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The Application of The Susan Loucks-Horsley Learning Model with a Contextual Approach to Static Fluid Material to Improve Concept Understanding Class XI High School Students

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A B S T R A C T

The problem found from interviews with physics teachers at SMAN 1 Gaung who said that students' understanding of physics material was still low. This is due to the use of learning models that have not been varied so that students' understanding of physics concepts is still low. Efforts to improve students' concept understanding can be applied through learning using the Susan Loucks-Horsley model with a contextual approach. This study aims to improve students' concept understanding. The type of research used is quasi-experimental design with non-equivalent control group design. The population in this study were students of class XI MIPA SMAN 1 Gaung. The samples used were XI MIPA 1 class as the experimental class and XI MIPA 2 class as the control class taken by random sampling which had gone through normality and homogeneity tests. Data were determined through tests that were prepared based on seven indicators of concept understanding. Data were analyzed descriptively and inferentially to determine the category of explanation of students' concept understanding. The research results obtained from the N-gain test score in the experimental class amounted to 0.7 and the control class amounted to 0.3. The score results show that the understanding of the concept of experimental class students is higher than the control class. This research can be concluded that the Susan Loucks-Horsley model with a contextual approach can improve the understanding of the concept of students of class XI MIPA SMAN 1 Gaung.

1. Introduction

Education is a conscious effort and plan made to create a learning atmosphere in the learning process. The more education develops in a country, the bigger and more advanced the country will be. Education has an important role in preparing

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students to live a life that is growing rapidly. The potential possessed by learners can be revealed through the learning process. The physics learning process has great significance and impact on success during the learning process (Sasmita, 2020). One of the problems that often occurs in learning physics is that students sometimes have difficulty understanding and responding to the material provided by the teacher. This is because teachers still apply the lecture approach in learning physics, which makes lessons monotonous and uninteresting (Aini et al., 2018), and inappropriate use of media (Arista, 2021). This is because learning physics requires the ability to count, manipulate, observe, and the ability to respond to a problem critically (Agustin, 2019).

According to Bloom, concept understanding is an action process where students understand the concepts of learning materials so that they not only recognize and know the concepts, but are also able to reexpress concepts that are easier to understand and apply them (Shidik, 2020). The low understanding of the concept is influenced by the approach and learning model applied by the teacher in the classroom. The results of research conducted (Sasmita et al., 2019) indicates that the factors that influence concept understanding ability include the way the material is delivered by the teacher and the teacher's focus on solving problems without providing a deep understanding of the basic concepts of the material.

Based on the results of interviews with physics subject teachers at SMAN 1 Gaung Indragiri Hilir who said that students' understanding of concepts in physics subjects is still low, this can be seen in the results of daily tests on static fluid material in 2022. Of the 31 students in class XI MIPA 1 who reached the KKM score of 70 only 11 students, with an average obtained by class XI MIPA 1 of 64.83. In class XI MIPA 2 with 30 students who reached the KKM score of 70 only 7 students, with an average score of 62.33. The average score obtained from both classes is still below the KKM score of 70, the cause of this low learning outcome is due to students' low understanding of concepts. Sometimes, although students can answer questions, they are not able to apply the same concept to questions formulated in different ways. In other words, students do not have a deep understanding of concepts. This will affect students' physics learning outcomes (Nawati et al., 2017).

Students' difficulties in understanding physics concepts are not only caused by the material presented, but also because teachers do not provide the right learning model so that students do not have a role during teaching and learning activities (Puspita et al., 2017). The selection of learning models should be appropriate and support the achievement of teaching objectives. Therefore, the main consideration in the teaching process is the goal to be achieved. Therefore, a learning model that helps students understand physics concepts is needed. The Susan Loucks-Horsley learning model is one model that can be used because it can connect science with everyday life and involve the analysis process. This model also teaches students to create answers from various sources of information, which will then be delivered contextually (Nurhayati et al., 2019). Susan Loucks-Horsley's model can illustrate the incorporation of science and technology together in four stages. Students are invited to learn; they are given the opportunity to answer their own questions through observation, measurement or experimentation; they create explanations and solutions and implement what they have learned; and they have the opportunity to benefit from their learning and apply it in real life.

The application of approaches in learning is also very important to increase students' learning motivation, which in turn can improve their concept understanding. In this study, researchers combined the Susan Loucks-Horsley (SLH) learning model with a contextual approach in order to improve students' concept understanding of Static Fluid material. The contextual approach is a learning strategy that helps teachers connect the material taught with students' daily lives and stimulates students to link the knowledge they have with how to apply it in their lives. The purpose of this study was to describe students' concept understanding after the application of the Susan Loucks-Horsley Learning Model with a Contextual Approach and to determine the increase in students' concept understanding after the application of the Susan Loucks-Horsley Learning Model with a Contextual Approach to Static Fluid Material compared to conventional learning models.

2. Methodology

This research was conducted at SMAN 1 Gaung Indragiri Hilir which was carried out starting from October - November 2023 in the 2023/2024 school year. The type of research used is quasi-experimental design using non-equivalent control group design as shown in Table 1.

Table 1. Research Design Non-Equivalent Control Group Design

Class	**Pretest**	**Treatment**	**Posttest**
Experiment	O_1	X	O_2
Control	O_3	-	O_4

The population in this study were all students of class XI MIPA SMAN 1 Gaung in the academic year 2023/2024 which amounted to 2 classes and consisted of classes XI MIPA 1 and XI MIPA 2 with a total of 60 students. Sampling in this study used random sampling technique and the sample was determined through normality test and homogeneity test on the population using SPSS 29 based on the pretest results that have been done. The samples in this study were XI MIPA 1 class as the experimental class and XI MIPA 2 class as the control class. The data collected in this study were concept understanding tests in the form of pretest and posttest questions after applying this learning model. The pretest and posttest questions consisted of 25 items arranged based on indicators of concept understanding, namely interpreting, exemplifying, classifying, generalizing, inference, comparing and explaining. The data analysis techniques used in this research are descriptive analysis and inferential analysis. Descriptive analysis was used to see the students' conceptual understanding which was assessed from the pretest and posttest results.

After students undergo the test, the results of their concept understanding will be analyzed using two methods, namely descriptive analysis and inferential analysis. Descriptive analysis aims to obtain the average concept understanding score on static fluid material for experimental and control classes. Students' concept understanding can be measured by comparing the score obtained by students with the maximum score that can be achieved, using the equation:

$$Concept\ understanding = \frac{\sum score\ obtained}{\sum maximum\ score} \times 100\%$$

The scores obtained by students from experimental and control classes will be grouped into concept understanding categories referring to Table 2.

Table 2. Category of Student Concept Understanding

Interval	**Comprehension Category**
75 – 100	Very Good
50 – 75	Good
25 – 50	Quite Good
0 – 25	Not Good

The data obtained is then processed using the N-gain calculation and formulated in the form of the following equation:

$$G = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

The determination of the n-gain category can be seen in Table 3.

Table 3. N-Gain Score Category

Range <g>	**Category**
$g < 0,3$	Low
$0.3 \leq g < 0.7$	Medium
$g \geq 0.7$	High

Inferential analysis in this study was conducted to determine the differences in students' concept understanding when using the Susan Loucks-Horsley learning model with a contextual approach and conventional learning through hypothesis testing.

3. Results and Discussion

Result

The data on the results of students' concept understanding used in this study are data obtained from the results of pretests and posttests given to students before and after applying the Susan Loucks-Horsley learning model with a contextual approach in the experimental class and the application of conventional learning in the control class on static fluid material at SMAN 1 Gaung. The results of descriptive analysis seen through the category of students' concept understanding can be seen in Table 4.

Table 4. Results of Scores Obtained for Each Indicator

No	Concept Indicator	Experiment		Control	
		Pretest (%)	Posttest (%)	Pretest (%)	Posttest (%)
1	Interpreting	28	87	23	69
2	Exemplifying	28	78	20	71
3	Classifying	24	73	23	54
4	Generalizing	33	90	37	75
5	Inference	33	81	36	60
6	Comparing	27	74	20	54
7	Explaining	14	74	18	56
Average score		**25,51**	**78,48**	**23,73**	**62**

Based on Table 4, it can be seen that the understanding of the concept of static fluid material in the experimental class has increased. This can be seen from the average pretest and posttest of each indicator in the experimental class is superior. To determine whether or not there is an increase in the understanding of the concepts of students who apply the Susan Loucks-Horsley learning model with conventional learning, it can be done with the N-gain test and can be seen in Table 5.

Table 5. General N-Gain Test Results

No	Class	Average Score			Category
		Pretest	Posttest	N-gain	
1	Experiment	25,51	78,48	0,7	High
2	Control	23,73	62	0,5	Medium

Based on the results of the data test in Table 5, the average n-gain value of the experimental class is higher than the control class. In the results obtained, the average value of n-gain in the experimental class was 0.7 in the high category and the average value of n-gain in the control class was 0.5 in the medium category. So, descriptively it can be said that there is an increase in students' concept understanding in the use of the Susan Loucks-Horsley learning model with a contextual approach compared to conventional learning. So that this learning model can be applied in physics learning.

Discussion

Based on Table 4, the average pretest score before the implementation of learning in both classes was very low. However, after the implementation of learning that applies the Susan Loucks-Horsley model in the experimental class has increased. The average posttest score obtained by the experimental class is 78.48 and the control class is 62. Based on these results there is a difference in the average understanding of the concepts of the two classes which is 16.48, the experimental class obtained higher results. From this explanation it can be said that applying the Susan Loucks-Horsley learning model with a contextual approach can improve students' concept understanding. Based on the acquisition of data on the results of students' concept understanding, it is found that concept understanding includes several indicators, namely interpretation, exemplifying, classifying, generalizing, inference, comparing, and explaining in the experimental class and control class varies as shown in Figure 1.

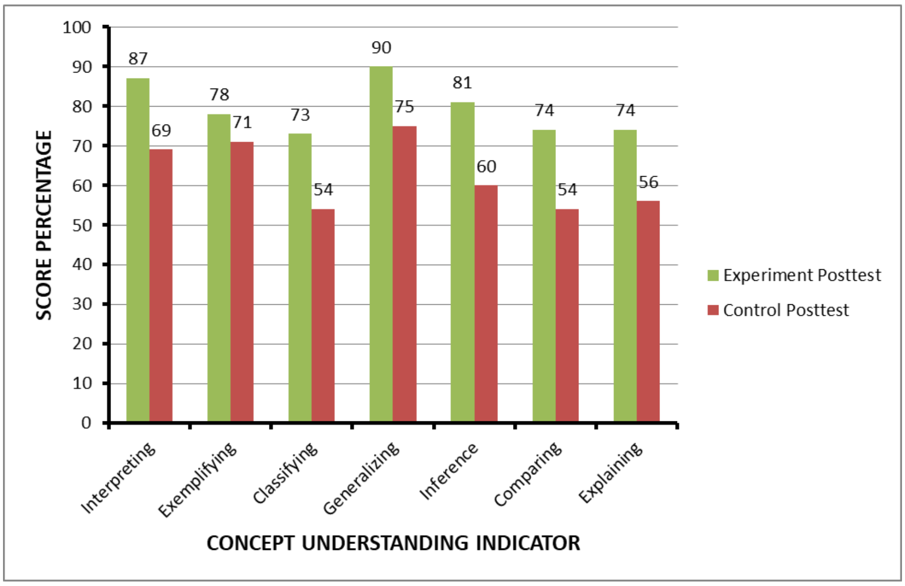

Figure 1. Graph of Comparison Results of Scores of Each Indicator of Concept Understanding.

Based on the diagram in Figure 1, it can be seen that the overall level of understanding of the concept of experimental class students with control classes on each indicator is different. In the experimental class that used the Susan Loucks-Horsley learning model with a contextual approach, it was higher in each indicator of concept understanding than the control class that used conventional learning. As for each indicator of understanding the concept of students, including indicators of interpreting, exemplifying, classifying, generalizing, inference, comparing and explaining. In the experimental class each indicator has its own percentage. Of the seven indicators of concept understanding, the generalizing indicator is the indicator with the highest percentage with a total percentage of 90%, while the indicator with the lowest percentage is the classifying indicator with a total percentage of 73%. In the control class, the same treatment was also applied. The concept understanding indicator that has the highest percentage in the control class is the generalize indicator with a total percentage of 75%, while the lowest concept understanding indicator is the classify and compare indicator with a total percentage of both indicators of 54%. The following is a further explanation for each indicator of concept understanding.

a. Interpreting

Interpreting is the ability of learners to transform information from one form to another. Interpreting can involve the process of converting sentences into other sentences, describing pictures with words, interpreting numbers in the form of words, composing sentences based on numbers, describing sentences into pictures, and so on. Based on Figure 1, it is found that the indicator of interpreting the average posttest score in the experimental class than the control class with the score obtained in the experimental class is 87% and the control class is 69%. The difference in posttest scores between the two classes is 18. The difference in posttest scores is due to the use of the SLH learning model and LKPD in the experimental class which provides exposure to static fluid material and its application in life, so that students are able to identify questions carefully and thoroughly, students are able to understand events correctly based on the images that have been given. This is in line with research (Rohman et al., 2021) when students transform information from one form to another, they are taught to generate a variety of ideas, so that students with a deep understanding of concepts can express a variety of interpretations from their own point of view, including in interpreting a given image.

b. Exemplifying

The exemplifying indicator is the ability to provide examples of a general concept or principle. In the exemplifying indicator, the average posttest score of the experimental class was higher than the control class. From the results of the study, the average score of experimental class students was 78%, which means that students were able to identify the main characteristics of a concept. this is because, in the experimental class, the introduction of problems related to examples of the application of static fluid in everyday life was given. thus, helping students to relate the problem to what happens in life and minimizing misunderstandings that come from experiences that have been experienced by students. This is in line with Suryani's opinion in (Emiliani et al., 2018) if learning is always related to situations or problems in everyday life, then the understanding of concepts obtained tends to last long. In addition, the low score that occurred in the control class was caused by students' lack of understanding of examples that represent a concept, as well as a lack of good understanding of the examples presented. This is in line with research conducted by (Husain et al., 2018) on the exemplify indicator, learners show little ability in working on problems that require them to find case examples that illustrate a concept or principle.

c. Classifying

The indicator of understanding the concept of classifying is when students have the knowledge that something, be it an object or phenomenon, belongs to a certain category of a concept. Based on Figure 1, we can see the difference in the average scores obtained by the two classes, this indicator is the indicator with the lowest percentage compared to other indicators. The experimental class scored 73%, while the control class was 54%. The difference in the average score of the two classes is 19%. This happens because students do not yet have the ability to categorize or classify patterns that are in accordance with the concept, or because of their lack of understanding of the material so that they are often wrong in choosing answers. This is in line with the results of research conducted by (Prihatingsih et al., 2016) which showed that most students could make groupings, but could not explain the basis of the groupings. This shows that although they can understand the problem, they do not use the right concept in solving the problem. The experimental class score was higher than the control class due to active and enthusiastic learners during the learning process that applied the Susan Loucks-Horsley model with a contextual approach. So that students are able to classify hydrostatic pressure, Pascal's law, Archimedes, surface tension and their application in everyday life.

d. Generalizing

The generalizing indicator is the ability of students to make one sentence that describes the information received or abstracts a theme into a concise statement. Based on Figure 1, it is found that the generalizing indicator is the highest percentage compared to each other indicator with a total percentage of 90%. In the control class, the score obtained was 75%, the difference in the average score of the two classes was 25%. Based on the posttest data in Table 4, there is a difference in the average score obtained by the two classes, the experimental class percentage score is higher. This is because experimental class students are applied the Susan Loucks-Horsley model with a contextual approach so that students are able to make a statement or abstract the general theme of a static fluid concept and its application in life. The question on this indicator is in the form of generalizing the understanding of static fluid material in physics learning which is a relatively easy question. This is in line with research (Dewi et al., 2023) generalizing encourages students to choose the essence of information and summarize it, so that students can more easily answer the questions given.

e. Inference

Inference indicator is the ability of students to draw logical conclusions from the information presented. In the inference process, students will collect various information relevant to the problem, accompanied by a correct understanding of the concept. Based on the research results, on the inference indicator, the average posttest score of the experimental class was higher than the control class. Based on Figure 1, the score obtained by the experimental class on the inference indicator was 81%, and the score obtained by the control class was 61%. This is because students in the experimental class were given Learner Worksheets (LKPD) on Archimedes' law which contained steps of student activities that helped them run experiments, manage experimental data, and conclude correctly about a concept that is in accordance with the material in the LKPD. Thus, students can readjust their prior knowledge with the information they get from the results of the experiment. This is reinforced by research (Husain et al., 2018) students have the ability to make inferences or draw logical conclusions from the information provided.

f. Comparing

The indicator of comparing is determining the relationship of two ideas, objects and the like. Based on the research results on the indicator of comparing the average posttest score in the experimental class is higher than the control class. Based on Figure 1, the experimental class obtained an average score of 74% and the control class obtained a score of 54%, the difference in the average scores of the two classes was 20. The difference in posttest scores is due to the higher difficulty level of the questions compared to other questions in the same category. The control class that applied conventional learning using the lecture method, many students did not understand the concept and misconceptions occurred in answering questions related to the comparison of hydrostatic pressure in two different types of liquid. This is in accordance with research conducted by (Trianggono, 2017) students' ability to compare relies heavily on their ability to observe specific details of an object, thus the importance of students' elaboration skills in the comparing process.

g. Explaining

The indicator of explaining is the ability of students to explain the cause and effect that occurs from changing a system. Based on Figure 1, it can be seen that the average score of the experimental class is higher. The experimental class obtained a score of 74% and the control class obtained a score of 56%. The difference in the average score obtained from the experimental class and the control class is 18%. The difference in scoring results is due to the use of the Susan Loucks-Horsley model with a contextual approach in the experimental class, students in groups discuss experiments on Archimedes' Law so that they find for themselves what affects the position of objects in liquid, these findings help them to understand the concept well. The low score obtained in the control class is due to the fact that the understanding is still instructional so that most students only remember a concept without understanding the reasons behind the occurrence of phenomena related to the concept. This is in line with research conducted by (Riwanto et al., 2019) which shows that most learners are able to explain theoretical concepts.

Based on the description of the discussion above, the percentage of indicator scores obtained in the experimental class is higher than the control class. In the experimental class, the average posttest data obtained was 78.48 and the control class was 62, the difference between the posttest scores of the two classes was 16.48. The posttest data will then be analyzed based on the n-gain test to determine the effectiveness of the learning model used. on the results of the n-gain test the score obtained in the experimental class was 0.7 high category, in the control class the score obtained was 0.5 medium category. So, descriptively it can be said that there is an increase in students' concept understanding in the use of the Susan Loucks-Horsley learning model with a contextual approach compared to conventional learning.

The results of inferential data analysis in this study by conducting prerequisite tests first, namely normality test and homogeneity test. Both prerequisite tests were carried out on the pretest value data and then on the posttest value data that had been carried out on both class groups after being given treatment. On the posttest value, the normality test was carried out using the Kolmogorov Smirnov technique which after being tested, it was found that both class groups had a significance value greater than equal to 0.05, namely 0.148 for the experimental class and 0.093 for the control class, which means that both class data were normally distributed. Then in the homogeneity test using the Levene Test test technique, it was found that the two class groups based on the results of the Based on Mean output had a significance value greater than equal to 0.05, namely 0.670, which means that the data of the two classes were homogeneous. After the prerequisite test is carried out, a hypothesis test is carried out which in this study uses the Independent Sample T test. The results of hypothesis testing found that the significance value (sig.2-tailed) in both class groups was <0.001 which is based on decision making if less than equal to 0.05 then H_a is accepted and H_0 is rejected. The results of hypothesis testing can be seen in Table 6.

Table 6. Hypothesis Test Output Results

		Levene's Test for Equality of Variances				**t-test for Equality of Means**	
						Significance	
		F	**Sig.**	**t**	**df**	**One-Sided p**	**Two-Sided p**
Score	Equal variances assumed	.183	.670	5.855	57	<,001	<,001
	Equal variances not assumed			5.851	56.686	<,001	<,001

Based on the explanation of descriptive and inferential analysis, it can be seen that in the descriptive analysis obtained experimental class n-gain test data of 0.7 with a high category and control class of 0.5 with a medium category, in the inferential analysis obtained hypothesis test data with a significance value <0.001, meaning that there is a significant difference in the level of understanding of student concepts between the control class applying the conventional learning model and the experimental class applying the Susan Loucks-Horsley learning model with a contextual approach. This means that the application of the Susan Loucks-Horsley model with a contextual approach in the experimental class has a positive effect on students' concept understanding and is better able to improve students' concept understanding during the learning process.

4. Conclusion

Based on the results of research conducted at SMAN 1 Gaung by applying the Susan Loucks-Horsley learning model with a contextual approach, it was found that students' concept understanding was better than the class that applied conventional learning. Evident from the pretest and posttest scores of concept understanding that have been tested using the N-gain test, the class using the Susan Loucks-Horsley model is in the high category and the class applying conventional learning is in the medium category. There is a significant increase in students' concept understanding between the class applying the Susan Loucks-Horsley model with a contextual approach and the class applying conventional learning. This is evidenced from the hypothesis test which shows significant results from both classes. Based on the conclusions that have been presented, the author recommends that the application of the Susan Loucks-Horsley learning model with a contextual approach can be used as an alternative to be applied in the physics learning process at school. It is suggested that further research be conducted on the Susan Loucks-Horsley learning model which can be combined with various learning media containing experimental elements to improve the quality of the educational process, especially physics subjects in the future.

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