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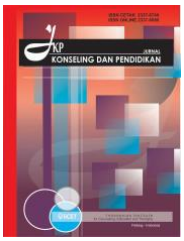

The effect of a learning approach based on experience and prior knowledge on the mastery of the concept of static fluids

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ABSTRACT

The development of science and technology in the world of education today has dominated the development of other sciences. Science is the study of natural phenomena. These natural phenomena can occur at any time without being realized by humans. This study aims to determine the difference in concept mastery between students who are taught with an experiential learning approach and students who are taught using a conventional approach to class XI Science at SMA Negeri 2 Makassar in the 2020/2021 academic year, to determine the differences in conceptual mastery between students who have high and low initial knowledge. This research is a type of quasi-experimental research (quasi-experimental), involving two groups, namely the experimental group and the control gro up. The data analysis carried out is descriptive and inferential analysis to examine the proposed hypothesis. The conclusion of this study is that there are significant differences in concept mastery between students who are taught using an experiential learning approach (PBP), there are significant differences in conceptual mastery among students who have high prior knowledge and there is an interaction between the learning approach and prior knowledge of mastery of students' physics concepts.

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Introduction

Problem-solving is the individuals or groups skills to finding solutions for a problem in physics learning that is conceptual and related in daily life, which involves the knowledge and actions possessed (Yadaeni et al., 2018). This skill has been a core part of education for decades in developing knowledge and understanding in various learning contexts (Michelini & Stefanel, 2019), as well as the most important learning outputs in the field of science especially physics (Bolger et al., 2012). One physics concept that is often found in the application of daily life is static fluid (Krist et al., 2019). Some researches still find student difficulties in solving problems in Hydrostatic Pressure, Pascals' Law, and Archimedes' Law.

Education is a process of activity that is very important and useful in human life (Mahmudovna, 2021). Education for humans is a process of discovering and developing oneself in all dimensions of personality(Mirzaei et al., 2021). Formal education in it cannot be separated from the educational process called the teaching and learning process (Palau et al., 2021). The subject of the educational process is the teaching and learning process (Vakaliuk et al., 2021). The point of the educational process is students who learn (Renatovna & Renatovna, 2021). The function of education is to guide students to a high-value goal, that is, if a situation occurs, these students can increase their knowledge and skills and have the right attitude (Khan & Zhao, 2021).

Physics as a branch of Science in addition to Biology and Chemistry is the basis for mastering and applying technology in education (Shoiynbayeva et al., 2021). Efforts to develop Science and Technology

must be accompanied by quality efforts(Rozenblatt-Rosen et al., 2021). One of the competencies required of learning Physics based on the curriculum is mastery of concepts, principles, principles and laws of Physics(Sundari et al., 2021).

Static fluid is one of the physics concepts taught in high school. Until now, students still have difficulty understanding concepts related to static fluids (Kusairi et al., 2017), especially the Archimedes concepts (Lima et al., 2014) and hydrostatic pressure (Loverude et al., 2003). It fails to meet minimum standards due to students' lack of conceptual understanding (Loverude et al., 2003), lack of in-depth physics training (Zacharia & De Jong, 2014), lack of teacher conceptualization and lack of refreshment for teachers in the form of training in deepening physics (Qhobela & Moru, 2020). To overcome the difficulties faced by students, conceptual questions can be applied to diagnose the extent of students' understanding of the material being studied. In addition, the application of problem-based learning that is based on conceptual to stimulate students and connect them with the real world. (Jamaludin & Batlolona, 2021)

Students will have difficulty in accepting new concepts or materials taught next, if students do not understand the previous basic concepts (Supena et al., 2021). It is important if students have initial abilities as a provision to understand the material that will be given(Meylasari et al., 2021). This study aims to determine the difference in concept mastery between students who are taught with an experiential learning approach (Hermansyah et al., 2021) and students who are taught using a conventional approach to class XI Science at SMA Negeri 2 Makassar in the 2020/2021 academic year, to determine the differences in conceptual mastery between students who have high and low initial knowledge in class XI science at SMA Negeri 2 Makassar in the academic year 2020/2021 and to determine the effect of the interaction between learning approaches and prior knowledge on the achievement of mastery of students' concepts in class XI science at SMA Negeri 2 Makassar in the academic year 2020/2021.

In general, to increase interest in physics lessons, students must understand the concepts of physics very well and related to gadgets (Astuti et al., 2018). In the concept of physics, analysis and depiction are required in understanding it (Bhakti et al., 2020). Images are a visual form of understanding something, one of the conditions of the image to apply the concept of physics that is to use android-based digital comics as a learning medium. One of the learning media that can be used in learning is comics. Comics are a medium consisting of fictional and non-fiction ideas delivered through visual images to explain the course of a story (Toh & Kaur, 2016). Comics can enhance and enlarge communication by facilitating readers to create their understanding. In this era, the limited number of comics in the mass media is explicitly scientific (Putra & Iqbal, 2014).

Method

This research is a type of quasi-experimental research (quasi-experimental), involving two groups, namely the experimental group and the control group. The variables of this study consisted of independent variables, moderator variables and dependent variables. The data analysis carried out is descriptive and inferential analysis to examine the proposed hypothesis. The populations in this study were all students of class XI IPA SMAN 2 with a total of 209 students. The sample was determined by using a random sampling technique. This research was conducted in class XI IPA SMAN 2 Makassar. Data collection in this study used a test consisting of two types, namely a written test and a preliminary knowledge test. The data collected includes data on students' prior knowledge and pretest data on concept mastery. The data collection technique used in this study consisted of data on initial knowledge and data on students' conceptual mastery. The data analysis carried out is descriptive and inferential analysis to examine the proposed hypothesis.

Results and Discussions

The data obtained consisted of data on students' prior knowledge of physics during the initial knowledge test conducted at the beginning of the research process and data on mastery of physics concepts from the results of data analysis both descriptively and inferentially, along with the dis cussion on static fluid material obtained from giving a concept mastery test after the research by using a learning approach based on experience and conventional approaches.

The analysis carried out on the data for pretest and posttest data is normality test using x2 test, homogeneity test using variance test or F_{max} and hypothesis testing using the average similarity test T test. Initial knowledge data was obtained through giving a test with multiple choice questions. The initial

knowledge of students is divided into two categories, namely high initial knowledge and low initial knowledge. The distribution of students in each group can be seen based on table 1.

Based on table 1 above, it shows that for each class group the distribution of the number of students is the same, namely 9 students for each class who have High initial knowledge and 9 students who have low initial knowledge. The concept mastery score data was obtained with a multiple-choice written test consisting of 28 items (can be seen in the appendix). The data on the students' concept mastery scores for the posttest group 1 and group 2 are presented in table 2.

Table 1. Total Distribution of Students in Each Group

Pendekatan (A) Early Knowledge (B)	Based Learning Approach (PBP) (A1)	PK (A2)	Total
High (B1)	9	9	18
Low (B2)	9	9	18
Total	18	18	36

Table 2. Scores of Concept Mastery and Initial Knowledge of Class XI IPA 3 Students with Experience-Based Learning Approach.

No.	No. Sort Respondents	Score PK	Score PA	Description
1	6	16	10	Low
2	21	14	10	Low
3	27	13	10	Low
4	18	19	11	Low
5	26	16	11	Low
6	20	14	12	Low
7	24	15	12	Low
8	19	16	13	Low
9	22	17	13	Low
29	16	25	20	High
30	4	22	20	High
31	8	24	21	High
32	10	21	21	High
33	11	23	21	High
34	12	20	21	High
35	35	21	21	High
36	15	20	21	High
37	32	23	21	High
Total		339	289	
Range		18,83	16,06	
Standard Deviation		3,79	4,94	
Variants		14,38	24,41	
Score Minimal		13	10	
Score Maximal		25	21	
Score Ideal		28	27	

Based on table 2, it can be seen that the maximum score obtained is 25 out of a possible 28 score and the minimum score obtained is 13 out of a possible zero score so that the average score obtained is 18.83. Because the sample was determined by using a random sampling technique. Based on table 2 above, it can also be made a distribution table of the frequency distribution of the physics concept mastery test scores for students of class which is presented in table 3.

Based on table 3, it can be seen that there are no students who are in the very Low category and 1 student is in the Low category. There are 8 students (44.44%) in the medium category. In the 18-23 range, there are 7 students (38.89%) in the High category and 2 students (11.11%) in the very High category. Based on the results of the analysis above, it can be concluded that the mastery of the concepts of students in class can be said to be good, because most of the students are in the medium, high and very high categories. Based on table 3 above, a histogram of the distribution of concept mastery test scores based on prior knowledge of Physics is made as shown in the figure 1.

Table 3. Frequency Distribution of Students' Physics Concept Mastery Scores taught with an Experience-Based Learning Approach (PBP) in class XI IPA 3.

Score Range	Frequency	Percentage (%)	Description
0-5	0	0	Very Low
6-11	1	5,56	Low
12-17	8	44,44	Medium
18-23	7	38,89	High
24-29	2	11,11	Very High
Total	18	100	

Meanwhile, the posttest score data for mastery of Physics concepts and prior knowledge for classes taught using a conventional approach in class XI IPA 4 are presented in table 4.

Table 4. Concept Mastery Score and Initial Knowledge of Class XI IPA 4 Students with Conventional Approach.

No	No. Sort Respondents	Concept Mastery	Early Knowledge	
			Score	Description
1	32	13	7	Low
2	5	15	8	Low
3	21	11	8	Low
4	26	15	9	Low
5	14	13	10	Low
6	18	16	10	Low
7	27	14	10	Low
8	29	15	10	Low
9	24	17	11	Low
29	15	19	19	High
30	30	20	19	High
31	16	19	20	High
32	35	17	20	High
33	36	18	20	High
34	9	18	21	
35	10	17	21	
36	7	20	22	
37	31	18	23	
Total		295	268	
Range		16,39	14,89	
Standard Deviation		2,57	5,97	
Variants		6,60	35,63	
Score Minimal		11	7	
Score Maximal		20	23	
Score Ideal		28	27	

Based on table 4, it can be seen that the maximum score obtained is 20 out of a possible 28 score and the minimum score obtained is 11 out of a possible zero score so that the average score obtained is 16.39. Completing the description of the data above, a frequency distribution table and a histogram of the physics concept mastery score of class XI IPA 4 SMAN 2 Makassar are presented..

Table 5. Frequency Distribution of Students' Physics Concept Mastery Scores taught with the Conventional Approach in Class XI IPA 4 at SMAN 2 Makassar.

Score Range	Frequency	Percentage (%)	Category
0 – 5	0	0	Very low
6 – 11	1	5,56	Low
12 – 17	10	55,56	Medium
18 – 23	7	38,89	High
24 – 29	0	0	Very high
Total	18	100	

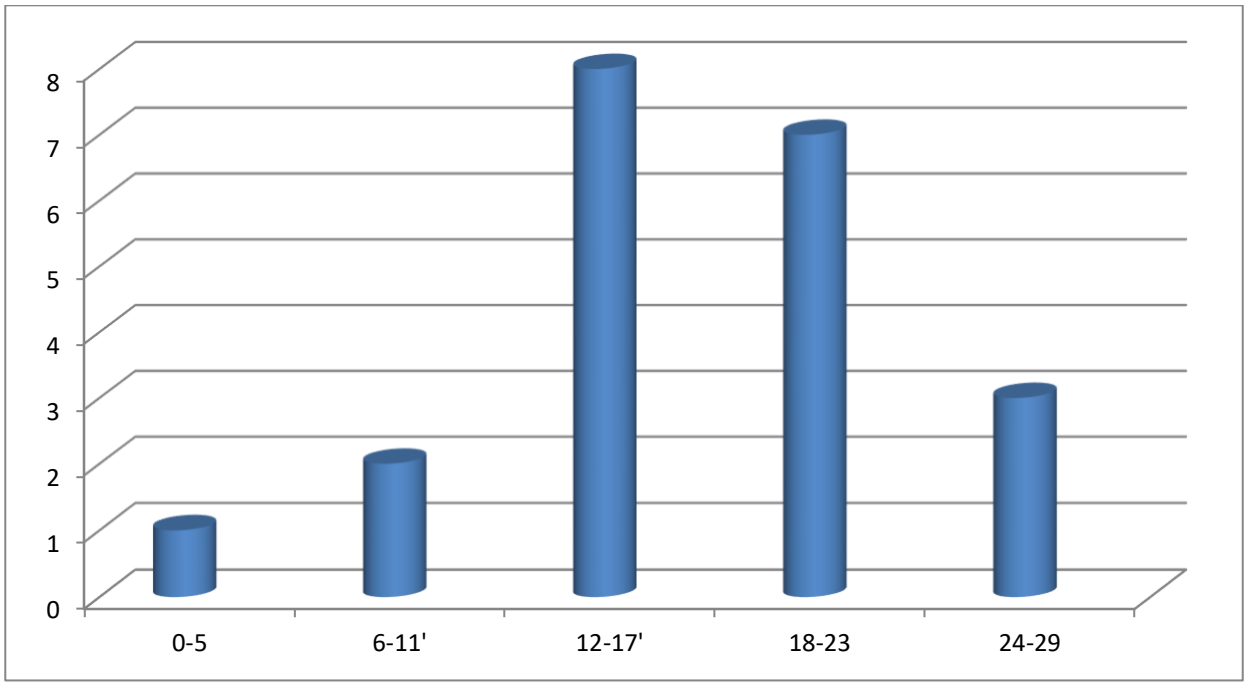

Figure 1. Histogram of Physics Concept Mastery Scores for Class XI IPA 3 Class Students with PBP.

Based on table 5, it can be seen that there are no students in the very low category and 1 student in the low category. There are 10 students (55.56%) in the medium category. In the 18-23 range, there are 7 students (38.89%) in the high category and no students (0%) in the very high category.

Based on the results of the analysis above, it can be concluded that the mastery of the concepts of students in class XI IPA 4 SMAN 2 Makassar can be said to be good because most of the students are in the medium and high categories. Based on the data in table 5, it can be seen the histogram as shown in Figure 2.

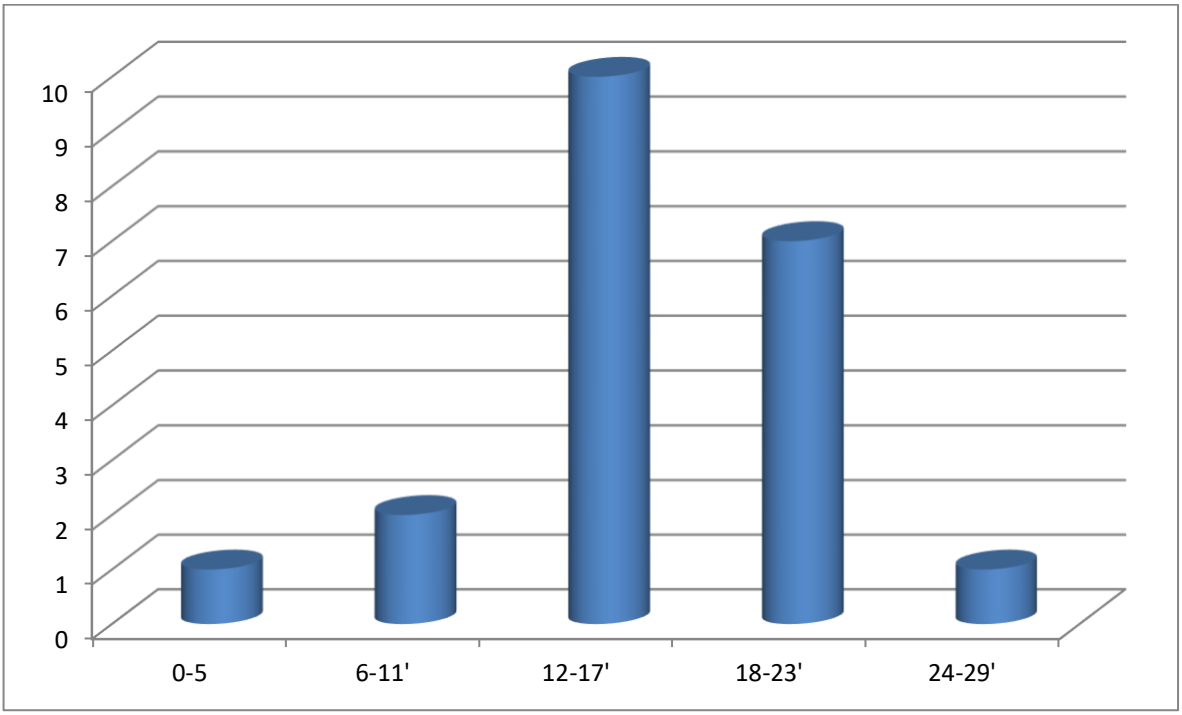

Figure 2. Histogram of Physics Concept Mastery Scores for Class XI IPA 4 Students with a Conventional Approach.

For each category of students can be grouped into 4 treatment groups, namely groups of students taught using PBP with high prior knowledge, groups of students taught using PBP with low knowledge, groups of students taught using conventional approaches with high prior knowledge and groups of students who are taught with a conventional approach with low knowledge.

To see a comparison between the average score of mastery of Physics concepts of students who are taught with PBP in class XI IPA 3 and students who are taught using conventional approaches in class XI IPA 4 can be seen in the following histogram.

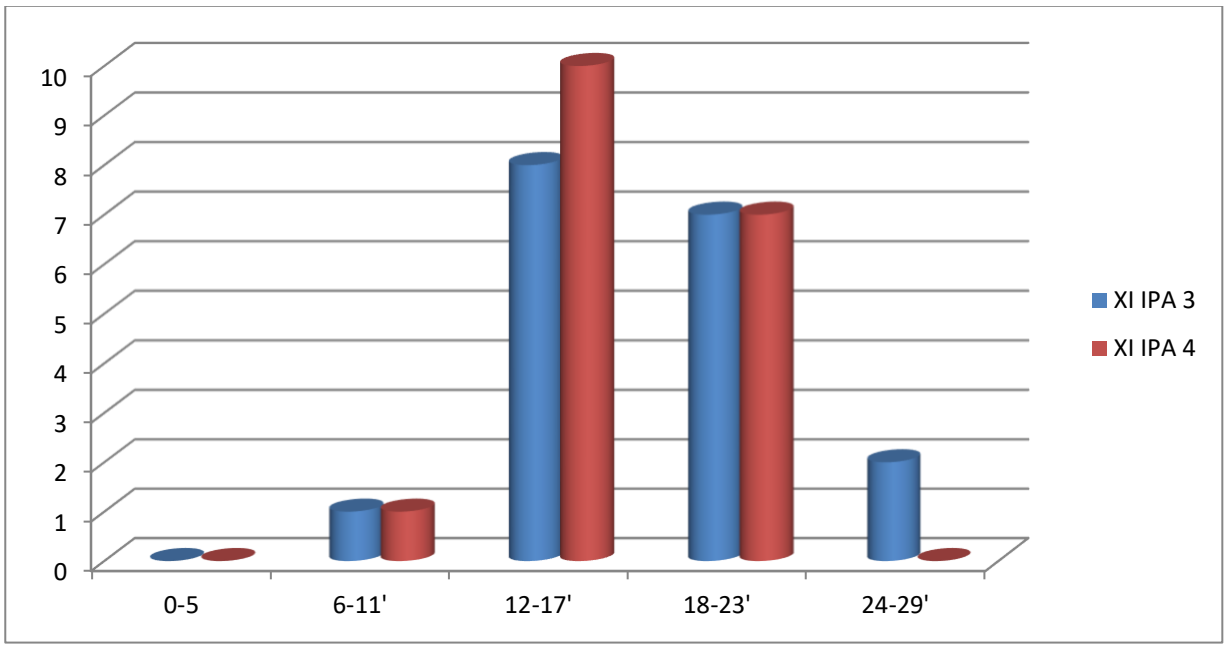

Figure 3. Average Concept Mastery Score Based on Grouping Learning Approach.

Based on Figure 3 above, it can be concluded that for the highest average score at intervals of 0-5, 6-11 and 18-23, the number of students is almost the same between those taught with PBP and those taught with the conventional approach scores of 12-17 were obtained by more students in class XI IPA 4 who were taught using a conventional approach, while for the average score in the range of scores of 24-29, students in class XI IPA 3 were taught by PBP. This shows that the concept mastery score for the very high category is mostly owned by class XI IPA 3 than class XI IPA 4. Meanwhile, class XI IPA 4 itself shows good mastery of concepts in the score range 12-17 for the medium category.

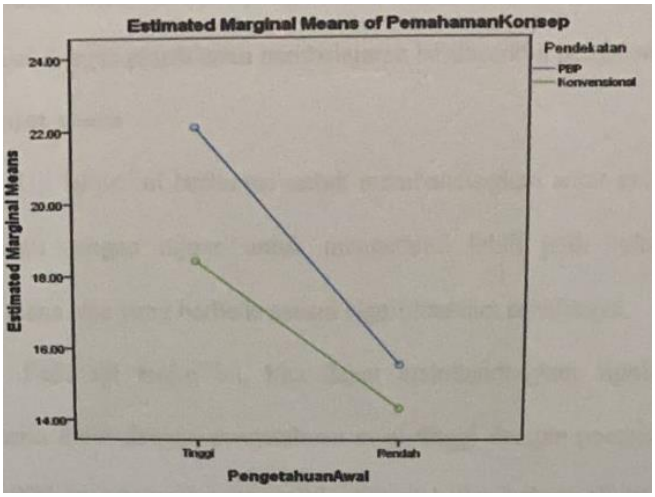

Figure 4. Plot Profile of Estimating Margin Means Concept Mastery of Class XI Science Students.

Figure 4 above serves to assess whether there is an interaction between variables. If the two lines do not show parallel, then there is an interaction effect. On the other hand, if the two lines are parallel, then there is no interaction effect. However, in the graph above there is no intersection between the two types of color

lines, but if the two lines are extended, then the two types of lines will meet, which indicates that there is an interaction between the variables in this study, namely the learning approach, prior knowledge and mastery of concepts Physics students.

Based on the picture above, it can be concluded that there is an interaction between the learning approach, namely PBP and the conventional approach and the initial knowledge of students in the category of high and low initial knowledge on students' conceptual mastery, where these two types of learning approaches are good for the types of students who have initial knowledge is high and low, but based on research data, a higher concept mastery score is obtained for classes taught with an experiential learning approach.

Conclusions

Based on the results of data analysis and research results as described in the previous chapter, it can be concluded that there is a significant difference in concept mastery between students who are taught using an experiential learning approach (PBP) and students who are taught using a conventional class XI approach. IPA SMAN 2 Makassar in the academic year 2020/2021, there is a significant difference in mastery of concepts in students who have high initial knowledge between those taught with an experiential learning approach (PBP) and students of XI IPA SMAN 2 Makassar in the 2020-2021 academic year who are taught with a conventional approach and there is an interaction between the learning approach and prior knowledge on the mastery of physics concepts for class XI IPA SMAN 2 Makassar students in the 2020/2021 school year. This research is useful to be able to add references for researchers regarding the types of learning approaches that are suitable for the development of students' conceptual mastery in the learning process in the classroom, can be used as material for consideration by researchers, especially physics educators to maximize the teaching and learning process(Makhrus et al., 2021).

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