psychologically students are not ready to follow learning. Azmidar et al (2017) explain that students who are not interested in learning will not be able to participate in learning well. Students who are frustrated with the learning process will not actively seek information about the learning material and will only hear the teacher's explanation. Whereas the actual learning process not only receives information from the teacher but students must actively build their own knowledge. Therefore, the facts about the higher human circulatory conception of students in CLIS learning combined with brain gym could prove that the application of brain gym can increase the potential of the CLIS model in empowering students' cognitive learning outcomes.

CONCLUSION

Based on the results of data analysis it can be seen that there are differences in student learning outcomes in CLIS learning and students in CLIS learning combined with a brain gym. The increase in students' human circulatory conception in CLIS learning combined with a gym is 40.61% higher than the increase in students' human circulatory conception in CLIS learning. It can be concluded that the application of brain gym can optimize CLIS potential in empowering students' human circulatory conception since the application of a brain gym can increase student activity in learning. This research is only limited to the study of students' cognitive learning outcomes. Therefore it is necessary to conduct further research that examines the effect of CLIS learning combined with brain gym on other variables such as motivation, metacognitive skills, critical thinking skills, and other variables.

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