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The Effect of Discovery Learning on Students' Conceptual Understanding of Cell

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Abstract: This study aims to determine the effect of discovery learning on cell material on students' concept comprehension of class XI. In this study, the quantitative research method used quasi-experiments and a non-equivalent pretest-posttest control group design. The instruments used in the research consisted of learning materials (lesson plan, students' worksheet and textbooks) and data collection instruments in the form of reasoned multiple choice written tests of 20 pretest-posttest questions. The research was conducted at Madrasah Aliyah Batu Bara. The population in this study were all 3 classes of XI IPA, and the sample used was 2 classes totaling 60 students taken using cluster random sampling technique. Class XI IPA 1 as an experimental class using the discovery learning model, while class XI IPA 2 as a control class using conventional learning methods. Data analysis techniques in this study were analyzed using ANCOVA. The results showed that there was an influence of the discovery learning model on cell material on students' concept comprehension.

Keywords: conceptual understanding, discovery learning model, biology lesson.

Abstrak: *Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran discovery learning pada materi sel terhadap pemahaman konsep siswa kelas XI. Dalam penelitian ini, metode penelitian kuantitatif menggunakan quasi eksperimen dan desain penelitian non-equivalen pretest-posttest control group design. Instrumen yang digunakan penelitian terdiri atas perangkat pembelajaran (rencana pelaksanaan pembelajaran, lembar kerja peserta didik dan buku teks) dan instrument pengumpulan data berupa tes tertulis pilihan ganda beralasan sebanyak 20 soal pretest-posttest. Penelitian dilakukan di Madrasah Aliyah Batu Bara. Populasi dalam penelitian ini adalah seluruh kelas XI IPA sebanyak 3 kelas, dan sampel yang digunakan sebanyak 2 kelas berjumlah 60 siswa diambil dengan menggunakan teknik cluster random sampling. Kelas XI IPA 1 sebagai kelas eskperimen yang menggunakan model pembelajaran discovery learning, sedangkan kelas XI IPA 2 sebagai kelas kontrol yang menggunakan metode pembelajaran konvensional. Teknik analisis data dalam penelitian ini dianalisis menggunakan ANCOVA. Hasil penelitian menunjukkan bahwa adanya pengaruh model pembelajaran discovery learning pada materi sel terhadap pemahaman konsep siswa.*

Kata kunci: *pemahaman konsep, model discovery learning, pelajaran biologi.*

▪ INTRODUCTION

The teaching and learning process is an activity that can be utilized by educators to construct the knowledge of their students (Adhani & Rupa, 2020). The knowledge gained by students from learning outcomes results in an understanding of the concepts that have been taught (Amanda et al., 2022). According to Yustini et al. (2018) teaching and learning activities are principally to activate students in forming meaning or understanding. This is because the position of understanding itself is a reference for the success of a teaching and learning process (Yustini et al., 2018).

According to Bloom, understanding is the ability to capture notions such as being able to express a material presented in another form that can be understood (Radiko et

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al., 2018), connecting prior knowledge with new knowledge (Yulisa et al., 2020) based on their own understanding so that learning will be meaningful (Nahdi et al., 2018). Understanding is the ability to understand the meaning of a concept or action (Wang & Gafurov, 2010). According to (Hamzah Buno, 2016) understanding of concepts is an important part of solving problems, both in the learning process itself and in the everyday environment. The ability to understand concepts plays a major role in determining student learning outcomes in biology learning.

Biology is a subject that tends to be rote (Suryanti et al., 2019). This can be a cause for students having difficulty understanding biology lessons, because basically learning biology is not by memorizing all aspects of the material, but by understanding the concepts in it (Yusup, 2018). In Dewi & Primayana's research, (2019) that the lack of understanding of this concept in every school is influenced by how students learn to memorize subject matter without understanding it first so students will quickly forget the material they have learned. Biology learning that is abstract in nature has foreign terms and scientific names that require an intermediary to make it easier for students to understand a material explained by educators (Samaduri, 2022). One of the biology material that is less mastered by students is cell material. In this material students must know some of the parts of cells and their organelles, as well as their respective functions which sometimes become difficult to understand. This is supported by research conducted by Ramadhani (2017) that almost all of this cell material discusses microscopic objects that cannot be seen with the naked eye, so special tools are needed to be able to observe these objects. Furthermore, in the research of Utami & Susanti., (2020) stated that in learning bioprocesses in cells, one cannot understand if they only look at pictures because this material is material about processes contained in cells. Practicum and animated videos are learning media that can be used to help students visualize material. So that students have the opportunity to develop curiosity with their own learning experiences.

Based on the results of pre-research interviews that were conducted at one of the private Madrasah Aliyah, Batu Bara said that the learning activities used were more conventional or lecturing in nature. In addition, 60% of students got low learning outcomes on the cell concept. This is evidenced by the daily test scores of students who are below the KKM. The Minimum Completeness Criteria (KKM) that must be possessed is ≥ 75 in class XI Ipa. In addition to the student's difficulties, apart from the cell material which is quite difficult, students do not read very well, practicum facilities are also not supported, such as a microscope that is damaged, and the time needed for the teacher to deliver the material is very limited. This material also has a high level of abstractness, so that it becomes a problem in the learning process which will make this material even more difficult for most students to understand. This is what causes students' low understanding of the concepts being studied. In Çimer's research (2012) the main reasons for learning difficulties are material that is difficult to understand, the teacher's teaching style, students' learning style habits, students' negative feelings and attitudes towards the material and lack of resources. This is in line with Jayanti's research (2018) that the problems that arise in teaching and learning activities can originate from the level of difficulty of teaching materials (subject matter), teacher competence, as well as the facilities and infrastructure available in schools. Especially for abstract materials that require microscopic observation, for example on cell material,

in addition to the availability of laboratory facilities and adequate tools and materials, teacher skills are also needed in using these devices, so that practicum activities can run smoothly.

Based on the results of the initial observations, in reality students often experience difficulties when understanding a concept of learning material due to the monotonous learning process which is carried out conventionally or the lecture method. The teacher who is dominant in the learning process causes students to be more passive so that students wait more for the teacher's presentation rather than looking for and discussing with their friends. According to Tanjung et al., (2020) the lecture method which is often applied by teachers can lead to student boredom and a lack of understanding of the material. This makes cell and bioprocess material still difficult for students to understand because this material examines biology at the cellular level which cannot be observed directly without tools. In addition, activities are rarely carried out that construct their own knowledge with learning experiences according to the material.

Thus, it is necessary to design a learning model that can increase student involvement in learning biology, so that students' understanding of biology concepts can be achieved properly. One learning model that can increase students' understanding is the model developed by Bruner (1977) known as discovery learning. The discovery learning model is a model that directs students to discover concepts through various information or data obtained through observation or experimentation (Nugrahaeni et al., 2017). The discovery learning is defined as a learning process that occurs when what is learned is not presented with lessons in its final form, but is expected to organize itself (Suendarti, 2017). This is in line with research by Fauzi et al., (2017) that through the discovery learning students will be guided to identify what they want to know by searching for information themselves, then students organize or form (constructively) what is known and understood into the final form. In addition, discovery learning can encourage students to play an active role in learning activities. This is in accordance with research conducted by Tam & Ewe., (2018) that through discovery learning can encourage students to become active participants in the learning process by exploring concepts and answering questions through students' own experiences. Furthermore, in the research results of Fadlilah et al., (2020) that student learning outcomes in aspects of knowledge, attitudes and skills have increased through the application of discovery learning. According to Yuliatun et al., (2017) discovery learning is important for educators to innovate in accordance with the curriculum and scientific approach which requires students to be active in following it. Discovery occurs when individuals are directly involved, especially in using their mental processes to discover concepts and principles (Putriani & Rahayu, 2018).

The discovery learning requires students to learn to discover new things actively. The use of discovery learning can change passive learning conditions to become active and creative (Werdiningsih & Pratiwi, 2017). Research using the discovery for conceptual understanding has been carried out by other researchers before, as was done by Oghenevwede (2010) who argued that discovery learning improves student performance in biology so that it is more effective and superior. In Joy's research results (2014) also suggests that discovery learning helps increase the effectiveness of learning. Furthermore, the results of the study that Koksal & Berberoglu., (2014) found a significant effect of the discovery learning on students' science learning outcomes.

Then Widiadnyana et al., (2014) concluded that the discovery learning can influence the understanding of scientific concepts and attitudes in learning. And the results of research by Patrianingsih & Kaseng (2016) also suggest that the discovery learning can improve students' understanding of biology concepts. However, not many studies have examined this cell matter, and most of the research conducted has focused on subjects other than biology.

Based on the description above, the researcher wants to know how the influence of the Discovery Learning (DL) learning model on cell material has on students' understanding of class XI concepts. Therefore the purpose of this study was to determine the effect of the Discovery Learning (DL) learning model on cell material on students' understanding of class XI concepts. With this research, it can provide an update on the learning model for students so that they better understand the concept of cell material and the learning process continues to run optimally.

▪ METHOD

This study uses a quantitative research approach with quasi-experimental research methods (quasi-experimental). The design used in this study was a non-equivalent pre-test-posttest control group design (Sugiyono, 2013). The independent variable (free) in this study is the discovery learning, while the dependent variable (bound) is understanding the concept of cell material.

Participants

The research was conducted at one of the Madrasah Aliyah in Batu Bara District. This research was conducted in September until completion. The population in this study were students of class XI IPA which consisted of 3 classes, with a total of 90 students. The research sample consisted of 2 classes, namely class XI IPA1 totaling 30 students and XI IPA 2 totaling 30 students. The sampling technique used in this research is cluster random sampling, namely a sampling technique whose selection proposes to groups rather than individuals.

Instruments

The research instruments consisted of learning tools (RPP, students' worksheet and student books) and data collection instruments (concept comprehension tests). Learning devices are used in the implementation of learning, while data collection instruments are used as research data collection tools. The research data included the value of understanding the concept which was collected by written test technique in the form of closed reasoned multiple choice (two-tier) consisting of 20 pretest and 20 posttest. Prior to data collection, this instrument was validated by two expert validators. After expert validation, the instrument was tested on non-sample students, namely XII IPA. The results of the item validation test for understanding the concept obtained data on 23 questions that met the valid criteria, while 17 questions did not meet the criteria, namely invalid. The results of the reliability of the items on understanding the concept obtained r_{count} 0.742 while r_{table} = 0.374. Comparison between rcount and rtable with a significance level of 5% obtained the results of $r_{count} > r_{table}$ (0.742 > 0.374), then the instrument is declared reliable.

Procedure

The procedure of this research consists of research steps and steps in learning. The steps in the research consisted of the research preparation stage including literature study, instrument design and research instrument validation. In addition, a survey of school conditions, research permits, discussions with the biology teacher concerned were carried out to discuss the research implementation schedule and class management that the researcher would carry out. Then, the implementation stage is determining the sample, collecting data before learning (pretest), learning phase (Student Worksheets) in the experimental class, and collecting data after learning (posttest). The next stage is the reporting stage, at this stage data processing and data analysis is carried out. After that, the stage of working on the results and discussion and drawing conclusions from the data is carried out.

Meanwhile the learning steps consist of six stages according to the syntax of the Discovery learning , namely: 1) stimulation, the teacher provides an apperception or stimulus by giving a description of phenomena about cells; 2) problem statement, students identify problems and make their own hypotheses; 3) data collection, the teacher provides directions for the experimental procedures shown in the learning videos and students collect as much relevant information as possible; 4) data processing, students processing data and information obtained; 5) verification, students hold discussions by presenting their findings to prove their initial hypothesis; and 6) generalization, students draw conclusions based on the verification results.

Table 1. Discovery learning learning activities

Syntax	**Learning activities**	
	Teacher	**Student**
Stimulation	Instruct students to observe pictures that describe cell problems in plants and animal cells	Observe the pictures displayed
Problem statement	Identify various problems by formulating problems and hypotheses that arise	Making problem formulations and hypotheses so that the question arises "What are the organelles in plant cells? What are the organelles in animal cells? What are the differences between plant cells and animal cells?
Data collection	To answer questions or prove whether this hypothesis is true or not, students are given the opportunity to collect various relevant information. The teacher explains the experimental procedures for microscopic observation of plant cells and animal cells which are shown in the learning video (Youtube), then the teacher	Observing the learning videos displayed by the teacher and writing down the findings

	instructs them to write down the results of their findings on the Youtube Link students' worksheet: https://youtu.be/jc9Z9RF-fh8	
Data processing	After collecting information obtained from observing the learning videos, the teacher asks students to discuss with their respective groups regarding the questions that arise , then relate it to the results obtained from watching the video.	Discuss the findings in groups and write down the answers in the
Verification	Select group representatives to come forward to present the results of the discussion, then link them back to the hypotheses that have been made	. Present the results of the discussion in front of the class.
Generalization	Ask students to make conclusions from the results of the discussion	Summarize the results of the discussions that were carried out

Data analysis techniques in this study were analyzed using Analysis of Covariance (ANCOVA). Descriptive analysis is used to describe the value of understanding the concept of the learning model. Meanwhile, the ANCOVA test is used to determine or see the effect of treatment on the response variable by controlling other quantitative variables. Before the ANCOVA test was carried out, prerequisite tests were carried out, namely: normality test, homogeneity test and linearity test. ANCOVA testing was carried out with the help of the SPSS version 24 for windows.

▪ RESULT AND DISSCUSSION

An increase in students' conceptual understanding was obtained from the difference in pretest and posttest in the learning activities of each class. Based on the results of descriptive statistical analysis of students' conceptual understanding, the mean (mean) pretest in the experimental class (DL) was 43.33 with a standard deviation of 10.775. The mean (mean) posttest of the experimental class (DL) was 78.50 with a standard deviation of 8.423. Meanwhile, the mean pretest in the control class (conventional) was 33.83 with a standard deviation of 11.347. The average value (mean) posttest control class (conventional) is 59.33 with a standard deviation value of 11.725. Based on these data it shows that there were positive results for both classes, both of which experienced an increase. However, the experimental class experienced a greater improvement than the control class.

To find out whether the discovery effective or not on the pretest and posttest that have been given, a normalized n-gain test is carried out. The results of the n-gain test are presented in Figure 1.

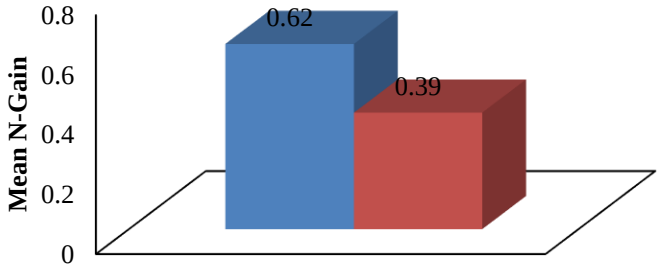

Figure 1. Average N-Gain between Experimental (blue) and Control group (red)

Based on Figure 1 above, it shows that the average n-gain score for each item in the experimental class (discovery learning) is 0.62. Based on the n-gain value, it can be concluded that the data is in the moderate category, namely $0.3 \leq g \leq 0.7$ with a percentage of %, namely 62%, which is in the fairly effective category. Meanwhile, the control class obtained an average n-gain score of 0.39. Based on the n-gain value, it can be concluded that the data is in the medium category, namely $0.3 \leq g \leq 0.7$ with a percentage %, namely 39%, in the ineffective category. This proves that the use of discovery learning is effective in increasing students' understanding of concepts in cell material. Further analysis was carried out for each problem of understanding the concept, which is presented in Figure 2.

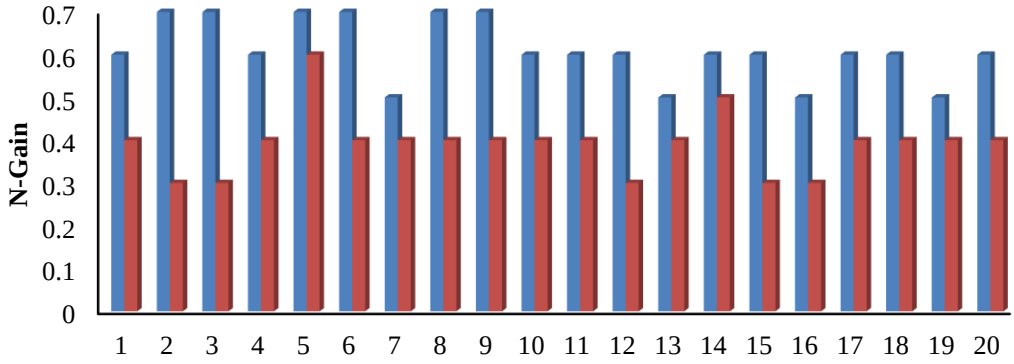

Figure 2. N-Gain for every single exam questions between experimental (blue) and control (red) group

Based on Figure 2 above, it provides an overview of the n-gain values for the experimental class and the control class obtained from test data for understanding concepts taught by discovery learning and conventional learning models. It is known that for each problem of understanding the concept, the highest increase occurred in the experimental class. In the experimental class, the increase in pretest and posttest results was significant compared to the increase in students' conceptual understanding in the control class.

Results of Data Analysis

In testing the hypothesis, the data obtained is first tested with prerequisites. The prerequisite test results include the normality test, homogeneity test and linearity test. The results of the pretest-posttest the experimental class (discovery learning) and the control class (conventional) show the sig. on the normality test, namely sig. >0.05. For pretest with a value of 0.200 > 0.05 and posttest experimental class with a value of 0.200 > 0.05. As for pretest with a value of 0.191 > 0.05 and posttest with a value of 0.200 > 0.05. Thus all data is normally distributed, both the experimental class and the control class. Then a homogeneity test was carried out, based on the data analysis results obtained sig. of 0.814 where the sig. > α (0.814 > 0.05). So it can be said that the data has a homogeneous variance. Then, a linearity test was carried out to see whether the data obtained was linear or not. Where the independent variable and the dependent variable are said to have a linear significance if the probability > 0.05. The results of the linearity test using the SPSS 24 program obtained a sig. 0.144, it can be concluded that there is a linear relationship between the independent variable (pretest) and the dependent variable (posttest).

ANCOVA Test

After the prerequisite test is carried out in the form of normality, homogeneity and linearity test results, it is continued with hypothesis testing. Hypothesis testing uses the Analysis of Covariance (ANCOVA) test. In analyzing the data, this study used the ANCOV A test because there were two classes being compared, namely the experimental class and the control class seen from the learning model with the pretest as the covariate. So that the ANCOVA test is feasible to calculate the required data analysis. To find out the results of the ANCOVA test can be seen in Table 2.

Table 2. ANCOVA results

Tests of Between-Subjects Effects

Dependent Variable: Nilai Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6240.361[a]	2	3120.180	33.467	.000	.540
Intercept	14128.401	1	14128.401	151.540	.000	.727
Pretest	729.944	1	729.944	7.829	.007	.121
Kelas	3274.014	1	3274.014	35.117	.000	.381
Error	5314.223	57	93.232			
Total	296525.000	60				
Corrected Total	11554.583	59				

a. R Squared = .540 (Adjusted R Squared = .524)

Based on the results of the ANCOVA test in Table 2, the significance score for the pretest is 0.007. If the sig. < 0.05 then H_1 is accepted. Therefore 0.007 <0.05, it can be concluded that there is a difference between the pretest and posttest scores. Furthermore, the significance number for the class variable is 0.000. If sig. < 0.05 then H_1 is accepted. Therefore 0.000 <0.05, it can be concluded that there is a difference

between the treatments given to the posttest. So it can be concluded that there is an influence of the discovery learning on students' understanding of concepts.

The results showed that in the experimental class the increase in pretest and posttest of students' understanding of concepts in cell material occurred significantly compared to the increase in students' understanding of concepts in the control class. This is caused by the use of learning models in both class groups (Ningkaula et al., 2021), where the experimental class uses the discovery learning and in the control class uses conventional learning models. In addition, the discovery is based on constructivist theory where students must build their own knowledge (Patrianingsih et al., 2017). This is supported by the results of research conducted by Meiliawati (2019) regarding students' understanding of concepts using the discovery is able to improve students' understanding of concepts because students find the concept itself with a series of discovery learning syntax where problems are raised by the teacher and students work to find answers to problems. the.

The discovery learning has enormous potential to create a more meaningful learning experience for students in concept discovery. In the learning process of discovery learning, students experience a mental process to assimilate a concept and principle. This is in accordance with Sulfemi & Yuliana's research (2019) that the discovery learning provides real experience, high-level thinking, student-centered, critical and creative, meaningful knowledge in life and changes in behavior towards knowledge. The same thing was stated by Ikalor et al., (2019) through the application of the discovery learning supporting students' abilities to build their own knowledge through the stages of the discovery learning.

The first stage, namely stimulation which begins by dividing students into small groups and providing student worksheets (students' worksheet) in each group. At this stage, where the teacher instructs students to observe the description of the phenomenon of cell material that is already in the students' worksheet with the aim of stimulating students to think about raising problems and being able to encourage exploration. This is in accordance with the statement of Yustina et al., (2018) that by providing stimulation it can provide learning interaction conditions that can develop and assist students in exploring material. This is in line with relevant research by Patrianingsih & Kaseng (2016) that with the emergence of a curious attitude to investigate on their own and demands for exploration, it will direct students' thinking to understand, especially about the problems that become the topic of learning.

Next is the problem statement, where the teacher gives instructions or examples to students how to formulate a clear problem with the aim that students are given responsibility for formulating hypotheses on the questions that have been identified. When identifying a problem, questions such as "What are the organelles in a plant cell?" What are the organelles in animal cells? And what are the differences in plant cells and animal cells?", these problems are then selected and formulated and a temporary answer (hypothesis) is sought. The temporary answer that emerged was "the differences between plant cells and animal cells that are more prominent in terms of shape, that is, plants have cell walls, while animal cells do not have cell walls". This stage will bring up empirical reasoning to understand the information obtained (Widiadnyana et al., 2014). This is in line with previous research by Wahjudi (2015) that by giving students

the opportunity to identify and analyze problems, it will build students' understanding so they are used to finding problems.

Next is the data collection, to answer questions or prove whether the hypothesis is true or not, by giving students the opportunity to collect relevant information. At this stage the teacher provides an explanation of the experimental procedure for microscopic observation on plant cells (Allium cepa L) and animal cells (oral epithelial cells) which are displayed in the learning video (Youtube), where in this study there was no direct practicum because the infrastructure did not support it. From observing the learning videos, the teacher directs each group to observe the experimental learning videos, then directs groups of students to write down their findings, namely the practicum objective "to observe the structure of animal cells and plant cells with their parts" and describe the results of microscopic observations on plant cells (Allium cepa L) and animal cells (oral epithelial cells) in the experimental activities contained in the students' worksheet. Students' curiosity develops when students do experiments. Students' curiosity also arises because of students' motivation to find answers, so that the learning process is student-centered learning (Patrianingsih et al., 2017). This is supported by the research of Widiadnyana et al., (2014) that the experimental method can improve cognitive learning outcomes, strong interactions between students and objects in experimental activities can encourage students' attention to better understand objects.

Next is the data processing, where the teacher guides all groups of students in processing experimental data, so that groups of students can answer questions on the students' worksheet according to the material and data obtained in the microscopic observation experiments on plant cells (Allium cepa L) and animal cells (oral epithelial cells). At this stage, students honestly and objectively interpret the data and information needed to test their hypotheses. Testing the hypothesis is the process of determining which answers are considered acceptable according to the data or information obtained based on data collection so that teachers can develop students' rational thinking skills (Patandung, 2017). This is in line with the results of previous research Patrianingsih et al., (2017) that with a rational attitude towards processing information and being able to accept the information it obtains, it can help students' understanding.

The next stage is verification, where students verify the data they have collected through relevant literature and prove the hypotheses that have been made before. Verification is also carried out before presentation activities by groups that do not have a turn to present in front of the class (In'am & Hajar, 2017). At the end of this process, students were asked to present the results of each group's discussion followed by question and answer. The results of the presentation and question and answer can be used as a reference for understanding the concept. This is in line with research (Kholifah et al., 2015) which gave the result that the more explanations the presenter gave, the better students' understanding of the concept. Furthermore, it is supported by relevant research Patrianingsih et al., (2017) that presentation activities can bring up a critical attitude, confidence, and the ability to make decisions so as to gain an understanding of the concepts being studied.

The last stage is generalization, where at this stage students draw a conclusion based on the results of data collection that has been done before. The conclusion they made was a new concept that they got from the learning results, namely "the differences between plant cells and animal cells from the practicum that has been done, it can be

concluded that plant cells in shallot cells (Allium cepa L) have cell chambers, have a cell nucleus, and have a cell wall, while animal cells in oral epithelial cells do not have a cell wall so they have a shape that is not fixed and easily changes its shape, composed of a cell nucleus and a cytoplasmic membrane. It can be concluded that the hypothesis made at the beginning is accepted. This stage plays a very important role in increasing student activity, especially mental activity, namely remembering, solving problems, analyzing factors, seeing relationships and making decisions (Masdariah et al., 2018). This is in accordance with previous research by Patrianingsih et al. (2017) that by providing conclusions will be a process of constructing students' thoughts by induction, so as to provide students with an understanding of the concept.

Throughout these stages, it can be seen that the roles between teachers and students are very clear. It can also be seen that the discovery learning is more influential than the conventional learning model for the results of students' understanding of concepts. As for the privileges of the discovery learning in the learning that is carried out, namely basically all the syntax or steps of the discovery learning can affect the results of students' understanding of concepts. However, of the six syntaxes there is a syntax that contributes to active learning, namely in the data collection . and data processing (data processing) because at this stage students play an active role in finding as many answers as possible to the hypothesis made at the beginning, reading relevant literature, then discussing it with their group mates so they can answer the hypothesis themselves. This is in line with the results of research conducted by Masdariah et al., (2018) that with discussions, students are more courageous in expressing opinions, responding to statements by both friends and teachers. Furthermore, it is supported by the research results of Tanjung et al., (2020) that with many opinions and clear evidence, students understand which answer is correct. This means that students can understand the material and concepts that have been studied and the learning outcomes obtained can be increased.

Learning with the discovery learning will make learning active, because students are directly involved in learning through investigative activities, finding concepts and applying them in everyday life. Besides that, it can train students to solve problems and encourage students to find general concepts or principles based on materials/data provided by the teacher, this will help in increasing students' understanding of biology concepts. This is in line with the results of research conducted by Syahputri & Derlina, (2016) that the discovery learning is able to create a democratic classroom atmosphere, an environment that respects each other, provides opportunities for students to learn independently, have their own opinions, and discuss finding solutions in encounter a problem.

The advantages of the discovery learning are student interest and the formation of abstract concepts to be meaningful achieved through direct experience carried out in learning activities, learning is more realistic and meaningful because it is motivated by direct interaction of students with real examples, involving students directly in learning and evoking student motivation. This is in line with research conducted by Patrianingsih & Kaseng (2016) showing that the discovery learning applied in the learning process contributes to understanding biological concepts. The discovery learning has the potential to provide a more meaningful learning experience for students in the concept discovery process. The same thing was conveyed in the research of Swaak et al., (2004)

that discovery learning assumes students are doing activities and conceptualizing their basic knowledge. In addition, the results of Oghenevwede's research (2010) state that the discovery model is more effective in teaching biology, therefore teachers are advised to use this model in teaching the discovery of a concept.

Learning with discovery learning is recommended for use by teachers in learning science based on several facts and research results which show advantages, including, 1) directing residual learning activities independently by involving thinking skills and learning motivation; 2) helping students strengthen their self-concept, because they gain trust in working with others; 3) centered on students and teachers play an equally active role in expressing their ideas (Utami, 2017). However, this research also has weaknesses in research including limitations on the scope of time during research, minimal infrastructure and students not used to using discovery learning in learning. This is in line with what was conveyed by Yustina et al., (2018) regarding the weaknesses of the discovery , including: 1) it requires more optimal media preparation; 2) the expectations contained in this model can be shattered dealing with students and teachers who are used to old ways of learning; and 3) it takes a long time for students to discover new theories.

▪ CONCLUSION

Based on the results of the research and data analysis conducted, there is a significant influence of the discovery learning on students' understanding of concepts. Therefore the researcher concluded that there was an influence of the discovery on cell material on students' understanding of concepts. Therefore, researchers suggest that teachers apply the discovery learning model as an alternative learning model in learning. Thus, future research if you want to use the discovery learning should provide sufficient time to socialize this model so that the results obtained are maximized. This research is expected to be a reference for teachers in developing biology lessons in the future, so as to increase students' understanding of concepts.

▪ REFERENCES

Adhani, A., & Rupa, D. (2020). *Analisis pemahaman konsep mahasiswa pendidikan biologi pada matakuliah fisiologi tumbuhan*. *Quantum: Jurnal Inovasi Pendidikan Sains*, *11*(1), 18–26. https://scholar.archive.org/work/3jmqe67adbfvnk5qp7tjzkuv7e/access/wayback/https://ppjp.ulm.ac.id/journal/index.php/quantum/article/download/8035/pdf

Amanda, T., Rabiatul, S., & Laily, T. (2022). *Evaluasi pemahaman konsep mahasiswa pendidikan biologi pada materi pengetahuan lingkungan prodi pendidikan biologi , fstt , universitas pendidikan mandalika*. *Jurnal Pedago Biologi*, *10*(1), 272–284. https://doi.org/http://dx.doi.org/10.30651/pb:jppb.v10i1.14439

Bruner, J. S. (1977). *The process of education*. Harvard University Press. https://books.google.fr/books?hl=fr&lr=&id=S6FKW90QY40C&oi=fnd&pg=PR29&dq=jerome+bruner&ots=lbjVjc61t1&sig=zjhrWnAgu4qNBwxEaAasqb9asTQ

Çimer, A. (2012). What makes biology learning difficult and effective : Students ' views. *Educational Research and Reviews*, *7*(3), 61–71. https://doi.org/10.5897/ERR11.205

Dewi, P. Y. A., & Primayana, K. H. (2019). Effect of learning module with setting contextual teaching and learning to increase the understanding of concepts. *International Journal of Education and Learning*, *1*(1), 19–26. https://doi.org/10.31763/ijele.v1i1.26

Fadlilah, N., Sulisworo, D., & Maruto, G. (2020). The effectiveness of a video-based laboratory on discovery learning to enhance learning outcomes. *Universal Journal of Educational Research*, *8*(8), 3648–3654. https://doi.org/10.13189/ujer.2020.080843

Fauzi, A. R., Zainuddin, & Atok, R. Al. (2017). *Penguatan karakter rasa ingin tahu dan peduli sosial melalui discovery learning*. *Jurnal Teori dan Praksis Pembelajaran IPS*, *2*(2), 27–36. https://doi.org/10.17977/um022v2i22017p079

Ikalor, A., Jamaluddin, & Rasmi, D. A. C. (2019*). Efektivitas penerapan model discovery learning terhadap peningkatan kemampuan berpikir kritis dan penguasaan konsep Biologi siswa kelas VII Smp Negeri 19 Mataram tahun ajaran 2015/2016*. *Jurnal Ilmiah Pendidikan Indonesia*, *1*(2), 153–161.

In'am, A., & Hajar, S. (2017). Learning geometry through discovery learning using a scientific approach. *International Journal of Instruction*, *10*(1), 55–70. https://doi.org/http://dx.doi.org/10.12973/iji.2017.1014a

Jayanti, M. I. (2018). *Faktor kesulitan guru melaksanakan pembelajaran materi struktur dan fungsi sel di Sma Negeri Se-Kota Bima*. *Jurnal Pendidikan Mipa*, *8*(1), 94–98. https://doi.org/10.37630/jpm.v8i1.69

Joy, A. (2014). Impact of discovery-based learning method on senior secondary school physics. *IOSR Journal of Research & Method in Education (IOSRJRME)*, *4*(3), 32–36. https://doi.org/10.9790/7388-04353236

Kholifah, A. N. U. R., Rinanto, Y., & Ramli, M. (2015). *Kajian penerapan model guided discovery learning disertai concept map terhadap pemahaman konsep siswa Sma kelas XI pada materi sistem imun*. *Bio-Pedagogi*, *4*(1), 12–18.

Koksal, E. A., & Berberoglu, G. (2014). The effect of guided-inquiry instruction on 6th grade Turkish students' achievement, science process skills, and attitudes toward science. *International Journal of Science Education*, *36*(1), 66–78. https://doi.org/10.1080/09500693.2012.721942

Masdariah, M., B., N., & Rachmawaty. (2018). *Kajian deskriptif model discovery learning dalam meningkatkan motivasi belajar , aktivitas belajar dan hasil belajar peserta didik*. *Prosiding Seminar Nasional Biologi dan Pembelajarannya*, 551–557.

Meiliawati, R. (2019). *Pemahaman konsep sifat jari-jari atom dan keelektronegatifan pada Mahasiswa Pendidikan Kimia semester IV tahun ajaran 2016 / 2017 hasil pembelajaran menggunakan model discovery learning*. *jurnal Ilmiah Kanderang Tingang*, *10*(1), 38–45. https://doi.org/10.37304/jikt.v10i1.19

Nahdi, D. S., Yonanda, D. A., & Agustin, N. F. (2018). *Upaya meningkatkan pemahaman konsep siswa melalui penerapan metode demonstrasi pada mata pelajaran Ipa*. *Jurnal Cakrawala Pendas*, *4*(2), 9. https://doi.org/10.31949/jcp.v4i2.1050

Ningkaula, T. A., Laliyo, L. A. R., Iyabu, H., & Abdullah, R. (2021). *Dampak Model Discovery Learning Berpendekatan Stem Terhadap Pemahaman Konsep Hidrolisis Garam Siswa Sma*. *Jurnal Pendidikan Kimia Indonesia*, *5*(2), 76.

https://doi.org/10.23887/jpk.v5i1.28871

Nugrahaeni, A., Redhana, I. W., & Kartawan, I. M. A. (2017). *Penerapan model pembelajaran discovery learning untuk meningkatkan kemampuan berpikir kritis dan hasil belajar Kimia*. *Undiksha: Jurnal Pendidikan Kimia Indonesia*, *1*(1), 23–29. https://doi.org/10.23887/jpk.v1i1.12808

Oghenevwede, O. E. (2010). Effects of discovery and inquiry approaches in teaching and learning of Biology on secondary schools students' performance in Delta State, Nigeria. *Journal of Research in Education and Society*, *1*(1), 30–39.

Patandung, Y. (2017). *Pengaruh model discovery learning terhadap peningkatan motivasi belajar Ipa siswa*. *Journal of Educational Science and Technology*, *3*(Iii), 9–17. https://doi.org/10.26858/est.v3i1.3508

Patrianingsih, E. A., B, N., & Kaseng, E. S. (2017). *Pengaruh model pembelajaran discovery learning terhadap pemahaman konsep Biologi dan sikap ilmiah peserta didik Sma Negeri 3 Takalar*. *UNM Journal of Biological Education*, *1*(1), 31–46.

Patrianingsih, E. A., & Kaseng, E. S. (2016). *Model pembelajaran discovery learning , pemahaman konsep Biologi, dan sikap ilmiah peserta didik*. *jurnal penelitian pendidikan Insani*, *19*(2), 74–86. https://ojs.unm.ac.id/Insani/article/view/3588

Putriani, D., & Rahayu, C. (2018). The effect of discovery learning model using sunflowers in circles on mathematics learning outcomes. *International Journal of Trends in Mathematics Education Research*, *1*(1), 22–25. https://doi.org/10.33122/ijtmer.v1i1.26

Radiko, E., Kurniawan, Y., & Muliyani, R. (2018). *Identifikasi pemahaman konsep siswa pada materi zat dan wujudnya. JIPF (Jurnal Ilmu Pendidikan Fisika)*, *3*(2), 52. https://doi.org/10.26737/jipf.v3i2.581

Ramadhani, A. R. D. (2017). *Profil dan validasi secara teoritis booklet materi sel untuk meningkatkan pemahaman konsep peserta didik kelas XI Sma. BioEdu Berkala Ilmiah Pendidikan Biologi*, *6*(1), 21–30. https://doi.org/10.26740/bioedu.v10n2.p275-282

Samaduri, A. (2022). *Analisis pemahaman konsep siswa yang diukur menggunakan tes pilihan ganda. Jurnal Pendidikan Glasser*, *6*(1), 109–120. https://doi.org/10.32529/glasser.v6i1.1466

Suendarti, M. (2017). The effect of learning discovery model on the learning outcomes of natural science of Junior High School Students Indonesia. *International Journal of Environmental and Science Education*, *12*(10), 2213–2216.

Sugiyono, S. (2013). *Metode penelitian kuantitatif, kualitatif dan R & D*. CV. Alfabeta.

Sulfemi, W. B., & Yuliana, D. (2019). *Penerapan model pembelajaran discovery learning meningkatkan motivasi dan hasil belajar pendidikan kewarganegaraan. Jurnal Rontal Keilmuan PKn*, *5*(1), 17–30. https://doi.org/10.29100/jr.v5i1.1021

Suryanti, E., Fitriani, A., Redjeki, S., & Riandi, R. (2019). *Identifikasi kesulitan Mahasiswa dalam pembelajaran Biologi Molekuler berstrategi modified free inquiry. Perspektif Pendidikan dan Keguruan*, *10*(2), 37–47. https://doi.org/10.25299/perspektif.2019.vol10(2).3990

Swaak, J., Jong, T. de, & Joolingen, W. van. (2004). The effects of discovery learning and expository instruction on the acquisition of definitional and intuitive knowledge. *Journal of computer assisted learning*, *20*(4), 225–234. https://doi.org/10.1111/j.1365-2729.2004.00092

Syahputri, A., & Derlina, D. (2016). *Pengaruh model pembelajaran discovery learning terhadap hasil belajar siswa kelas XI semester genap pada materi pokok fluida dinamis di Sma N 1 Stabat T.P 2014/2015*. *Jurnal Inpafi*, *4*(4). https://doi.org/10.24114/inpafi.v4j4.5628

Tam, S. M., & Ewe, J. A. (2018). Utilizing a discovery learning, real-world based fruit juice clarification experiment to enhance teaching and learning of biological enzyme concepts. *International Journal for Innovation Education and Research*, *6*(6), 21–36. https://doi.org/10.31686/ijier.vol6.iss6.1048

Tanjung, I. F., Rohani, R., & Vera, N. M. (2020). *Pengaruh strategi pembelajaran discovery learning berbantuan mini-magz terhadap hasil belajar kognitif Biologi siswa*. *Jurnal Biolokus*, *3*(2), 335. https://doi.org/10.30821/biolokus.v3i2.796

Utami, A. D., & Susanti, R. (2020). An implementation of guided discovery learning on bioprocess in cells material to improve learning outcomes. *Journal of Biology Education*, *9*(3), 257–261. https://doi.org/10.15294/jbe.v9i3.36402

Utami, M. F. L. B. (2017). *Penerapan strategi discovery learning (DL) untuk meningkatkan keterampilan berpikir kritis dan pemahaman konsep Ipa*. *JINoP (Jurnal Inovasi Pembelajaran)*, *3*(1), 483–490. https://doi.org/10.22219/jinop.v3i1.4317

Wahjudi, E. (2015). *Penerapan discovery learning dalam pembelajaran Ipa sebagai upaya untuk meningkatkan hasil belajar siswa kelas IX-1 di Smp Negeri 1 Kalianget*. *Jurnal Lentera Sains (Lensa)*, *5*(1), 1–16. https://doi.org/10.24929/lensa.v5i1.242

Wang, Y., & Gafurov, D. (2010). The cognitive process of comprehension: A formal description. *International Journal of Cognitive Informatics and Natural Intelligence*, *4*(3), 44–58. https://doi.org/10.4018/jcini.2010070104

Werdiningsih, I., & Pratiwi, H. (2017). Discovery Learning with Scientific Approach on Geometry Discovery Learning with Scientific Approach on Geometry. *Journal of Physics: Conference Series PAPER*. https://doi.org/10.1088/1742-6596/895/1/012033

Widiadnyana, I. W., Sadia, I. ., & Suastra, I. . (2014). *Pengaruh model discovery learning terhadap pemahaman konsep Ipa dan sikap ilmiah siswa Smp*. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *4*(2), 1–13. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/1344

Yuliatun, L., Masykuri, M., & Utami, B. (2017). Discovery learning with hierarchy concept to improve analysis ability and study achievement hydrolysis subject. *Jurnal Inovasi Pendidikan IPA*, *3*(2), 172–179. https://doi.org/10.21831/jipi.v3i2.13919

Yulisa, Y., Hakim, L., & Lia, L. (2020). *Pengaruh video pembelajaran Fisika terhadap pemahaman konsep siswa Smp*. *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika*, *1*(1), 37. https://doi.org/10.31851/luminous.v1i1.3445

Yustina, Darmawati, & Apriandi, R. (2018). *Strategi pembelajaran Biologi*. UR Press.

Yustini, P. E., Sadia, I. W., & Setiawan, I. G. A. N. (2018). *Analisis komparasi penggunaan model pembelajaran inkuiri bebas dan inkuiri terbimbing terhadap pemahaman konsep Biologi ditinjau dari gaya kognitif siswa Sma*. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *8*(1), 26–35. https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ipa/article/view/2926

Yusup, I. R. (2018). *Kesulitan guru pada pembelajaran Biologi tingkat Madrasah/Sekolah di Provinsi Jawa Barat (Studi kasus wilayah Priangan Timur)*. *Jurnal Bioeduin : Program Studi Pendidikan Biologi*, *8*(2), 34–42. https://doi.org/10.15575/bioeduin.v8i2.3187