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Improving Understanding of Wiggins Concept through the Application of Blended Discovery Learning Model in Biology Learning

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ABSTRACT

Students are required to have the ability to think, one of which is understanding. In the era of the fast development of information technology, understanding in students is not just knowing facts, but knowing the meaning, and emphasizing the involvement of students in dealing with problems. This research aimed to determine the improvement of students' concept understanding based on Wiggins' aspects of understanding, which are explain, interpretation, application, perspective, empathy and self-knowledge in biology learning by applying a blended discovery learning model. This research is a quasi-experimental research with pretest-posttest control group design. The population in this research were all students of class X Mathematics and Natural Sciences SMAN 1 Sumber in the 2022/2023 academic year with samples of class X Mathematics and Natural Sciences 4 as the experimental class and X Mathematics and Natural Sciences 3 as the control class. Data collection techniques used tests, and questionnaires. The results showed that there were differences in the improvement of students' understanding based on significant aspects of Wiggins' understanding in biology learning using models of blended discovery learning on kingdom plantae material.

Introduction

The rapid development of science in the 21st century is having an impact on many areas, including education. According to Dewi (2019), the rapid development of information and communication technology in the 21st century has an impact on the lives of today's students, which are different and much more complex than in the past, and requires students to learn more and be proactive about various changes in order to be prepared to face global challenges. Education is inseparable from the learning process, so that learning becomes an important activity for transferring information from teachers to students. According to Gloria et al., (2019), one of the successes of learning is the formation of thinking skills and understanding. In knowledge, students only know what has been learned without any meaning from what has been learned, in the aspect of understanding, students have the ability to understand the meaning of what has been learned. Understanding is very different from knowing, understanding is not just knowing the facts, but knowing the meaning. In Bloom's Taxonomy, learners who understand can analyse, synthesise and evaluate information and situations independently, not just recall and apply

previous learning. Learners who understand can take previous learning and use it effectively when faced with new problems and contexts that require their knowledge, skills and understanding (Wiggins & McTighe, 2011).

Students' understanding is related to constructivism learning theory, where this constructivism approach aims to increase students' understanding because in constructivism learning theory emphasizes the involvement of students in dealing with problems that occur (Masgumelar & Mustafa, 2021). However, during the covid-19 pandemic, students in learning biology only follow virtually without involving the real experience of the students themselves, so that students' understanding of learning is also less than optimal because students are not directly and tangibly involved. Meanwhile, biology learning is a science that studies living things with a broad object of study so that understanding it is still lacking if it is only understood online (Ula et al., 2021). Based on the pre-research data obtained, the cognitive learning outcomes of students covering biological concepts in biology subjects are still relatively low. This means that students do not have a good understanding because they cannot analyze, synthesize, and evaluate information and situations independently, not just remembering previous learning and applying it. Muspikawijaya et al., (2017) found that students' concept understanding on cell metabolism material was still low. Another study found that students had difficulty understanding concepts in plantae material (Sipayung & Simanjuntak 2022; Samaduri, 2022; Hanifah et al., 2020).

Student cognitive learning outcomes, which measure the extent to which students are able to follow and understand biology learning in school, refer to Bloom's taxonomy. Bloom criticized the generality of teachers' expectations of student understanding and in his findings formulated six criteria that are often described as different cognitive levels in order of increasing complexity, namely, knowing, understanding, applying, analyzing, synthesizing, and evaluating. Bloom's taxonomy places comprehension at the second cognitive level, whereas Wiggins & McTighe have a different view. While Bloom's taxonomy can be seen as teacher-centered, with teachers designing instruction and assessments, Wiggins attempts to emphasize a more learner-centered focus by highlighting six aspects of comprehension, which include explanation, interpretation, application, perspective, empathy, and self-knowledge (Tiernan, 2011; Wiggins & McTighe, 2005). aken together, these six aspects of understanding form a comprehensive picture of comprehension (Tiernan, 2011). In this study, Wiggins' aspects of understanding will be used to form a complete understanding of students' learning of biology.

By understanding these cognitive aspects, it is important to apply an effective learning model to improve student understanding. One such model is the discovery learning model, which can be a solution to overcome students' understanding problems. The discovery learning model can be a solution to overcome students' understanding problems. Masgumelar & Mustafa (2021) stated that constructivism has a close relationship with discovery learning. In this approach, students will be faced with a problem, related to everyday life, which must find a solution to the problem (Herlanti et al., 2017). Moreover, the discovery learning model requires students to convey ideas through the discovery process (Martaida et al., 2017). This model can actively engage students in problem-solving activities, promote independent learning, and enhance critical thinking, understanding, and creative learning.

The implementation of biology learning at SMAN 1 Sumber in the 2022/2023 school year is a transition period of covid-19 era learning so that it still requires adjustments to learning activities. In order to maximize information technology that continues to develop in the 21st century, there is nothing wrong with continuing to use devices such as smartphones in the biology learning process by combining learning or what is known as blended. Blended learning is a learning that combines or combines face to face learning with ICT media, such as

computers (online or offline), multimedia, virtual classes, the internet and so on (Amin, 2017). Blended learning can be combined with the discovery learning model into blended discovery learning.

This study used a blended discovery learning model by referring to the steps of blended discovery learning according to Ningsih & Jayanti's (2022) which was modified by integrating Wiggins' aspects of understanding. Wiggins & McTighe (2005) stated that there are six facets or six aspects of understanding. Students really understand when they can explain, this is where students make generalizations or give examples to show something. Students truly understand when they can interpret. Students truly understand when they can apply. This is where students use information in a new context. Students truly understand when they have perspective. This is where students have the ability to see and hear other points of view to envision the bigger issue. Students truly understand when they can empathize. This is where the student finds value in what may seem other or different from his/her experience. Students truly understand when they have self-knowledge. This is where students achieve metacognitive awareness, which is the ability to look inside themselves and reflect on why they understand or do not understand something (Tiernan, 2011). Based on the problems related to students' understanding of biology learning that have been conveyed, this study aims to determine the improvement of students' concept understanding based on Wiggins' aspects of understanding in biology learning by applying a blended discovery learning model.

Method

The research used a type of quasi experimental research consisting of two groups in the form of an experimental class and a control class. The research design used pretest-posttest control group design. The experimental class was treated with a blended discovery learning model.

Tabel 1 Design of the research design pretest posttest control group design

Groups	Pretest	Treatment	Posttest
Experiment	T_1	X	T_2
Control	T_1	-	T_2

Keterangan:

T_1 Pretest, was conducted before treatment

Treatment in the form of applying the blended discovery learning model

T_2 Posttest was conducted after treatment

The research was conducted at SMA Negeri 1 Sumber, Cirebon Regency in the even semester of the 2022/2023 school year. The population in this study were students of SMA Negeri 1 Sumber class X MIPA which amounted to 249 students. The sampling technique used purposive sampling, the samples used were 2 classes, namely class X MIPA 4 (35 students) as the experimental class and class X MIPA 3 (35 students) as the control class. The criteria used to obtain the sample class in this study are the results of consideration with the Biology subject teacher of class X MIPA at SMAN 1 Sumber.

The research instrument used to measure Wiggins' understanding is a multiple choice question on the concept of kingdom plantae which includes four aspects of Wiggins' understanding, namely aspects of explanation, interpretation, application, perspective. To measure the aspects of empathy and self-knowledge, a questionnaire was used. Research data related to understanding aspects of explanation, interpretation, application and perspective were analyzed using the Normalized Gain (N-Gain) test. Before Mann Whitney U hypothesis test, prerequisite tests were conducted including normality and homogeneity tests. Normality test used Kormogorov-Smirnov test and homogeneity test used Leneve test through SPSS 22.0. Statistical testing was conducted at a significance level of 0.05. Questionnaire data was analyzed by calculating the average of all scores obtained.

Results and Discussion

Table 2 shows the results obtained for Wiggins' understanding in the explanation aspect, showing that the experimental class experienced a greater increase in understanding in the explanation aspect compared to the control class.

Tabel 2 Mean score of pretest, posttest and N-Gain of explanation aspect of experimental class and control class

Class	Pretest Mean	Posttest Mean	N-Gain	Criteria
Experiment	54,76	96,67	0,92	High
Control	58,10	83,81	0,61	Medium

The explanation aspect is the first aspect of Wiggins' understanding aspect that requires learners to be able to explain what they know and provide reasons that support the explanation before learners can conclude that learners understand what is taught (Wiggins & McTighe, 2005). n the first stage of learning using blended discovery learning, namely the stimulation stage which is carried out offline, learners are given a stimulus that directs learners to prepare for learning. Through the stimulation stage, students are required to observe the stimulus given and provide answers related to the stimulus according to what they know, so that the stimulation stage can support the increase in the explanation aspect of students' concept understanding based on Wiggins' understanding aspects. (Sunarto & Amalia, 2022) states that at the stimulation stage, students are faced with something that can arouse curiosity. So that the increase in the explanation aspect in the experimental class is higher than the increase in the explanation aspect that occurs in the control class.

Tabel 3 shows the results obtained for Wiggins' understanding in the interpretation aspect. Based on the results obtained, it shows that the experimental class experienced a greater increase in understanding in the interpretation aspect compared to the control class.

Tabel 3 Mean score of pretest, posttest and N-Gain of interpretation aspect of experimental class and control class

Class	Pretest Mean	Posttest Mean	N-Gain	Criteria
Experiment	48,57	94,29	0,89	High
Control	41,90	79,06	0,64	Medium

The interpretation aspect experienced a higher increase in the experimental class compared to the control class. The interpretation aspect is the second aspect of Wiggins' comprehension aspect. It is contextual and specific. When interpreting, learners move between the text and their own experience (Wiggins & McTighe, 2005). hrough the problem statement stage or problem statement/identification carried out offline, learners are required to be able to interpret the stimulus provided by the teacher as well as formulate problems and propose hypotheses.

Mukaramah et al., (2020) stated that at the problem statement stage students are given the opportunity to identify and analyze the problem at hand, this serves to build students to determine the problem. From the problem statement stage, students are required to interpret the knowledge they have to use and help in the process of formulating problems. In addition, the interpretation aspect can increase because there is a data collection stage or data collection and also data processing. At the data collection stage, students collect data through exploration with direct observation activities, students will interpret the data they get which then continues at the data processing stage data. In'am & Hajar (2017) state that through observation activities provide meaning to the learning process and reasoning to think systematically and logically. Then at the data processing stage, the process of obtaining data through direct observation activities or from relevant sources occurs, after which new data can be interpreted by students. So that the interpretation aspect in the experimental class has a higher increase compared to the control class.

Tabel 4 shows the results obtained for Wiggins' understanding in the application aspect, the experimental class experienced a greater increase in Wiggins' understanding in the application aspect when compared to the control class.

Tabel 4 Mean scores of pretest, posttest and N-Gain of application aspects of experimental and control classes

Class	Pretest Mean	Posttest Mean	N-Gain	Criteria
Experiment	58,10	100	1,00	High
Control	49,52	77,14	0,55	Medium

The increase in the application aspect in the experimental class is known to be higher than in the control class. This application aspect is the third aspect in Wiggins' understanding aspect. The application aspect is the ability of learners to use their knowledge effectively (Wiggins & McTighe, 2005). he application aspect experienced a higher increase in the experimental class compared to the control class, in the experimental class that applied the blended discovery learning model there was a data processing stage or online data processing, through the data processing stage students could apply the knowledge they had from the results of data collection to be conveyed to other students. Patandung (2017) states that the data collection process requires the ability to use the thinking potential of students, from the process of using this thinking potential, students will apply what they know. So that the results for the application aspect in the experimental class experienced a higher increase compared to the control class.

Tabel 5 shows the results obtained for Wiggins' understanding of the perspective aspect. The experimental class experienced a greater increase in understanding on the perspective aspect compared to the control class.

Tabel 5 Mean scores of pretest, posttest and N-Gain of perspective aspects of experimental and control classes

Class	Pretest Mean	Posttest Mean	N-Gain	Criteria
Experiment	47,86	92,86	0,86	High
Control	47,50	75,00	0,52	Medium

Perspective as an aspect of understanding is about how things look from different points of view (Wiggins & McTighe, 2005). In the perspective aspect, the experimental class gets a higher increase compared to the control class, because in the blended discovery learning process at the verification and generalization stages online, students are given the opportunity to conduct a careful examination to prove whether or not the hypothesis is set with the findings obtained and then communicated through presentation activities and conclude the results of the discussion that has been carried out. Through presentation activities at the verification stage, students can give their views on the results that have been obtained and then conclude them. The verification stage plays a very important role in increasing the motivation of students because there will be a very strong learning drive in students to prove the truth of the data that has been collected, while the generalization stage plays a role in increasing students' activities, especially mental activities, namely remembering, solving problems, analyzing factors, seeing relationships and making decisions(Masdariah et al., 2018).

Figure 1 shows the data from the questionnaire recapitulation of the empathy aspect of students in the experimental class using the blended discovery learning model. Based on Figure 1, it can be seen that as many as 14% of students gave very strong answers, 77% strong, 9% sufficient and 0% for weak answers. The overall average of the results of the questionnaire analysis of the empathy aspects of students in biology learning using the blended discovery learning model on the Negative-Positive Affective Empathy and Negative-Positive Cognitive Empathy statements shows a strong (good) category with an average value of 73%.

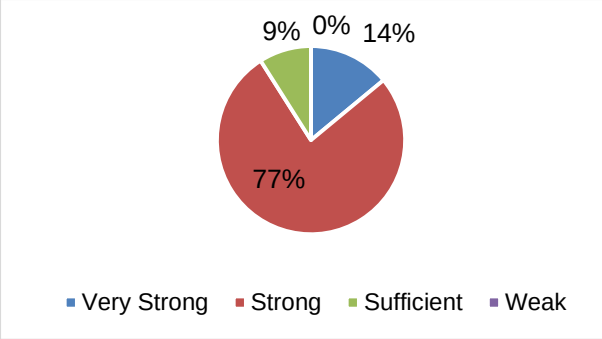

Figure 1 Percentage chart of the questionnaire on the empathy aspect of students

Empathy, Wiggins' fifth aspect of understanding, is the ability to enter into the feelings and views of others. The ability to understand another person's condition. The empathy aspect is an effort to feel as others feel, to see as others see (Wiggins & McTighe, 2005). The indicators of the empathy aspect used are projecting oneself to feel and appreciate the situation, influence, point of view of others and paying attention and listening sensitively to see what others often see. Indicators of empathy aspects used are learners can feel negative emotions and positive emotions felt by other learners and can recognize negative emotions and positive emotions felt by other learners. The types of statements used are Negative-Positive Affective Empathy and Negative-Positive Cognitive Empathy. Based on the data obtained, it shows that the percentage for the empathy aspect of students based on aspects of Wiggins' understanding in experimental class students is included in the strong (good) category. In the empathy aspect of Negative-Affective Empathy (NAE), the ability of students to feel negative emotions that other students feel when learning biology using a blended discovery learning model is good as well as in the empathy statement related to Positive-Affective Empathy (NAE). Affective empathy refers to the ability to experience other people's emotions. In other words, people with high levels of empathy can easily recognize other people's emotions and experience those emotions. The empathy aspect of students in the experimental class for the Negative-Cognitive Empathy (NCE) & Positive-Cognitive Empathy (PCE) statements obtained good results. Cognitive empathy refers to the ability to infer and recognize the emotions of others (Brett et al., 2023).

Good empathy results in students occur because in biology learning using the blended discovery learning model there are stages of data collection or data collection (offline), data processing (data processing), verification (proof) which is carried out online using whatsapp and google meet. Through the data collection and data processing stages, students interact and cooperate with each other with their group members, when proving students interact with each other exchanging arguments, because they often interact among friends, students feel and recognize the feelings felt by each other during biology learning. Yaqin (2021) conveyed that because they interact with each other, students will have an interest, the growth of empathy is accompanied by an interest in what happens to others. Learners have an interest or interest in helping to ease the burden of other students or helping out of the problems they face.

Figure 2 shows the data from the questionnaire results on the aspects of students' self-knowledge. Based on Figure 2, it can be seen that the results of the questionnaire on the aspects of students' self-knowledge as many as 27% of students answered strongly agree, 53% of students answered agree, 19% of students answered disagree and 1% of students answered strongly disagree. From the results in Figure 2, it can be seen that students have the ability to assess themselves accurately and organize themselves effectively well when learning biology using a blended discovery learning model.

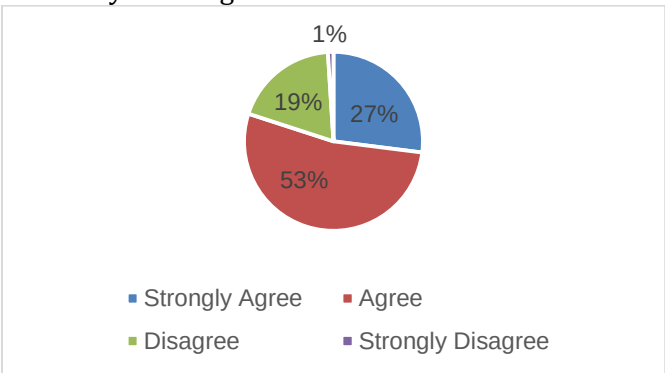

Figure 2 Percentage of students' self-knowledge questionnaire

The overall results of the questionnaire analysis of the self-knowledge aspect of students based on Wiggins' understanding aspects can be seen in Figure 3. It can be seen that as many as 40% of students gave very strong answers, 49% strong, 11% sufficient and 0% for weak answers. The overall average of the results of the questionnaire analysis of the self-knowledge aspects of students in biology learning using the blended discovery learning model shows a strong (good) category with an average value of 77%.

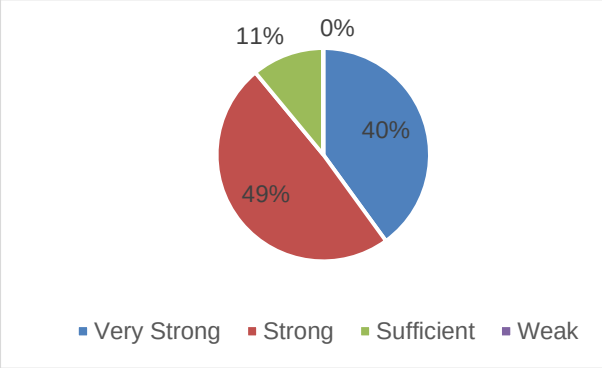

Figure 3 Recapitulation of questionnaires on self-knowledge aspects of students

Self-knowledge is key to understanding because it requires learners to consciously question their way of seeing things, when learners want to become more understanding they must go beyond themselves. This aspect asks learners to seek and find fault in themselves and have the discipline and courage to face uncertainty and inconsistency (Wiggins & McTighe, 2005). The indicators used for the self-knowledge aspect are assessing oneself accurately and managing oneself effectively. It consists of five statement indicators, namely being able to know the topics studied in biology learning, being able to describe and explain the topics studied in biology learning, being able to know the benefits of the topics studied in biology learning for oneself and for others and being able to know one's own weaknesses and shortcomings regarding the topics studied in biology learning.

Based on the results obtained, the self-knowledge aspect of students in the experimental class is included in the strong (good) category. This shows that students have the ability to understand themselves well. Good results in the aspect of self knowledge are obtained because in the biology learning process using the blended discovery learning model there is a verification learning step, through this proof stage students will know the extent to which they understand the material that has been obtained by conveying to other students through presentation activities carried out online. In addition, because there is a generalization learning stage (generalization / drawing conclusions) which is carried out online. Through this generalization stage, learners learn to know their own abilities. By providing learning conclusions, students know the extent to which they understand the material presented, this is in accordance with the statement of Gloria & Sudarmin (2018) hat the ability of students to know themselves will make students know their own development.

The results of the Kolmogorov-Smirnov normality test indicate the following significance values, the significance value in the experimental class with the application of the blended discovery learning model for the pretest 0.089> 0.05 while for the posttest 0.000 < 0.05. Control class for pretest 0.003 < 0.05 and posttest 0.000 < 0.05.

Tabel 6 Normality test results

Understanding Result	Significance	Criteria	Normality Test Conclusion
Pretest Experiment	0,089	> 0,05	Normal distribution
Posttest Experiment	0,000	< 0,05	Non-normally distributed
Pretest Control	0,003	< 0,05	Non-normally distributed
Posttest Control	0,000	< 0,05	Non-normally distributed

Tabel 7 shows the results of the homogeneity test. The results of the homogeneity test (Levene) obtained data obtained a significance of 0.014 <0.05, then the variance between data groups is not homogeneous (heterogeneous).

Tabel 7 Homogeneity Test Result

Result	Significance	Criteria	Homogeneity Test Conclusion
Student Understanding	0,014	< 0,05	Data is not homogenous (heterogeneous)

Based on the Mann Whitney U statistical test in Figure 4, the Asymp. Sig. (2-tailed) value of 0.000 <0.05 so that it can be stated that there are differences in students' concept understanding based on aspects of Wiggins' understanding between the experimental class and the control class. Because there is a significant difference, there is an effect of using the blended discovery learning model on students' concept understanding based on aspects of Wiggins' understanding in biology learning.

Test Statistics[a]

	Pemahaman
Mann-Whitney U	88.000
Wilcoxon W	718.000
Z	-6.238
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Kelas

Figure 4 Mann Whitney U test result

Students' understanding is related to constructivism learning theory, where this constructivism approach aims to increase students' understanding because in constructivism learning theory emphasizes the involvement of students in dealing with problems that occur (Masgumelar & Mustafa, 2021). n learning using the blended discovery learning model related to the theory of constructivism, learners form and acquire their knowledge naturally based on their own experiences in a customized way. Sahputro & Pakpahan (2021) stated that constructivism is based on the idea that students acquire and form their knowledge naturally based on their experiences which are adjusted to the character of their intellectual development. Constructivism theory is oriented towards how learners build their understanding of science, focusing more on the formation of knowledge rather than the delivery and storage of knowledge, on how learners build their own knowledge. Nurhidayati (2017) states that cognitive constructivism emphasizes self-determined learning activities and is oriented towards self-discovery, this is in accordance with the blended discovery learning process where in the process learners try to make their own discoveries through observation activities.

Conclusion

Based on the results of the research and the discussions that have been described, it can be concluded that there are significant differences in the improvement of students' conceptual understanding based on the aspects of Wiggins' understanding between the class using the blended discovery learning model and the class that does not use this model. Specifically, the experimental class demonstrated a notable improvement, with a posttest score indicating a higher level of understanding compared to the control class. This difference is statistically significant, suggesting that the blended discovery learning model effectively enhances students' conceptual understanding.

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