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The Effect of Discovery Learning on Student Learning Outcomes: Elasticity and Static Fluid Contexts

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Abstract: Physics learning at school still shows the implementation of the learning model teacher's use is still learning with a teacher-centred teaching and learning process that creating low student learning outcomes. Therefore, a study was conducted by employing the discovery learning model to increase student learning outcomes. The type of research conducted was a quasi-experiment with the research design RandomisedPossttest Only Control Group Design. With the same number of sample class members, namely 36 students. The research data includes student physics learning outcomes on cognitive aspects. Data analysis techniques employed are normality test, homogeneity and hypothesis testing at the real level of 0.05. Based on data analysis, average physics learning outcomes of students in the knowledge aspect of the experimental class is 82 higher than the control class which is 76. Hypothesis testing of the posttest conducted $t_{count}<t_{table}$ where 2.52 > 1.66 H_0 is rejected and H_1 is accepted, it can be concluded in the study that the usage of the discovery learning model has a significan effect on the physics students' learning outcomes a real level of 0.05.

Keywords: Discovery learning model; Elasticity; Physics learning outcomes; Static fluid

Introduction

Curriculum is a system of rules and regulations concerning learning outcomes of graduates, study subjects, assessment and processes used as guidance for the organisation of study programmes (Kemendukbud, 2014). The learning process within the 2013 curriculum one of the standardisedRetrieved from elements that is has changed to achieve successful teaching and shaping student competencies. Authorities in the Education and Culture Minister decree of the Republic of Indonesia No. 65 of 2013 concerning process retrieved fromelaborating that in carrying out the learning process in the 2013 curriculum in school establishment must conducted in an interactive manner, be inspiring, enjoyable, stimulating, encourage Learners can increase creativity, provide space for initiative, provide opportunities to participate actively according to talents and interests to be able to improve the physical and psychological development of learners (Waybin, 2014). According to Law No. 20/2003 article 3 (Depdiknas, 2003), National education has the hope of increasing the potential of learners in order to become human beings are faithful and devoted to Almighty God, morally good, physically fit, educated, capable, functional, creative, self-sufficient, and a democratic and highly responsible citizen. To realise the objectives of national education, alearning process is held at school in multiple fields of study, including physical science.

Physics as one of the natural sciences is in the spotlight in the development of education, especially in school learning Relevance of scientific concepts, among them are applied to increase studentcapabilities to comprehend physics concepts that can be spotted in daily life (Maison, 2018). Physics is a subject that in the learning process uses various natural events to improve students' deductive analytical thinking skills and develop knowledge and skills using mathematics that can be used to solve problems qualitatively and quantitatively, and a confident attitude (Aryanta, 2022). In the other hand, Physics is one of the lessons which is regarded as difficult and is usually avoided by some students because it is perceived to be is very

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challenging, sometimes frustrating, requires perseverance, accuracy and a lot of practice, so in reality not many students like physics (Putra & Hidayusa, 2019).

Students' attitudes towards learning physics are also influenced by other factors such as lack of motivation provided by the teacher during the learning process, stagnant and unvaried learning models, and strategies as well as many students who think that learning physics is only for smarter students in the exact field who can quickly understand physics (Sari, 2018). Currently, the main problem in learning physics is still centred on the teacher and has not provided access to students to develop independently and find their own concepts in the learning process. This is due to learning conditions that still apply learning that tends to the teacher as the centre of learning so that students will become passive (Simanjuntak et al., 2019).

Learning outcomes are learning achievements owned by students after receiving knowledge from learning. Learning outcomes are one of the goals of the learning process which includes three aspects, namely: attitudes, knowledge, and skills (Yusuf, 2017). Improving physics learning outcomes is also an important task for a teacher, including how to guide students to real learning and be able to solve problems and find concepts independently in the learning process (Ramadhanti et al., 2022). One of the models that can be used by a teacher is through a learning model where the main role is the student while the teacher is only a facilitator (Hapsari et al., 2021). Implementing students'worksheets can be help students be active, creative, and easy to understand. learning then students can obtain satisfactory learning outcomes (Fatimah, 2022).

In the physics lesson process, low student learning outcomes are obtained because the learning model used by the teacher is still not interesting for students, the interaction between students and teachers is still lacking during physics learning activities where the teacher is still monotonous and the learning models and methods used by teachers during the learning process are still less innovative and varied (Laili et al., 2015). This can also be seen from the response of students who tend to be passive and their understanding of the material, especially static fluid, is still lacking. Students' problem-solving skills in physics learning are still lacking as a result, students' physics learning outcomes are still relatively low and have not achieved learning completeness (Usnila, 2022).

Either of the innovative the learning model used is discovery learning. The discovery learning model is either model that is in accordance with the 2013 curriculum which contains a scientific approach. According to Rahmayani (2019) the Discovery Learning is a method of cognitive learning that asks teachers to be more effective in finding condition that can make students actively learn to create knowledge of their own. Discovery activities through learning activities can increase students' knowledge and skills stimulantly and give students the ability to discover knowledge of their own, so that this process will be remembered by students for a long time. According to Yuliasari (2017) the discovery learning uses an inductive approach or investigation to learn, this strategy presents problems to be solved through trial and error so as to provide a great opportunity for students to develop their cognition in creating a solution to the issue. The Discovery Learning has several advantages:learners Active in the learning environment, as they learn to think and apply their skills abilities in finding the final result; learners truly comprehend the learning content, as they engage in the process of discovery that is obtained in this way is longer remembered; self-discovery raises satisfaction in learners; learners acquire knowledge with this model will be more able to apply their acquired skills to a variety of different contexts; this model trains learners to learn more on their own (Suherman, 2003). Key characteristics of the discovery learning are student-centred, exploring and solving problems to create, connect and generalise knowledge, as well as the process of integrating the new and the old knowledge. Discovery happens when indicators are involved, primarily in the use of their mind processes to encounter concepts and principles (Lestari, 2022).

According to the observations conducted with the physics teacher of class XI SMAN 4 Padang, the learning model implemented by the teacher is mostly monotonous and not student-centred, which emphasises more on the process of transferring knowledge from teacher to student in the classroom. The physics learning process that is most often used is learning that places students as objects in classical learning activities with the lecture method resulting in a lack of active student roles in the course learning process when following the education and study process. The teacher asks questions, students answer the teacher's questions and tend to be dominated by only a few students. This is also due to the implementation each syntax of the learning model not optimal, there is only explaining the material directly in front of the class.

The physics material that will be discussed in this study is elasticity and static fluid. According to Azizah (2015), elasticity, static fluid, temperature and heat, optics, and kinematics are difficult materials because physics learning is still often with the lecture method so that students find it difficult to solve problems in the material. The lack of application of the model in learning activities is evidenced by the data on the acquisition of students' daily test results on the material of rotational dynamics and equilibrium of rigid objects which are still far from the set. Student learning outcomes have not reached the school's Learning Objective Completeness Criteria (KKM) value of 80, because the teacher has not used a learning model that is in accordance with the characteristics of the material so that students are passive in participating in the learning process. Based on this, an appropriate learning model is needed to overcome this problem by increasing student activeness within the learning process tocan improve optimal learning outcomes.

Method

The research type employed in this study is a quasi-experiment with a randomised posttest only control group design (see Table 1). This design includes two groups, an experimental group, and a control group. The experimental class is given maintenance at form of learning using the discovery learning, while the control class uses direct learning. After being treated with different learning models, both groups will be given a final test (posttest) to see the effect on student learning outcomes.

Table 1. Research design

Class	Treatment	Posttest
Experiment	X_1	O
Control	-	O

Source: Sugiyono (2015)

The sample technique used in this study was purposive sampling. The sample selection was carried out with the consideration of the subject teacher who categorised two classes that were homogeneous and had the same average ability in terms of the results of the daily test assessment. The two classes were XI MIPA 3 class as the experimental class and XI MIPA 6 class as the control class.

The data in this research are students' physics learning results on elasticity and static fluid materials. The data collection technique used posttest questions in themultiple-choice form as many as 29 questions. The items used in this test has been verified for validity, reliability, difficulty level and differentiation. Before the learning outcomes test is carried out, a trial test of questions in different populations aims to determine whether the test instrument to be used is normal and homogeneous. The questions used in the posttest are questions that have the same indicators, and are in the form of multiple choices with cognitive levels C2 to C5.

Data analysis techniques utiliseda normality test with the Liliefors test and a homogeneity test with the F test. Data requirements are normally distributed $L_c < L_t$ and data requirements have homogeneous variance $F_c < F_t$. Having normally distributed and homogeneous data, then hypothesis testing is conducted with the t test to define whether H_0 is accepted or rejected. The test requirement H_0 is accepted if $t < t_t$ and H_0 is rejected if it has another price at a significant level of 0.05. After processing the data, it was then analysed and conclusions were drawn in the study.

In the implementation of the learning process, the students' worksheet (LKPD) is used so that the discovery that is applied can be implemented properly so that students can improve student learning outcomes. Quantitative research process according to Sugiyono (2015) is as follows.

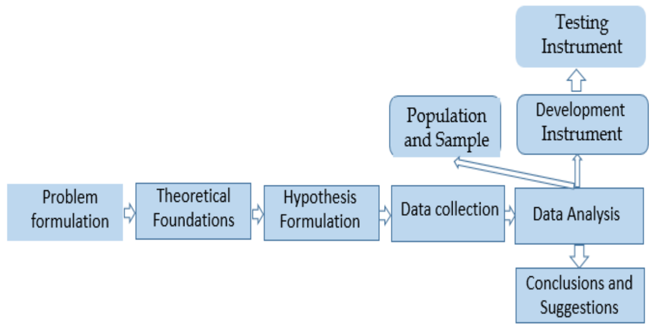


Figure 1. Research flow

Result and Discussion

Description of the Implementation of Discovery Learning Model

In this study, learning was carried out face-to-face using the discovery learning model which took place for 10 meetings with a duration of 6 weeks of learning. The following describes the implementation of the discovery learning model during the learning process

Stimulation

First syntax of the discovery learning model is stimulation. This syntax is carried out in the core activities, namely before starting learning or material. The stimulation stage is a stage for students where students are asked to observe with reading, listening, and viewing activities (without or with tools) to later understand what has been given by the teacher (Permatasari et al., 2022). Stimulation syntax also aims to provoke students' memories of the concepts needed to learn the material.

The first week to the second week, the material taught was elasticity, while the third week to the sixth week the material taught was static fluid. The elasticity material consists of 4 meetings and static fluid 6 meetings with a time allocation of 2 hours of learning each. In this study, the first stage is that students are exposed to discourse that is already on the LKPD as an introduction to the material to be studied, each meeting will have a different discourse according to the material to be studied, the educator presents a stimulus in the form of discourse, images, natural phenomena, observations, or videos to provoke student curiosity. When providing stimulus at the beginning students look more enthusiastic, during the learning process they are more active, and foster student learning motivation so that for the next stage of learning students better understand the material being taught.

Problem Statement

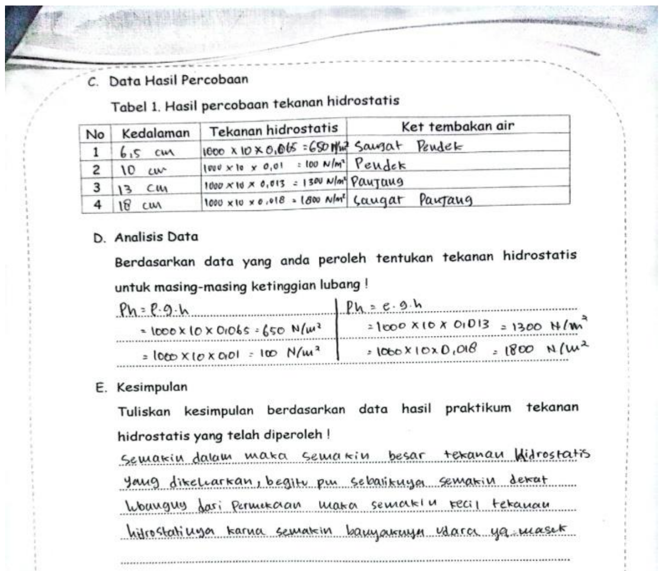
The second syntax of the discovery model is problem statement. In the problem statement syntax, students are directed to identify problems related to the material being studied. The problem statement is to give students the opportunity to identify as many problems as possible that are relevant to the lesson (Masril, 2018). The information collected will then be formulated into a temporary answer that needs to be proven. Through the problem statement syntax, students will be trained to find information to solve a problem. In this study, problem statement activities were carried out by students by discussing with educators using the question-and-answer method and literacy activities or reading books.

After the educator provides a stimulus to students, the educator will then provide an opportunity for students to provide opinions or temporary answers related to the material discussed, then students provide responses or arguments regarding the material discussed. In some meetings, during the learning process after the educator provides a discourse, students are more active and provide a variety of questions, then these questions are formulated into the main questions that will be studied in the learning process in accordance with the learning objectives. Some meetings students are less active in asking questions, so the educator will provide questions that will be studied in the meeting.

Data Collection

The third syntax is data collection. For the implementation of this syntax, learners are divided into groups. In groups, learners collect the information needed to prove the hypothesis. Learners are directed to discuss related activities in the LKPD. In the LKPD, activities have been arranged for learners together with the group to find a correct conclusion.

After the problem statement has been made, then students are asked to collect data guided by the LKPD that the teacher has prepared. This data collection is carried out collaboratively or in groups with practicum activities for each meeting on elasticity and static fluid material. Practical activities begin with student activities reading the objectives of the practicum, preparing tools and materials, then carrying out the practicum by following the experimental procedures in the LKPD, after which students record the data obtained in the experimental data. With practicum activities, students are more active in learning activities, each student collaborates with each other in finding practical data so that they find their own knowledge from the practicum they do. Students who have responsibility will be actively involved in their groups and accept suggestions, criticisms and feel they are not the most correct in their groups. Someone who has an open attitude will also be willing to change his mind if there is more valid evidence submitted by others (Suyanta et al, 2023). There are still some students who do not contribute enough, so this is where the role of educators is to be able to become mentors and supervisors so that data collection activities can be carried out properly and all students have their respective roles in practical data collection.


C. Data Hasil Percobaan

Tabel 1. Hasil percobaan tekanan hidrostatis

No	Kedalaman	Tekanan hidrostatis	Ket tembakan air
1	6,5 cm	1000 x 10 x 0,065 = 650 N/m²	Sangat Pendek
2	10 cm	1000 x 10 x 0,01 = 100 N/m²	Pendek
3	13 cm	1000 x 10 x 0,013 = 1300 N/m²	Panjang
4	18 cm	1000 x 10 x 0,018 = 1800 N/m²	Sangat Panjang

D. Analisis Data

Berdasarkan data yang anda peroleh tentukan tekanan hidrostatis untuk masing-masing ketinggian lubang !

Ph = ρ·g·h
= 1000 x 10 x 0,065 = 650 N/m²
= 1000 x 10 x 0,01 = 100 N/m²

Ph = ρ·g·h
= 1000 x 10 x 0,013 = 1300 N/m²
= 1000 x 10 x 0,018 = 1800 N/m²

E. Kesimpulan

Tuliskan kesimpulan berdasarkan data hasil praktikum tekanan hidrostatis yang telah diperoleh !

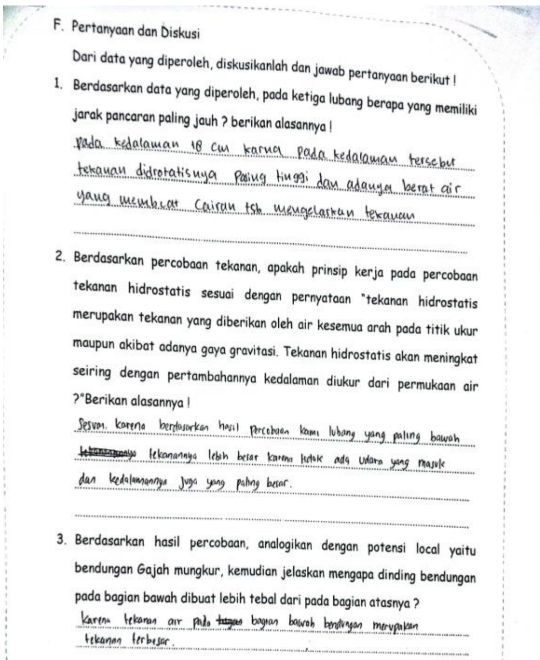
Semakin dalam maka semakin besar tekanan hidrostatis yang dikeluarkan, begitu pun sebaliknya semakin dekat lubangnya dari permukaan maka semakin kecil tekanan hidrostatisnya karna semakin banyaknya udara yg masuk

Figure 2. Student responses on data collection syntax

Data Processing

The fourth syntax is data processing or data processing. Data processing is carried out after learners carry out data collection activities. In groups, learners process the data that has been collected to prove the truth of the hypothesis. Educators continue to guide learners during data processing so that learners' work is more directed. After processing the data that has been collected, learners will obtain results that determine the truth of the hypothesis that has been formulated. These results will then be verified in the next stage.

The data obtained during the practicum then together with the group students process the data to prove the truth of the hypothesis. After that students answer the discussion questions, and draw conclusions based on the data obtained and processed. Based on the answers to students' discussion questions, students have been able to solve the problems given. In several meetings when carrying out data collection in groups, students were more active and enthusiastic about giving their opinions on the data to be processed, students collaborated in drawing conclusions from practical activities in the LKPD. However, there are still some students who do not contribute, so this is where the role of the educator is to be able to become a guide and supervisor so that data processing activities can be carried out properly and all students have their respective roles in processing practical data.


F. Pertanyaan dan Diskusi

Dari data yang diperoleh, diskusikanlah dan jawab pertanyaan berikut !

1. Berdasarkan data yang diperoleh, pada ketiga lubang berapa yang memiliki jarak pancaran paling jauh ? berikan alasannya !

pada kedalaman 18 cm karna pada kedalaman tersebut tekanan hidrostatisnya paling tinggi dan adanya berat air yang membuat cairan tsb mengeluarkan tekanan

2. Berdasarkan percobaan tekanan, apakah prinsip kerja pada percobaan tekanan hidrostatis sesuai dengan pernyataan "tekanan hidrostatis merupakan tekanan yang diberikan oleh air kesemua arah pada titik ukur maupun akibat adanya gaya gravitasi. Tekanan hidrostatis akan meningkat seiring dengan pertambahannya kedalaman diukur dari permukaan air ?"Berikan alasannya !

Sesuai. karena berdasarkan hasil percobaan kami lubang yang paling bawah tekanannya lebih besar karena titik ada udara yang masuk dan kedalamannya juga yang paling besar.

3. Berdasarkan hasil percobaan, analogikan dengan potensi local yaitu bendungan Gajah mungkur, kemudian jelaskan mengapa dinding bendungan pada bagian bawah dibuat lebih tebal dari pada bagian atasnya ?

karena tekanan air pada bagian bawah bendungan merupakan tekanan terbesar.

Figure 3. Student responses on data processing syntax

Verification

The fifth syntax of the discovery learning model is verification. In this syntax, students conduct discussion activities between groups by means of one group presenting in front of the class and other groups paying attention and asking questions. The data that has been processed will then be verified by students, this aims to check the success or failure of the discovery results, then students will communicate or present the results in front of the class. Presentation of practicum results is carried out by each group at each meeting. The group that performs will discuss the results they found, so other groups can examine the results of the discussion. When the presentation activities were carried out, students were more active and many of the questions they conveyed then the group that performed would answer and provide conclusions on the results of the presentation.

Generalization

The first meeting of elasticity material until the last meeting of static fluid material Educators always guides students to conclude the material that has been learned. Conclusions are obtained by conducting verification activities. Then in the closing activities educators and students conclude about the learning activities carried out. Educators provide reinforcement of learning outcomes so that students more easily understand the material. After providing reinforcement, educators give assignments to see students' abilities after learning today's learning.From these learning steps, it can be seen that the discovery learning method wants to have a high level of independence so that students are able to solve the problems by making observations first (Maulina, 2022).

Description of Data on Physics Learning Outcomes in the Knowledge Aspect

Data obtained from the knowledge (cognitive) aspect. Data on student learning outcomes in the knowledge aspect were obtained after the learning process via written tests in the form of objective questions. This test was assigned to both samples at the end of conducting research. According to the outcome of statistical calculations, the average value ($\bar{X}$), standard deviation (S), and variance (S2) of experiment and control class were obtained as in Table 2.

Table 2. Mean, Highest, Lowest, Standard Deviation and Variance of Sample Classes

Class	Rate		$\bar{X}$	S^2	S
	Max	Min			
Experiment	96	62	82	90.74	9.52
Control	93	55	76	112.69	10.61

Table 2 shows mean scores of students' physics learning results in the knowledge aspect experiment class is better from the control class. Standard deviation value of the experiment class is smaller when compared to the standard deviation value of the control class, suggests thatthe physics learning outcomes of the experimental class students are more evenly distributed from the control class. The experimental class variance value is lower relative to the control class, which suggests that the physics Student learning achievement in the control class was further heterogeneous instead of in experiment class.

Data analysis was carried out to see whether the average difference between the two sample classes was significant or not. Before drawing conclusions from the research results, data analysis was carried out through statistical hypothesis checking. Hypothesis cheking is done to decide if the hypothesis is accepted or rejected. The steps taken in hypothesis testing are through normality test and homogeneity test of both sample classes first, then hypothesis testing is carried out.

To see whether the sample class comes from a normal population or not, a normality test is conducted using the Liliefors test. Based on the results of the normality test conducted, the prices of L_h and L_t at the real level (α) 0.05 for N = 36 are obtained as in Table 3.

Table 3. Results of the Normality Test

Class	A	L_c	L_t	Description
Experiment	0.05	0.11	0.14	Normal
Control		0.09	0.14	Normal

Table 3 indicates that both sample classes have similar a value of L_c<$L_t$at a significant level of 0.05, meaning that the data from final test scores of both samples' classes are is normally designed.

After the normality check is carried out, then the homogeneity test is carried out to see does the data of the two sample classes have homogeneous variances or not. The results of the homogeneity test calculation can be seen in Table 4 below.

Table 4. Results of the Homogeneity Test

Class	A	N	S^2	F_c	F_t	Description
Experiment	0.05	36	90.74	1.24	1.39	Homogen
Control		36	112.69			

From Table 4, for both sample classes at the real level of 0.05, the value of F_h is 1.241 and F_t is 1.397. These results show that F_c<F_t, this means that sample data from two classes have homogeneous variances. After conducting normality and homogeneity tests on the final assessment data of both sample classes, it was found that the data in both sample classes were normally distributed and had homogeneous variances. To test the research hypothesis, t-test was used. The results of the t-test of the two sample classes can be viewed in Table 5 below.

Table 5. Results of Hypothesis Test

Class	1-α	N	$\bar{X}$	S^2	t_{count}	t_t
Experiment	0.95	36	82	90.74	2.52	1.66
Control		36	76	112.69		

From Table 5, it can be seen that t_{count} = 2.524 while t_t = 1.667 with the test criteria H_0 is accepted if t_c<t_t and H_0 is rejected if it has another price at a confirmation level of 0.05 with probability of freedom dk = (n_1 + n_2) - 2. Because the price of t is not in the H_0 acceptance area, it is concluded that H_1 is accepted at a real level of 0.05.

According to the statistical analysis conducted from the data of the two sample classes, there is a significant positive difference between application of the discovery learning model in the knowledge aspect. The complete t-test results can be seen in the appendix. The acceptance and rejection curves of the null hypothesis can be seen in Figure 4 below.

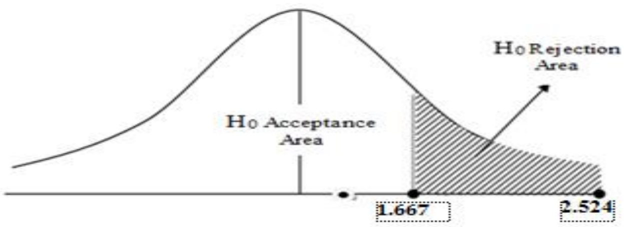


Figure 4. Acceptance and rejection curves of the null hypothesis

Based on Figure 4, the hypothesis acceptance curve on the knowledge aspect shows that th is in the rejection area of H_0, which means that the difference in treatment in the two sample classes has an effect. This is because the learning process is done by finding a concept so that students are more active and make it easier for students to find solutions from practicum activities (Hendrik & Minarni, 2017). Based on the data analyses that have been conducted, there is a significant effect of using the discovery learning model on elasticity and static fluid material on the learning outcomes of class XI Students of SMAN 4 Padang in the knowledge aspect.

According to the outcome of data student physics learning outcomes analysis, the working hypothesis H_1 that has been stated previously, namely: "there is a positive effect of using discovery learning on elasticity and static fluid on the learning outcomes of students in class XI SMAN 4 Padang", can be accepted. This happens because the discovery learning has a positive impact on learning outcomes in the knowledge aspect observed during the learning process. This can be observed from the high average end test scores of students who studied with the implementation of the discovery learning assisted by LKPD compared to the learning with the direct learning assisted by physics textbooks from the school.

The steps of the discovery learning thatavailable at affect the improvement of student learning outcomes are stimulation, problem finding, data collection, data treatment, verification, and generalization (Kurniasih, 2014). In the first stage, namely stimulation, students are given a discourse to stimulate students' curiosity so that they are motivated to investigate the problem themselves. At this stage students are prepared to be motivated to find the principles that will be learned in elasticity and static fluid material. The discovery learning model enables students to construct their knowledge based on their pre-existing knowledge (Masril, 2018). The second stage, namely problem statement, is to give students the opportunity to identify the discourse given by providing questions or temporary answers related to the material discussed then students provide responses or arguments regarding the material discussed. The interaction between teachers and students at this stage aims to achieve learning objectives (Ramadhani, 2022).

The third stage is data collection, students are given the chance to collect as much information as possible related to the discourse given. Thus, students are given the freedom to collect information or data through practical activities. In this case students are guided by using students' worksheet. Discovery learning emphasises students to seek and find their own subject matter through various activities. Discovery learning trains students to get their own answers based on their findings or rediscover something that has been found (Hilmi et al, 2017).

In the fourth stage, data processing, students are directed to process the data obtained through practical activities in groups to obtain solutions to the problems given. Together with their group members, students process data using the procedures obtained. Thus, students are trained to be able to locate solutions to existing problems. In the discovery process, students use their mental processes, among others: observing, classifying, making conjectures, measuring, concluding and so on to find concepts or principles (Roestiyah, 2001).

The fifth stage is verification, students re-examine the answers that have been found to solve the problems given with teacher guidance through presentation activities. Students are trained to be more active, careful, and brave in conveying the findings of the activities on the LKPD. At this stage students foster self-confidence, improve the ability to analyse an answer based on the evidence that has been collected (Sugiarti & Husain, 2021). The last stage is generalisation, students together with the teacher draw conclusions by taking into account the verification results and interpreting the answers obtained. This confirms that the discovery learning in physics learning has a very significant part in supporting students to become better proactive retrieved from education process (Rosnidar, 2021).

The improvement of students' physics learning outcomes was caused by discovery learning guides students to start learning with curiosity through the stimulus provided. Through the stimulus, students can build initial knowledge that is relevant and needed to learn the learning material. Furthermore, students conduct a thorough analysis of the existing problems, collect the information needed, and process the information to obtain a result or temporary conclusion by formulating the concept (Xu et al., 2018).Then students are given a forum to verify these results by means of group discussions until they reach the correct conclusion. This reason is in Suitable with Sari (2020) which suggests that the author's use of the discovery learning in the learning process has a favourable influence on student outcomes because in each stage or phase of the discovery learning Available at foster and develop scholar activities such as provision of stimuli, identification of problems, data collection, data processing, substantiation, and inference. The phase that contributes the most in improving students' learning outcomes is the third phase which is data collection when doing experiment, because at this stage students directly carry out observation activities to find the expected concepts and materials and record all the information so that at this stage it can improve students' cognition (Nugrahaeni et al., 2017).

The supporting materials used learning process in the experiment class was at form of teaching materials sourced from the learning curriculum and LKPD used every time the learning process takes place. These supporting materials are used and developed in learning with existing materials so that they can be applied in learning. In addition, the advantage of worksheets for students is that students Learners will study autonomously, learn to comprehend, and carry out task. The worksheets used should bein conjunction with syntax of the learning model applied, because by using student worksheets in the flow of the learning process more learning activities include interactive, and interesting. This causes student physics learning outcomes to increase (Suwastini et al., 2022).

The outcome of monitoring students' activities in the activity process experimental class conducted learning by applying the discovery learning shows that studentsseemed more interested in participating in learning, students were more enthusiastic in working on the LKPD given, and teacher and student interactions also went well. In addition, students are more able to express their opinionstoproblem solving given by the teacher. From the outcomes of the LKPD completed by students in the experimental class, it also shows that students are better capable of finding the concepts of elasticity and static fluid according to the procedures in the LKPD given. This is in accordance with what is revealed by Zwart (2021) which states that the implementation of discovery learningavailable at changing studentsconditions of learning from passive to more actively and creatively. In addition, usage LKPD in the study process makes students active and creative in finding concepts in the study process.

The analysis results obtained from the posttest results are different. The analysis results show that the mean rated students in experimental class were better from that of the control class, The use of LKPD based on the discovery learning model is one of the alternative solutions to improve students' physics competence in the learning process (Ihsan & Darvina, 2017). Students are more actively involved in learning through discussions with friends and teachers encourage students to conduct experiments that make students able to find scientific concepts and facts independently (Sundari & Rimadani, 2020). This is compatible with Hosnan (2014) which shows that the discovery learning model is a discovery learning model where students are stimulated to study through their engagement and teachers has the task of encouraging for the student to have an experience in conducting experiments that can make students themselves able to discover the principles for themselves. Students themselves are more interested in the activities implemented during the learning outcomes, with the discourse provided by the teacher making students more be active and interested in solving the given problems so learners can explore the material themselves and can comprehend the material freely (Rahayu et al., 2019).

According to the reasoning above, then it is found that the utilisation of the discovery learning in the a thorough studying process is very effective in giving a better influence in the discovery of principles with specific pattern explanations after finding their own learning outcomes (Chukwuyenum, 2011). Learning in experimental class with discovery learning model is more fun because there is group cooperation in learning. While in the control class who uses direct learning assisted by LKS from school students play less role in learning, learning is dominated by the teacher. The difference in studyingoutcomes of students in physics subject arises because of the different treatment between experimental and control class.

When conducting research utilising discovery learning with the help of LKPD, there were several obstacles. The first obstacle encountered was students who were not familiar with the discovery learning assisted by LKPD. During the studying process, it is expected that all active students in studying activities and find the concepts they learn by themselves. However, it was found that there were still students who did not understand the syntax discovery learning. To overcome this obstacle, teachers are expected to explain the definition and syntax discovery learning before the learning process.

The second obstacle is that when carrying out experiments it is difficult to control the time and all student activities because students feel interested and curious about the experimental tools that will be used. To overcome this, at the time of the experiment activities tried to supervise students closely, and can apply the discovery learning model integrating virtual laboratories can improve student learning outcomes, especially the knowledge aspect, so that the time to carry out the experiment can be used effectively and efficiently (Asrizal et al., 2019). The third obstacle, there are still some students who do not read and understand the objectives of the activities and learning objectives and have not been able to make a hypothesis before carrying out the experimental activities in the LKPD (Sundari, 2018). So that they do not understand the subject matter and learning activities contained in the LKPD. To overcome this, the teacher tried to guide students and remind them to read the LKPD properly and correctly.

The last obstacle, namely when conducting experiments, it is carried out in the classroom so that it takes time to prepare experimental equipment, learning also takes quite a long time, when group learning has not been maximised because some students did not participate in the group, to overcome this, during experimental activities tried to supervise students closely, so that the time to carry out experiments can be used effectively.

Conclusion

According to outcome of research and data analysis that has done carried out, summarised that the implementation of the discovery learning can have a significant effect on the learning outcomes of students in class XI MIPA in the physics subject of elasticity and static fluid. This is indicated by the value of tcount = 2.524 while ttable = 1.667. Thus, it is known that $t_{count}>t_{table}$ is 2.524> 1.667 which means H_1 is accepted and H_0 is rejected. This shows that the implementation of the discovery learning features a significant positive effect upon the physics learning results of students in class XI Mipa SMAN 4 Padang in the knowledge aspect with a real level of 0.05.

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There is no conflict of interest.

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