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Discovery Blended Learning in Biology: Its Effectiveness on Self-Efficacy and Student Learning Outcomes in the New Normal Era

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Abstract

The limited face-to-face interaction has reduced school hours and resulted in students having difficulty understanding the lesson and completing assignments given by the teacher, and this caused a decline in learning outcomes. Optimizing the learning process in the new normal era will be effective by applying blended learning. One of the learning models that can support students is blended learning with discovery learning models. Through the discovery blended learning (DBL) model, students become more active in the learning process. This model can increase students' self-efficacy and collaboration with peers in the class because students feel confident and can solve a problem. This study aims to analyze the effectiveness of blended learning with discovery learning models on self-efficacy and learning outcomes in Biology subject during the new normal era. This research is a quasi-experimental research design with non-equivalent control of pretest-posttest group design. Data analysis was carried out by using the N-gain test and independent t-test. The results indicate that there is a significant difference in effectiveness in the class using DBL on student learning outcomes and self-efficacy with the control class using the conventional model. In DBL syntax, students' ability in formulating problems and finding concepts independently, and presenting results can help students improve learning outcomes and self-efficacy. The DBL model can be used as an alternative model to support students learning Biology at the high school level (SMA/MA) in Indonesia so that students are more active in discussions to solve problems related to the subject matter. This model is also expected to guide students to find concepts independently so that students become more confident and believe in their abilities, especially in the new normal era.

Keywords: *Discovery Blended Learning*, *Sefl-efficacy*, Learning Outcomes

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INTRODUCTION

The recent COVID-19 epidemic has prompted the adoption of a number of regulations to halt the virus's spread. Every country faces a difficult decision when deciding how to best limit the spread of COVID-19 because this strategy has a detrimental effect on all facets of life (Wicaksana, 2020). Due of the current global COVID-19 pandemic, Indonesian education requires students to engage in online learning in order to complete their coursework and put their health first (Baety & Munandar, 2021). From mid-March 2020 to early July, the Indonesian government, through the Ministries of Education and Culture and of Religion, enacted a policy allowing for home study and work. Later, the government changed the directive and coined the phrase "New Normal" (Amalia & Fatonah, 2020).

According to Habibi (2020), the term "New normal" refers to a state, social habit, or individual's behavior following COVID-19. During the pandemic, technology and the internet facilitated teaching and learning processes, so teachers and students could conduct online learning utilizing applications that could offer interaction between teachers and students (Yudi Firmansyah & Fani Kardina, 2020). Blended learning, which mixes in-person training with online instruction using a number of platforms, is an effective learning technique in the contemporary age of the new normal (Purnama, 2020).

Dewi & Sadjiarto (2021) define online learning as distance learning carried out by utilizing various technologies and the Internet. Rosenberg (2001) the use of internet technology to give solutions that can improve knowledge and skills is stressed as being what is meant by the term "e-learning." Online learning is carried out on the internet network by combining synchronous and asynchronous learning (Purnama, 2020). While asynchronous learning can be flexible and not necessarily done at the same time as synchronous learning, both types of learning can be done using online courses. (Paramayati, 2021). Baety & Munandar (2021) reported that almost all secondary schools to tertiary institutions have conducted online learning. However, online learning is still considered ineffective due to the obstacles experienced by students and their parents or guardians, including a lack of understanding of the lesson because teachers only give students assignments. Other issues include internet network disturbances, boredom, limited mastery of technology, and limited facilities (Futriani Hidayah et al., 2020).

The government has taken measures to implement face-to-face learning in the Green Zone area, which allows the implementation of face-to-face learning while taking into account the health and safety of all school members, in response to various obstacles encountered during the online learning process, as stated in SKB Number 01 of 2020 (Limbong et al., 2021). Ode et al. (2021) The precautionary principle is employed in this face-to-face implementation because it affects school children' health and safety, and strict adherence to the established face-to-face implementation standards is necessary to protect student safety and health. For instructors and students who prefer face-to-face instruction, the existence of learning in the new normal period is a breath of fresh air (Adawiyah et al., 2021). The blended learning approach will be effective and efficient in optimizing the learning process in the present COVID-19 pandemic and new normal (Purnama, 2020).

Asynchronous learning activities that participants complete on their own are supplemented by synchronous learning activities such as in-person contact with instructors and group projects with peers (Howard et al., 2006). Blended learning comes from the word "blended" and "learning" (Dwiyogo, 2018). Thorne (2003) argued Blended learning is a response to the development of technology in terms of online learning with traditional learning. The term "blended learning" describes instruction that mixes in-person instruction with computer-based instruction (online and offline) (Dwiyogo, 2018). Through the use of technology-based learning, blended learning mixes in-person and online learning (Zgraggen, 2021). Currently, blended learning is starting to be considered in supporting the learning process because it is flexible, accessible, and integrated with sophisticated multimedia technology (Rafiola et al., 2020).

Fitriyana et al. (2020) discovered a substantial correlation between student achievement and self-efficacy in the android-based game. Self-efficacy is a personal factor that becomes an intermediary or mediator in the interaction between behavioral factors and environmental factors (Rafiola et al., 2020). Individuals with high self-efficacy can adapt quickly to the problems they face and do not feel anxious in dealing with these problems (Adinugraha, 2017). Furthermore, Monika & Adman (2017), Self-efficacy is a person's self-confidence that he can complete or perform academic tasks.

The level of tenacity or effort put forth by a person to complete a task or activity is determined by their level of self-efficacy.

Students in biology classes should participate more actively in group problem-solving because biology is related to how to learn and comprehend systematically. As a result, biology is not only about acquiring knowledge in the form of facts, concepts, and principles, but also a process of discovery (Sundari, 2018). According to Taiyeb & Mukhlisa (2015), students' subpar learning outcomes are a common issue in the learning process. Teachers must assist students in achieving better learning outcomes using active learning models as one of the aspects that contribute to the success of the learning process (Amijaya et al., 2018). The discovery learning paradigm is one of the many teaching strategies.

Discovery learning is a learning model that can solve problems in the learning process and intensive learning under the supervision of a teacher. In the discovery model, the teacher guides students to answer or solve a problem (Agusriyalni et al., 2021). According to Putrayasa et al. (2014) students can get closer to the source of their learning through the discovery learning approach. The students' self-confidence will also rise as a result of their perception that they independently found what they have learned. Additionally, their level of friendship-based cooperation will rise, which will enhance their learning opportunities. The discovery blended learning strategy is useful for enhancing students' motivation to study. Students who are engaged in their studies and are enthusiastic examples of this (Wijiastuti & Nurhayati, 2021).

Based on a study conducted by Cahyadi & Probosari (2012), Implementing blended learning in biology classes can help students' ability to think critically. (Sandi, 2005) reported that the student learning outcomes in Chemistry class were enhanced by the blended learning approach. Furthermore, Aini et al. (2021) emphasized that the application of blended learning based on Google classroom in terms of student learning outcomes on trigonometric equations was effective because there was an increase in learning outcomes (pre-test) scores. There haven't been many research, though, that look at how blended learning affects students' self-efficacy in biology classes, particularly in teachings about coordination systems.

In biology learning, students still have difficulty mastering the concept of biology. The content on coordination systems is among the classes that students find challenging to grasp. Siboro (2020) reported that the average percentage of students' learning difficulties in understanding the humanitarian coordination system in grade XI was 75.65% which was categorized as low indicating that students have difficulty understanding the humanitarian coordination system. This lesson is the most difficult for students because the concepts are difficult to understand, and there are so many topics to learn. Meanwhile, the teacher finds it difficult to present the material due to the limited time allocation (Raida, 2018). The human coordination system includes complex discussion because it includes detailed physiological processes of the human body and requires more time to study and discuss this in a face-to-face class or during regular study hours (Aminy et al., 2017).

Some other researchers focused only on issues related to the Discovery Learning model in biologi. Rosdiana et al. (2017) reported that the use of the Discovery Learning model affects the effectiveness and student learning results on ecosystem materials. According to other studies, the application of the Discovery Learning model of biology learning outcomes on fungi materials was found to have a positive influence (Anisa et al., 2021). Suparini et al. (2020) made the argument that the use of Discovery Blended Learning had an effect on students' critical thinking abilities on excretory material. This provides a chance to research how Discovery Blended Learning can be used to various class XI biology materials, such as the coordination system content.

Based on the preceding rationale, the researcher is curious to discover how well the Discovery Blended Learning (DBL) model works in enhancing students' self-efficacy and biological learning outcomes, particularly in the coordination system content during the new normal age. The goal of this study is to assess the effects of blended learning using discovery learning models on learning outcomes in biology and self-efficacy in the new normal age. The results are anticipated to be used as reference materials to learn more about how the blended learning model affects student biology learning outcomes and self-efficacy; as a study for consideration, empirical support, and as a reference for pertinent educational research in the future; to increase knowledge about learning models that have been shown to be successful; and to comprehend the significance of the role of self-efficacy in students.

RESEARCH METHOD

Research Design

This study is quasi-experimental since it includes a control group but is limited in its ability to properly control the external factors that influence how the experiment is carried out (Sugiyono, 2019). The employed design, which is shown in Table 1, is a group pretest-posttest nonequivalent control design. The DBL model served as the study's independent variable. Student learning results in the grade XI IPA coordination system content and self-efficacy are the dependent variables.

Table 1. Nonequivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experiment	U_1	X	O_1
Control	U_2	Y	O_2

Description:
X : Learning through the DBL model
Y : Learning through a conventional model
U_1 : The results of the Pre-test in DBL class
U_2 : The results of the Pre-test in Conventional Class
O_1 : The results of the Post-test in DBL class
O_2 : The results of the Post-test in Conventional Class

Population and Sample

The population of this study consisted of all grade XI IPA students from a private Madrasah Aliyah, which had three classes: XI IPA 1, XI IPA 2, and XI IPA 3. The results of the equivalence test using UAS scores of the three classes showed that the entire population had homogeneous characteristics. The sample for this study was selected via cluster random sampling. According to the sampling method, the sample used in this study consisted of students from grade XI IPA 1, the control class, which was chosen at random, and grade XI IPA 3, the experimental class, which was also chosen at random.

Research Instrument

Measurement and treatment tools were applied throughout this investigation. The treatment tools took the form of a DBL Model Learning Plan (RPP) and student worksheets (LKPD). The measurement tools included self-efficacy questionnaires for the students and measures for measuring learning outcomes (evaluation of concept mastery on the coordination system content). Before the instruments were used, construct validation and content validation was carried out first. The results of the validity and reliability of the pretest-posttest research questions were 0.892 > 0.361. Meanwhile, the results of the validity and reliability of the self-efficacy questionnaire were 0.934 > 0.361. Thus, both research instruments are valid and reliable.

Research Procedures

The research procedure is divided into three stages. The first stage was drafting and research instruments carried out in early December 2021. Next, the research implementation stage was carried out from April to May 2022. The third stage was data analysis and article completion. A coordination system was used to compare the prior knowledge of experimental class and control class students. The learning was carried out in two meetings in May 2022. The first meeting was a discussion related to nervous system material with the help of an online platform in the form of videos uploaded on e-learning and LKPD which was done in groups and the second meeting continued with material on the human sensory system. Students in the control group acquired traditional learning models in that setting. The experimental class, in contrast, used the discovery blended learning model, which combines the discovery learning model with online learning supported by an e-learning platform. Discovery blended learning syntax was adapted based on discovery learning syntax (Suparini et al.., 2020) which can be seen in the table 2.

Data Analysis Technique

The N-gain test was used to examine the data and find out how well the DBL model affected student learning outcomes and self-efficacy. Table 3 includes the N-gain effectiveness category, and Table 4 includes the standards for the degree of student efficacy. The normality and homogeneity tests were completed before the N-gain test, which is a preparatory test. In this study, the normality test followed the Shapiro-wilk test. In the Shapiro-wilk test, data whose significance value is greater than 0.05 at a significance level of 5% is data that is normally distributed. If the results of the analysis using the N-gain test show that it is effective, then an independent t-test is carried out to determine whether the results of the effectiveness of the DBL model are significantly different or not. The experimental class and the control class are found to differ significantly from one another if the value of Sig. (2-tailed) is less than 0.05. The analysis's conclusion can then be drawn in the table 3.

Table 2. *Discovery Blended Learning Syntax*

No.	Syntax	Learning Activities	Implementation
1.	Stimulation	Students formed groups and paid attention to the lessons delivered by the teacher in e-learning	Online
2.	Problem Statement	The teacher gave students LKPD and students identified the lesson on the video coordination system in e-learning	Online
3.	Data Collection	The teacher supported students in their groups to find and collect data according to their respective assignments from relevant sources	Online
4.	Data Processing	The teacher supported students in their groups to solve problems through discussion	Online
5.	Verification	The teacher supported students by comparing the results of discussions among groups regarding the coordination system	Offline
6.	Generalization	The teacher reinforced the learning concept and concluded together with the students. The results of the discussion were uploaded to the e-learning.	Offline and Online

Table 3. The Effectiveness of N-gain

Percentage (%)	Description
< 40	Not effective
40 – 55	Less effective
56 – 75	Quite effective
> 76	Effective

(Arikunto (1999) in (Arini, 2016))

Table 4. The criteria of Self-efficacy

Interval	Criteria
91-100	Very high
78-90	High
65-77	Quite High
52-64	Moderate
39-51	Quite Low
26-38	Low
14-25	Very Low

(Sadewi et al., 2012)

RESULTS AND DISCUSSION

Learning Outcomes

Based on the study's findings, Table 5 provides descriptive statistical information on student learning outcomes, including the average score, minimum score, and maximum score of the experimental class using the DBL model and the control class using the traditional approach.

Table 5. Descriptive Statistical Data for Experimental Class and Controlled Class

Data	Experimental Class		Controlled Class	
	Pretest	Posttest	Pretest	Posttest
Mean	47,68	77,50	47,86	60,71
Min	30	65	30	45
Max	70	90	70	80
Interval	40	25	40	35
Standard Deviation	9,669	7,136	10,923	9,400

Table 5 demonstrates that the two samples' average pretest scores are equal. Meanwhile, the average posttest scores of the two classes were different. Students who learnt using the DBL model typically scored better than those who learned using the traditional paradigm. Students in the experimental class are already aware of how to seek out information online and from conversations with teachers and peers to learn more. Students are also prepared to discuss the material in class and are confident in giving opinions, so student learning outcomes can increase.

The average N-gain score (DBL model) for the experimental class is 57.5276, or 57.5 percent, making it fairly effective with a minimum N-gain score of 36.36, or 36.4 percent, and a maximum of 75.00, or 75 percent. The average N-gain score for the control class (traditional model) is 24.5169, or 24.5 percent, while the N-gain score range for this class is 9.09, or 9.1 percent, to 44.44, or 44.4 percent, placing it in the ineffective category. Therefore, it can be concluded that the DBL model's use is sufficient to enhance students' learning outcomes for grade XI Madrasah Aliyah Swasta (MAS) students studying coordination systems in biology. Meanwhile, the use of conventional models is not effective in improving student learning outcomes.

The significance of the variations in outcomes between the experimental class and control class in terms of learning biology was determined using a t-test (see Table 6). The results of the t-test show that the variance of the N-gain data (percent) for the experimental class and control class is the same or homogenous because the value of Sig. on Levene's Test for Equality of Variances is $0.954 > 0.05$. As a result, the outcomes of the Equal variances assumed ar Levene's e used to inform the independent t-test for the N-gain score. The t-test findings show that the value of Sig. (2-tailed) is $0.000 < 0.05$, indicating that the DBL model and the traditional model are significantly (significantly) more successful at improving learning outcomes in Biology topics with coordination system materials in grade XI Madrasah Aliyah Swasta (MAS).

Table 6. Test Learning Outcomes' Independent Test Results

		Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Learning outcomes	Equal variances assumed	.003	.954	12.958	54	.000
	Equal variances not assumed			12.958	53.816	.000

According to the examination of the average percentage of student learning outcomes, the experimental class and the control class scored differently on the pretest-posttest learning outcomes. Students' learning results increased in the experimental class (DBL model). The learning outcomes of the students in the control class also improved, although the average posttest score for the experimental class was greater than the average for the control class. These results indicate that given the DBL model, student learning outcomes have increased higher than students who studied with the conventional model.

According to the conclusions of the Independent Sample T-Test, the DBL model and the conventional model are considerably more successful at enhancing learning outcomes in biology class in Madrasah Aliyah Swasta's grade XI on the topic of coordination systems. This study's findings concur with those of research by (Anggraita et al.., 2022) and (Hidayati, 2019), which discovered that the discovery learning model with blended learning has an impact on student learning outcomes. Due to the DBL learning model's goal of teaching students to uncover concepts on their own, the application of blended learning with DBL can enhance learning outcomes (Sukemi, 2022).

In the DBL model, the syntax that facilitates students to find concepts independently is the syntax of problem identification and data collection where students are given video links through e-learning before they are directed to come up with their questions and collect information to answer these problems. By providing videos through e-learning, students are more enthusiastic about conducting discussions to answer problems. Watching videos will help students comprehend the coordination system material's contents more quickly. By providing a stimulus in the form of a video to students can help students in understanding biology material Priadi et al. (2021). Students can also search for information through other relevant sources so that students can find more information related to Biology lessons, especially the coordination system. According to knowledge will last longer with online exploration.

Self-Efficacy

According to (Sadewi et al.., 2012), Table 4 shows a number of factors for the degree of self-efficacy. The results of the average gain after conversion are indicators of the magnitude of 88.14, the strength of 79.50, and the generality of 86.78. Students' self-efficacy for biology courses is high when it comes to indications of magnitude, strength, and generalization in the experimental class's lesson on the coordination system. Meanwhile, in the control class, the average score of the magnitude indicator is 74.50, strength is 68.28, and generality is 75.14. The level of student self-efficacy for the Biology subject on the coordination system material in the experimental class on the magnitude, strength, and generality indicators is in the fairly high category. This displays

the difference in the mean scores between the experimental class and the control class. Table 7 displays the average outcomes for each self-efficacy indicator for both the experimental group of students and the control group of students.

Table 7. Means of Indikator Self-efficacy

Indikator Self-efficacy	Experimental Group (DBL)		Controlled Group (Konvensional)	
	Mean	Category	Mean	Category
Magnitude	44,07	High	37,25	Quite high
Strength	39,75	High	34,14	Quite high
Generality	43,39	High	37,57	Quite high

The score for the N-gain efficacy for the interpretation category may be found in Table 3 based on the outcomes of the N-gain test computation. According to the findings, the experimental class's average N-gain score (DBL model) is 60.3999, or 60.4 percent, falling into the range of "very effective," with a minimum N-gain score of 30.00, or 30 percent, and a high of 82.22, or 82.2 percent. The control class (conventional model) has an average N-gain score of 22.9727, or 23 percent, falling into the ineffectual category with a range of 5.88, or 5.9%, to 41.89, or 41.9 percent, as well as a minimum N-gain score. Therefore, using the DBL model to teach students at Madrasah Aliyah Swasta (MAS) grade XI about coordination systems increases their self-efficacy in the topic of biology pretty effectively. Meanwhile, the use of conventional models is not effective in increasing students' self-efficacy.

The variance of the N-gain data (percent) for the experimental class and control class is the same or homogenous, as shown by the results of the self-efficacy of the t-test in Table 8 where the value of Sig. on Levene's Test for Equality of Variances is 0.054>0.05. Thus, the independent t-test for the N-gain score is guided by the results of Equal variances assumed. Based on the results of the t-test, the value of Sig. (2-tailed) is 0.000 < 0.05, so there is a significant (significant) difference in effectiveness between the use of the DBL model and the conventional model to increase student self-efficacy in Biology class in coordination system lesson in grade XI students of Madrasah Aliyah Swasta (MAS).

Table. 8 Independent Sample Test Self-efficacy

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	df	Sig. (2-tailed)
Self-efficacy	Equal variances assumed	3.889	.054	13.992	54	.000
	Equal variances not assumed			13.992	43.769	.000

The average scores for each self-efficacy indicator indicate that there is a difference between the experimental and control groups in terms of average scores. The magnitude indicator shows high criteria within the experimental group and quite high criteria in the control group. High criteria describe that students are quite capable to overcome learning difficulties and do assignments (Sunaryo, 2017). The DBL model - discussing in groups and presenting the results of their discussions in front of the class can spur students' self-efficacy, such as responses, objections, and questions from other

groups. In the experimental class, after being given treatment with the DBL model, students became more active in discussing to get the desired answer.

Furthermore, the strength indicator is included in the high criteria in the experimental group and the moderate criteria in the control group. In the control class, students still experienced a little uncertainty about their ability to complete the task, but it was different from the experimental class which used the DBL model. Students were confident and able to accomplish tasks assigned by the teacher by discussing with peers and teachers, or looking for answers from articles or books on online media. In the DBL model, there is a learning syntax that facilitates students to independently find material concepts through group discussions.

The experimental class scored highly on the last indicator, generality, but the control class also scored highly. The high criteria for this generality indicator prove that students believe they can complete various tasks and various materials in the learning provided by the teacher (Nugraha & Prabawati, 2019). With the DBL model, students in the experimental class achieved high criteria because students could learn based on their experience in solving problems and finding things to get new ideas with teacher guidance. The guidance and direction of teachers will help students in achieving learning goals.

The DBL model gives students opportunities to practice discussing and collaborating to solve subject-related problems and guiding students to find concepts independently to increase student self-efficacy. (Jazuli et al., 2022) concluded that blended learning had a significant effect on students' self-efficacy. Research carried out by (Putri et al., 2017) indicates that the discovery learning model is effective in increasing students' self-efficacy. An effective discovery learning model can foster students' self-efficacy (Purwati, 2018).

CONCLUSION

The results of this study showed that, in terms of student learning outcomes and self-efficacy, the DBL class and the control class utilizing the traditional paradigm were significantly more effective than each other. According to the study's findings and conclusions, it is clear that in the Discovery Blended Learning paradigm, students' capacity to formulate issues, locate concepts on their own, and communicate results can help students enhance learning outcomes and self-efficacy. Therefore, the DBL model should be used as a suitable alternative model to support the Biology learning process for SMA/MA in Indonesia so that students are more engaged in discussing and solving problems related to the subject learned and guiding students to find concepts independently to solve a problem so that students become more sure and believe in their abilities, especially in the new normal era. The DBL model is hoped to be used by teachers in the future as an alternate model to help students acquire good self-efficacy, which will benefit their biology learning results.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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