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Implementing Integrated Science Connected Model Learning to Foster Students' Science Learning Outcomes: A Study in Indonesia-Malaysia Border

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Abstract This study aims to discover whether the implementation of integrated science connected model learning can improve students' science learning outcomes in one of Public Junior High School in Border Area of West Borneo. The method used in this study was experimental method by using control group pretest-posttest design. The data analysis showed a difference in learning outcomes between the control and the experimental group, with a significant level of 0.5. Thus, the implementation of integrated science connected model learning can improve the students' science learning outcomes.

Keywords: *integrated science connected model, learning outcomes*

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1. Introduction

One of the border area of West Borneo is Sambas district. Sambas district has two sub-districts which are directly adjacent to Malaysia; Paloh sub-district and Sajingan Besar sub-district. According to the 2013 National Exam results, the average mark of junior high school students in the district for Science was 6.63 as the highest and 5.57 as the lowest, which is poor. Improvements in science learning in the junior high schools need to be done immediately.

According to the questionnaire responses, it was found that all junior high schools in Paloh sub-district still use the KTSP curriculum and separated science learning for VIII classes, which means science is taught separately into three subjects (physics, biology, and chemistry). Moreover, due to the limitations of tools and materials, teachers rarely do experiments in the laboratory. The schools should have implemented the latest 2013 curriculum, where materials of physics, chemistry, biology, and the science of earth and space are presented as a unity in Science subject, and knowledge, skills, and attitudes are also included fully in the learning process.

In this research, the researcher wants to implement integrated science connected model learning on VIII classes in odd semester at one of the junior high school in Paloh, which is Paloh Public Junior High School Number 3. This research aims to discover whether the implementation of integrated science connected model learning can improve the students' science learning outcomes.

Integrated science learning is a model of science learning that presents science as a whole, combining biology, physics, and chemistry as one. In integrated science learning, a topic is discussed and analyzed from various perspectives, through the lenses of biology, physics and chemistry. Students experience the concepts learned through real experience in accordance with the needs of the students. Hence, students could learn and understand the overall science of a topic.

Integrated science learning or integrated learning in general has been researched by many experts and proved to be able to provide more effective and better quality of learning. According to R. Rahayu et al, integrated science learning can help students to understand the science materials and acquire a thorough understanding [1]. According to Oludipe, integrated learning can improve understanding of various science concepts [2]. According to Erekson and Shumway, making connections between and among disciplines (as in integrated learning) provides the setting for increased understanding, retention, and application [3]. According to Fogarty, integrated learning provides a meaningful experience for students, because in integrated learning, students will understand the concepts learned through hands-on experience and connect it with other concepts that have been understood [4].

Integrated science learning or integrated learning in general has also been found to have advantages. According to Department of Education and Culture, integrated science learning improves the efficiency and effectiveness of learning and increases students' interest and motivation [5]. According to Trianto, integrated learning activities are relevant to students' developments, suitable to students' interests and needs, meaningful,

provoking the developments of students' thinking skills and social skills, pragmatic, and more time-efficient [6].

According to Fogarty there are three integrated learning models that can be implemented in science learning on Indonesia's education system level, which are the connected model, the webbed model, and the integrated model [4].

From all other models, the connected model was chosen because it was considered to be the most suitable and simple model for the junior high schools in the border area, in Paloh, Sambas. The connected model allows the integration of concepts in biology, physics, and chemistry with a topic. Whereas in webbed model, several subtopics have to be developed from a single topic in order to integrate the science concepts, which is more complex. In integrated model, various concepts, skills, and attitudes have to be made overlapping each other, which is also more complex. Thus, the connected model was chosen.

2. Methodology

The research was conducted in one of the junior high schools in the border area of Indonesia-Malaysia, Paloh, Sambas. This study examined the effect of implementing integrated science textbook on the learning outcomes with the Nonequivalent Control Group Design applied to students in two classes, 24 students in experimental class and 20 students in control class. The design is as follows:

O_1	x_1	O_2
O_3	x_2	O_4

Description:
O_1: pretest control class
O_2: posttest control class
X_1: lecture method treatment
X_2: connected model treatment
O_3: pretest experiment class
O_4: posttest experiment class

Figure 1. Nonequivalent Control Group Design

The control class was given the lecture method teaching and used the current learning materials (textbook) in the school, where biology, chemistry, and physics are presented separately. Whereas the experimental class used the lecture method teaching with the integrated connected model material, where biology, chemistry, and physics are taught in an integrated way, connected to each other in various topics. In this study, the materials were taught through two topics, food and respiratory topics, given in four meetings. Before the teachers taught the materials in class, the teachers were first trained on how to use and teach the materials in the class.

To obtain the students' learning outcomes, an essay test was given with four questions, which had been validated by biology, chemistry, and physics lecturers. The test assessment rubric is as follows:

Table 1. Test Assessment Rubric

No.	Indicator	Question	Score
1.	Explain the process of food digestion.	The food that we eat will be digested by the body to produce energy. Explain the digestion process that occurs in our body.	6
2.	a. Determine whether additive substances are present. b. Group the packaging materials based on their functions. c. Analyze food packaging based on their nutrients.	Siti bought a packaged food. On the food packaging, it is written the food composition is wheat flour, sugar, vegetable oil, tapioca starch, potato starch, salt, sodium, monosodium glutamate, and FCF Cl15985 food coloring. a. Does the food that Siti bought contains additive substances? b. Group the ingredients contained in the food according to its function! c. Does the food bought by Siti contains nutrients?	 1 5 1
3.	Explain the impact of the composition of food consumed on health.	Lina often experiences gastric pains. Do you think it is okay for Lina to consume drinks that contains oranges, sugar, sodium benzoate, and FCF Cl 15985 food coloring? Explain your opinion!	1
4.	a. Describe the relation between the nutrients contained in a food with the function of the food. b. Determine the enzyme that converts lactose into glucose.	Babies always consume milk and when they are hungry they will cry. a. Explain why babies can feel full/energized although they only consume milk. b. What is the enzyme that converts lactose in milk to glucose?	 1 1

A trial had also been conducted at another equivalent junior high school and produced reliability of 0.73. All test results were processed using SPPS version 19.

3. Results and Discussion

Students' scores were then collected and analyzed. It was found that in pretest, the average score of students in control class was 3.5 whereas the average score of students in experimental class was 6. In posttest, the average score of students in control class was 6 whereas the average score of students in experimental class was 11.5. The comparison is as in the chart below:

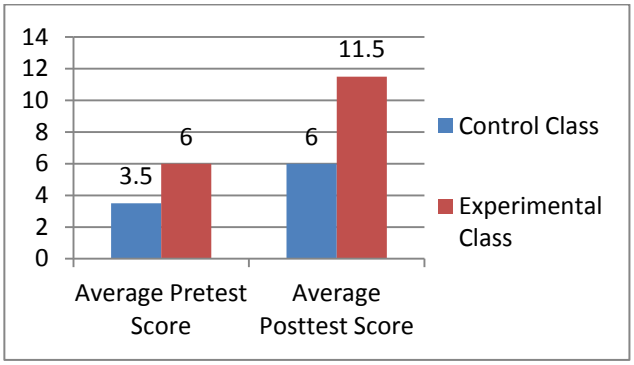

Figure 2. Comparison of Control Class and Experimental Class Average Score in Pretest and Posttest

It can be seen from the chart that the difference between the average pretest score and the average posttest score of control class was 2.5, whereas the difference between the average pretest score and the average posttest score of experimental class was 5.5. In average, the students in experimental class experienced a higher increase in score compared to students in control class.

To determine the normality of the data, tests of normality was done using SPSS version 19. The result is as follows:

Table 2. Tests of Normality

	Shapiro-Wilk			Description
	Statistic	Df	Sig.	
Pretest Control Class	.916	21	.072	Data is distributed normally
Posttest Control Class	.938	21	.195	Data is distributed normally
Pretest Experimental Class	.890	21	.022	Data is not distributed normally
Posttest Experimental Class	.975	21	.834	Data is distributed normally

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction.

Sig. ≥ 0.05, Ho is accepted, meaning the data is distributed normally.

Sig. < 0.05, Ho is rejected, meaning the data is not distributed normally.

Because the pretest control class data is distributed normally whereas the pretest experimental class data is not distributed normally, hypothesis test was done using the Mann-Whitney U Test to determine whether there was a difference of students' initial ability. The result acquired was the Sig. = 0.002 (< 0.05), meaning there was a difference of students' initial ability.

Because there was a difference of students' initial ability, Gain scores test was done. The result is as follows:

Table 3. Gain Scores Analyses

	Shapiro-Wilk			Description
	Statistic	Df	Sig.	
Control Class Gain	.979	21	.903	Data is distributed normally
Experimental Class Gain	.906	21	.047	Data is not distributed normally

Table 4. Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Datagain is the same across categories of Kelasgain	Independent Samples Mann-Whitney U Test	.001	Reject the null hypothesis.

Sig. < 0.05, Ho is rejected, means there was a difference of students' learning outcomes. The difference of students' learning outcomes was due to the different treatment given to each class. The students in experimental class were taught using the integrated science connected model learning, whereas the students in control class were taught using the usual lecture method. The integrated science connected model learning made it easier for students in experimental class to connect between one concept with other concepts and made the learning activity meaningful for the students, this is in accordance with Fogarty's statement.

In further analyses, on question number 1 and 2, most students in control class and experimental class could answer it correctly. But on question number 3, most students in control class could not answer it correctly, whereas students in experimental class were still able to answer the question correctly. Question number 3 requires an integrative explanation. Most students in control class only answered "No/not okay, because there is acid in the stomach", they could not explain the connection between the food composition and its effect on the stomach in terms of health. On question number 4, most students in control class only answered that the babies can feel full/energized because they drank an abundance of milk. They could not explain further in terms of connecting the concept of food nutrients with the function of the food. Whereas in experimental class, most students could answer in further detail, by connecting the concept of food nutrients with the function of the food for body.

4. Conclusion

The implementation of integrated science connected model learning can improve students' science learning outcomes in Paloh Public Junior High School Number 3 at Indonesia-Malaysia border area in Sambas district.

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