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Research Artikel

ENHANCING BIOLOGY LEARNING OUTCOMES THROUGH A BLENDED-DISCOVERY LEARNING MODEL INTEGRATED WITH THE *BIOENIAL* WEBSITE

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Abstract

The post-COVID-19 shift to blended learning presents a significant challenge for biology education, necessitating innovative pedagogical approaches to adapt to the digital era. This study addresses this need by investigating the effectiveness of a Blended-Discovery Learning (BDL) model, specifically when integrated with the Bioenial website, on students' biology learning outcomes. A quasi-experimental research design with a pretest-posttest non-equivalent control group was employed with 11th-grade students from a private school in Boyolali, Central Java. Three groups were compared: a control class, an experimental class using BDL with Google Classroom, and another experimental class using BDL with the Bioenial website. Data were collected using a multiple-choice test and analysed through ANCOVA. The findings revealed significant improvements in learning outcomes across all groups, as indicated by higher post-test scores compared with pre-test scores. The ANCOVA analysis demonstrated a significant effect of the instructional model on students' biology learning outcomes, with a large effect size (partial $\eta^2 = 0.343$). The BDL model integrated with the Bioenial website yielded the highest learning outcomes, followed by BDL with Google Classroom and the traditional control group. These findings highlight the potential of BDL as an effective instructional strategy in biology education and suggest that integrating BDL with a specialized digital platform can substantially enhance students' learning outcomes. Therefore, the implementation of BDL supported by dedicated web-based learning environments is highly recommended to optimize biology learning in the digital era.

Keywords: *Bioenial; biology education; Blended-Discovery Learning (BDL); blended learning; learning outcomes; website.*

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INTRODUCTION

Learning outcomes are critical in education as they provide a framework for assessing student learning, ensuring quality, and aligning educational practices with workforce demands. They serve as a fundamental measure of what students are expected to know, understand, and be able to accomplish upon the completion of a learning activity. Defined as competencies, these outcomes encompass a holistic blend of a student's cognitive, affective, and psychomotor skills acquired throughout the educational process (Goss, 2022; Tamam & Corebima, 2023). They provide a crucial framework for educators to design effective curricula and instructional strategies, while also serving as a key benchmark for evaluating academic achievement (Harris & Clayton, 2019). By aligning learning outcomes, experiences, and assessments, they provide direct evidence of student learning, supporting effective quality assurance and improvements in teaching and learning practices (Bayrakci & Karacaoglu, 2020).

In the context of biology education, students' learning outcomes are influenced by various factors, including teaching quality, student engagement, the use of technology, and the inherent characteristics of the biology subject itself (Karmana, 2024; Lestari et al., 2023). Biology education is not merely about memorizing scientific facts; it is a process of discovery that systematically investigates living organisms and natural phenomena (Ramdiah et al., 2020; Yli-Panula et al., 2018). The objects of study in biology are highly diverse, ranging from microscopic to macroscopic levels, and the learning process involves abstract concepts like cellular bioprocesses and metabolic functions. This inherent complexity makes it difficult for students to build a deep conceptual understanding, which can subsequently impact their learning outcomes (Supratman et al., 2023). This challenge highlights the critical need for innovative pedagogical approaches to effectively engage students and enhance their understanding of complex biological topics (Bhoi, 2024).

This challenge is particularly evident in Indonesia, where various studies have revealed persistently low biology learning outcomes among students. Evidence from large-scale international assessments further confirms this concern. In the 2022 Programme for International Student Assessment (PISA), Indonesian students obtained an average science score of 383, substantially lower than the OECD average of 485. Moreover, only 34% of Indonesian students achieved at least Level 2 proficiency in science, compared with 76% across OECD countries, indicating that a majority of students still struggle to explain scientific phenomena and apply scientific reasoning in everyday contexts (OECD, 2023).

The relatively low biology learning outcomes of Indonesian students can be attributed to several factors, including ineffective teaching strategies and a conventional instructional model applied by the teacher (Eka Lidiastuti et al., 2024), the limited use of instructional technologies, insufficient integration of local wisdom (Fauzi et al., 2024), and inadequate development of science process skills (Ilma et al., 2020; Sholihah & Amin, 2025). To overcome these challenges, educators need to design innovative pedagogical strategies that leverage educational technology to improve the quality of biology learning.

A promising instructional model that aligns with the specific characteristics of biology and has the potential to address the challenges discussed above is Blended-Discovery Learning (BDL). BDL combines the Discovery Learning approach with the Station Rotation model within a Blended Learning framework. Discovery learning promotes active participation, creativity, critical thinking, and students' autonomy in constructing knowledge (Bandara & Jayaweera, 2024). Likewise, blended learning offers flexibility, accessibility, personalized learning opportunities, and enhanced student engagement by integrating face-to-face instruction with online learning environments (Samuel, 2024). The integration of these approaches enables students to independently explore biological concepts while receiving structured guidance through multiple learning modalities, thereby supporting more meaningful learning experiences.

Previous studies have demonstrated the effectiveness of discovery learning supported by digital media in improving students' conceptual understanding in biology (Ningsih & Jayanti, 2022; Sari et al., 2025). Other studies have reported positive effects of blended learning on students' engagement and academic achievement in science education (Cao, 2023; Tong et al., 2022). In addition, the Station Rotation model has been found to facilitate differentiated instruction and increase students' participation in classroom activities (Xiangze & Abdullah, 2023). However, these studies have generally investigated these approaches in isolation. Limited evidence is available regarding the integration of Discovery Learning and Station Rotation within a blended learning framework implemented through a dedicated web-based environment for biology instruction.

Therefore, the novelty of this study lies not merely in employing BDL or educational websites as independent components, but in implementing a web-supported BDL environment that systematically integrates the phases of Discovery Learning with Station Rotation activities tailored to the characteristics of biology learning. The successful implementation of the BDL model in biology education requires instructional media that align with its pedagogical characteristics by facilitating both face-to-face and online learning experiences while supporting the development of students' science process skills (Xu et al., 2023). To address these requirements, this study employed the *Bioenial* website, a biology learning platform specifically designed to support interactive learning activities and foster science process skills. Unlike educational websites that primarily function as repositories of learning materials, *Bioenial* was utilized as a pedagogical tool to facilitate inquiry processes, provide access to diverse learning resources, and support students' active engagement throughout the BDL phases. Accordingly, this study aimed to examine the effectiveness of implementing the BDL model integrated with the Bioenial website in improving students' biology learning outcomes. The findings are expected to enrich the existing body of knowledge on technology-enhanced instructional models and provide practical insights for educators seeking to optimize the integration of digital technologies into biology education.

METHOD

This study was a quasi-experiment using a pretest-posttest nonequivalent control group design. A learning model combined with different learning media was applied to three classes. The BDL model combined with Google Classroom was used as the positive control group, the BDL model combined with the Bioenial website was used as the experimental group, and the Discovery Learning (conventional) model was used as the negative control group. The intervention was implemented for four consecutive instructional meetings over a four-week period, with each meeting lasting 90 minutes. To ensure comparability across groups, all classes were taught the same learning objectives, content, and assessment instruments, while the instructional model and learning media constituted the primary differences between groups. The research design can be seen in Table 1.

Table 1. Research design

Group	Pretest	Independent Variables	Post-test
E1	Y1	X1	X1Y2
E2	Y1	X2	X2Y2
C	Y1	-	Y2

Description: E1 : BDL combined Google Classroom
E2 : BDL combined *Bioenial* website
C : Discovery learning conventional
Y1 : Pretest score
XIY2 : Post-test score of BDL combined Google Classroom
X2Y2 : Post-test score of BDL combined *Bioenial* website
Y2 : Post-test score of the control class

The population of this study comprised all 11th-grade students at a private senior high school in the Solo Raya area, Central Java, Indonesia. A cluster random sampling technique was employed to select the participating classes. Three intact classes were included in the study: Class XI-3 (n = 21) served as the control group and received conventional instruction, Class XI-4 (n = 23) served as the first experimental group and was taught using the Blended-Discovery Learning (BDL) model integrated with Google Classroom, and Class XI-5 (n = 19) served as the second experimental group and was taught using the BDL model integrated with the Bioenial website. Thus, the final sample analyzed in this study consisted of 63 students.

A test instrument was used for data collection in this study. The instrument consisted of 10 multiple-choice questions developed based on the learning objectives of the Grade 11 biology topic on membrane transport, covering diffusion, osmosis, active transport, endocytosis, and exocytosis. The items were aligned with the curriculum indicators and reviewed by biology education experts to establish content validity. Reliability analysis using the Kuder–Richardson Formula 20 (KR-20) yielded a coefficient of 0.743, indicating acceptable internal consistency of the instrument. The improvement in students' biology learning outcomes was determined based on the pre-test and post-test results.

Data analysis was performed using the ANCOVA test in SPSS 25 to determine the effect of the Blended-Discovery Learning model on students' biology learning outcomes. As a prerequisite for the ANCOVA test, the normality and homogeneity of the data were first tested using the Kolmogorov-Smirnov and Levene's tests. The data were declared normal and homogeneous if the significance value was greater than the alpha level (α) 0,05. The Blended-Discovery Learning model is considered to have a significant impact on students' biology learning outcomes if the significance value is less than the alpha level (α) 0,05 (Ilma et al., 2022). Further analysis was conducted using the Least Significant Difference (LSD) test to determine the extent of the real difference among the three classes (Law et al., 2023).

RESULT AND DISCUSSION

Students' biology learning outcomes are influenced by the instructional models implemented by teachers. This study employed the Blended-Discovery Learning (BDL) model in biology education. A pre-test was administered to the control and experimental classes before the intervention to measure students' initial abilities. Following this, the biology learning process was carried out by implementing the BDL model combined with Google Classroom, the BDL model integrated with the *Bioenial* website, and conventional Discovery Learning in the control class. The students' learning outcomes from each of these treatments were then measured through a post-test to determine the effectiveness of the applied learning models and to assess the improvement in learning outcomes.

Normality and homogeneity tests were performed on the pre-test and post-test data to test the hypothesis that implementing BDL affects students' biology learning outcomes. The results of the normality test, based on the pre-test and post-test scores, are presented in Table 2.

Table 2 shows that the significance values are greater than 0.05. Therefore, it can be concluded that all samples are normally distributed. Furthermore, the second prerequisite test, the homogeneity test, was performed. The homogeneity test results for students' learning outcomes can be seen in Table 3

Table 2. The Normality Test Result

Score	Treatment	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Pretest	Discovery learning conventional (control)	0.141	21	0.200*
	BDL combined Google Classroom	0.149	21	0.200*
	BDL combined *Bioenial* website	0.168	21	0.123
Post- test	Discovery Learning (control)	0.152	21	0.200*
	BDL combined Google Classroom	0.174	21	0.098
	BDL combined *Bioenial* website	0.179	21	0.077

Table 3 shows that all samples have a significance value greater than 0.05. Therefore, it can be concluded that all samples have homogeneous variances. Based on the results of the normality and homogeneity tests, it can be stated that all samples meet the requirements for the ANCOVA test. The ANCOVA test determined the difference between the control and treatment classes. The results of the ANCOVA test are presented in Table 4.

Table 3. The Homogeneity Test Result

F	df1	df2	Sig.
0.568	2	60	0.570

The results of the ANCOVA analysis in Table 4 show that the model's significance value for the treatment classes (F = 15.399) is 0.000, which is lower than 0.05. Therefore, it can be concluded that the BDL model significantly impacts students' biology learning outcomes.

Table 4. The result of ANCOVA test

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected Model	6051.712[a]	3	2017.237	38.701	0.000
Intercept	20993.311	1	20993.311	402.763	0.000
Pretest	4562.823	1	4562.823	87.539	0.000
Class	1605.320	2	802.660	15.399	0.000
Error	3075.272	59	52.123		
Total	382500.000	63			
Correlated Total	9126.984	62			

a. R Squared = 0.663 (Adjusted R Squared = 0.646)

In addition to statistical significance, the magnitude of the treatment effect was examined using partial eta squared (partial η^2). The analysis yielded a partial η^2 value of 0.343, indicating that approximately 34.3% of the variance in students' post-test scores could be attributed to differences in the instructional models after controlling for pre-test performance. This result indicates a substantial educational effect, suggesting that the implementation of the BDL model produced meaningful improvements in students' biology learning outcomes beyond mere statistical significance.

Subsequently, to determine the least significant difference among the treatments, an LSD test was performed. The results of the LSD test are presented in Table 5.

Table 5. The Result of LSD Test

Classes	Mean	LSD Notation		
Discovery Learning (control)	70.722	A		
BDL combined with Google classroom	77.143		B	
BDL combined with *Bioenial* website	83.087			C

The LSD test results in Table 5 indicate significant differences among the three treatment groups based on the post-test mean scores. The control class using conventional Discovery learning showed the lowest mean score, followed by the BDL with Google Classroom, while the BDL with *Bioenial* website achieved the highest mean score, forming three distinct subsets. The improvement in biology learning outcomes is illustrated in Figure 1.

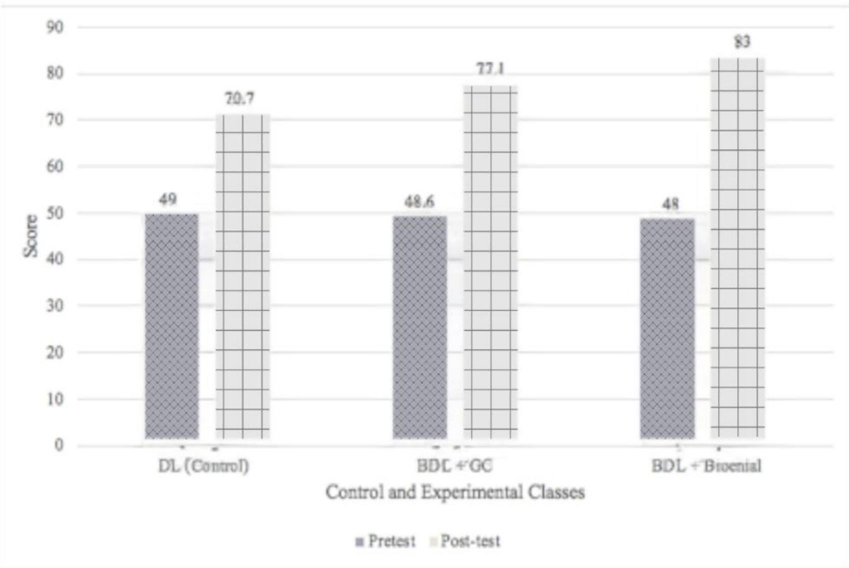

Figure 1. Average Pretest and Post-Test Scores of Classes with Discovery Learning Model (XI3: Control), BDL combined with Google Classroom (XI4: BDL+GC), BDL combined with Bioenial website (XI5: BDL+Bioenial)

As shown in Figure 1, the average learning outcomes in all three classes improved, as evidenced by comparing the pre-test and post-test scores. The most significant score increase was observed in the class when the BDL model was combined with the *Bioenial* website. This was followed by the class using the BDL model combined with Google Classroom, while the smallest increase was found in the control class.

The implementation of the BDL model in the experimental classes had a significant effect on students' biology learning outcomes. The BDL model, as utilized in this study, integrates Discovery Learning with Station Rotation Blended Learning. This pedagogical approach is a key concept in 21st-century education, merging face-to-face and online instruction to create a flexible, hybrid learning environment (Markauskaite et al., 2023; Yu et al., 2023). It makes learning more effective, allowing students to access resources anywhere and anytime. Furthermore, BDL facilitates student communication, enabling collaborative learning outside of the classroom. The discussion process during face-to-face and online sessions can enhance students' teamwork skills and deepen their understanding of the material. By organizing learning activities in collaborative groups, BDL promotes a more interactive and dynamic learning experience. The specific learning activities within the BDL model are detailed in Table 6.

Table 6. Learning Activities Within the BDL Model

No.	BDL Syntax	Students' Learning Activities
1	Teacher-led instruction: Orientation	Students observe problems related to the learning topics, identify variables, and make connections between their existing knowledge and new problems encountered.
2	Online instruction: Orientation	Students conduct a literature review and formulate a research question for further investigation.
3	Teacher-led instruction: Hypothesis generation	Students recognize and describe the relationships between variables and formulate hypotheses or provisional answers to problem statements.
4	Collaborative activities and stations: Hypothesis testing	In groups, students design and conduct an experiment and then collect the data.
5	Collaborative activities and stations: Conclusion	In groups, students present their experimental data in various forms, analyse it, and draw conclusions to address the problem formulations and prove the hypotheses.
6	Online instruction: Regulation (planning, monitoring, and evaluation)	Students reflect on their learning journey from the initial planning stages to its conclusion and actively participate in assessments to evaluate their learning achievements.

The BDL model facilitates students' learning through teacher-led instruction, online instruction, and collaborative group activities. This approach strengthens interaction and enriches students' learning experiences, which can positively influence their attitudes and learning outcomes (Wang & Yuan, 2022). The effectiveness of any learning process is highly dependent on strong interaction (Wang & Yuan, 2022). Various forms of interaction, such as asking questions, providing explanations, offering feedback, and collaborating in groups, can positively impact the learning process and its outcomes (AlHaqwi & Taha, 2015).

In teacher-led instruction sessions, the teacher is a facilitator to ensure learning remains student-centered. This approach offers several advantages, such as direct interaction between students and teachers through voice intonation, body language, and facial expressions, which are crucial for conveying a wide range of feelings and for giving or receiving feedback (Gherheș et al., 2021). This type of interaction is essential for providing students with adequate practical knowledge (Muthuprasad et al., 2021). Student-centered learning emphasizes that learning is a constructivist process, aligning with the theory of constructivism (Abualhaija, 2019). Furthermore, it views learning as a process of active information processing by students, a concept supported by cognitive learning theory (McSparron et al., 2019). When these two theories are combined, they lead to the perspective that students must actively process various information to construct their own knowledge. During the orientation phase, students build knowledge by connecting their existing understanding and new information gathered through observation and literature reviews.

In online learning sessions, students have the flexibility to access a variety of learning resources. It is beneficial as it helps students organize their study time more effectively (Alzahrani et al., 2023) and empowers them to become independent learners, allowing them to learn from anywhere and at any time (Dumford & Miller, 2018). This approach is also highly relevant in today's digital era, aligning well with the rapid advancements in communication and information technology (Sharma et al., 2023). Furthermore, the online orientation session provides additional opportunities for students to explore diverse literature related to observed phenomena, which in turn helps to foster more profound curiosity. This process enables them to generate problem formulations that will be investigated in the subsequent stages of learning activities.

In collaborative group sessions, students can build direct interaction with one another. Collaborative learning activities offer several benefits, such as allowing learners to cooperate and discuss in groups. It helps equalize learning achievement and minimize student gaps (Sukmawati et al., 2019; Supena et al., 2021). Collaborative group learning also encourages peer teaching, ensuring all students benefit from the process (Huysken et al., 2019). A strong social interaction among students and between students and the teacher is a key to success in these collaborative learning sessions.

The BDL model developed in this study emphasizes a constructivist approach to the learning process. Learning with a constructivist approach aims to enable students to build their understanding independently (Leow & Neo, 2023). It makes learning more meaningful, which helps activate students' long-term memory to absorb new information and construct new knowledge during the learning process (Lazou & Tsinakos, 2023). Combining a constructivist approach with collaborative learning in the BDL model is complementary. While the constructivist perspective requires learners to construct their knowledge, the collaborative perspective emphasizes social practice and group cooperation in building that knowledge (Zawacki-Richter & Jung, 2023).

The application of the BDL model in biology learning can be combined with various supporting media. In this study, the *Bioenial* website was used as a key supporting media to enhance biology learning in one experimental class. In the other experimental class, the BDL model was integrated with Google Classroom, a platform that teachers have widely adopted. As illustrated in Figure 1, the research results show that implementing the BDL model combined with the *Bioenial* website yielded the highest average scores on students' biology learning outcomes. The interface of the *Bioenial* website used in the learning process is presented in Figure 2.

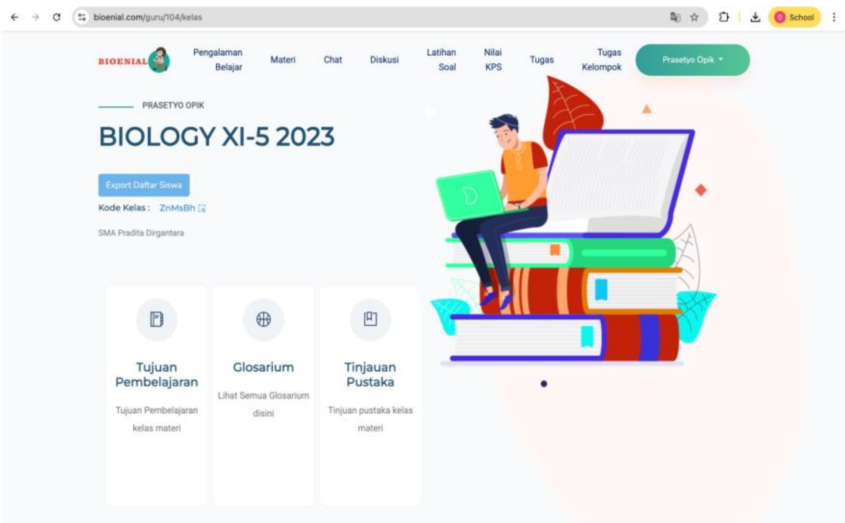

Figure 2. The *Bioenial* Class Dashboard Interface used to Support the BDL Learning Implementation

Figure 2 shows the interface of the *Bioenial* website used as supporting digital platform in the BDL implementation. The platform includes features for organizing learning objectives, materials, assignments, discussion, and students' performance data.

These features were utilized by teachers to facilitate learning activities and monitor students' participation during the biology learning process. The learning materials interface on the *Bioenial* website is presented in Figure 3.

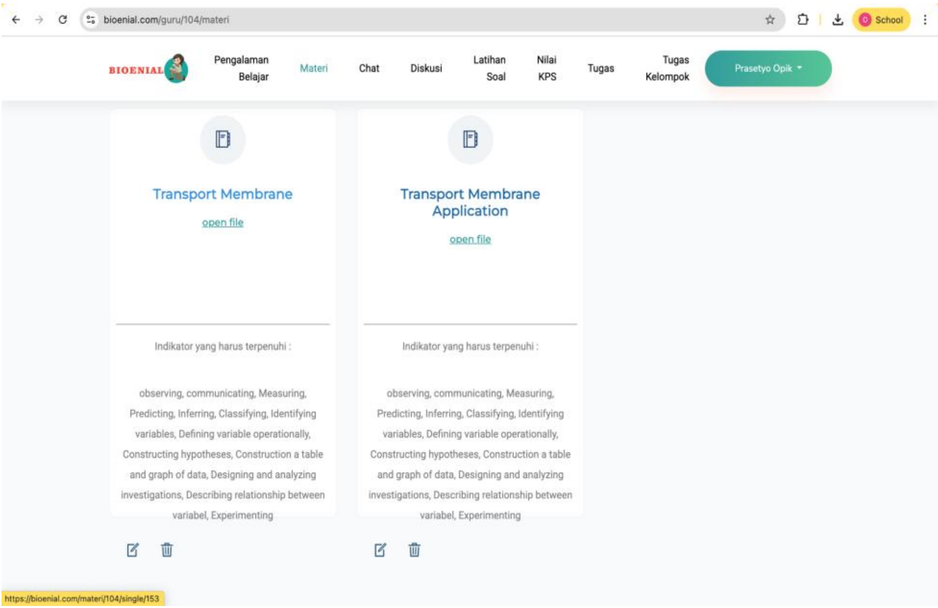

Figure 3. Learning Materials on *Bioenial* Website

Figure 3 illustrates the learning materials interface on the *Bioenial* website used in this study. The interface provided structured instructional content and downloadable digital resources related to the biology topic. The materials were organized based on curriculum indicators and learning objectives to support students' independent learning activities during the implementation of the BDL model. Furthermore, the platform provides an interactive discussion feature to support student-student and student-teacher interactions, as illustrated in Figure 4.

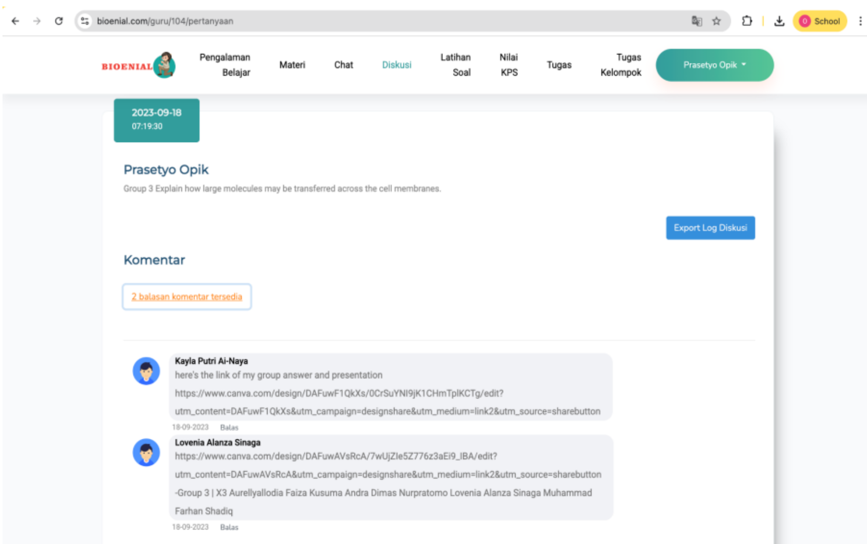

Figure 4. Discussion Feature in The *Bioenial* Website

Figure 4 illustrated the interactive discussion forum on the *Bioenial* website used in this study. The forum allows teachers to post guiding questions and enable students to share responses, comments, and learning artifacts during the implementation of the BDL model. This feature was used to support asynchronous communication and document students' participation in the digital learning activities. The platform also includes an assignment menu for managing and organizing students' tasks, as illustrated in Figure 5.

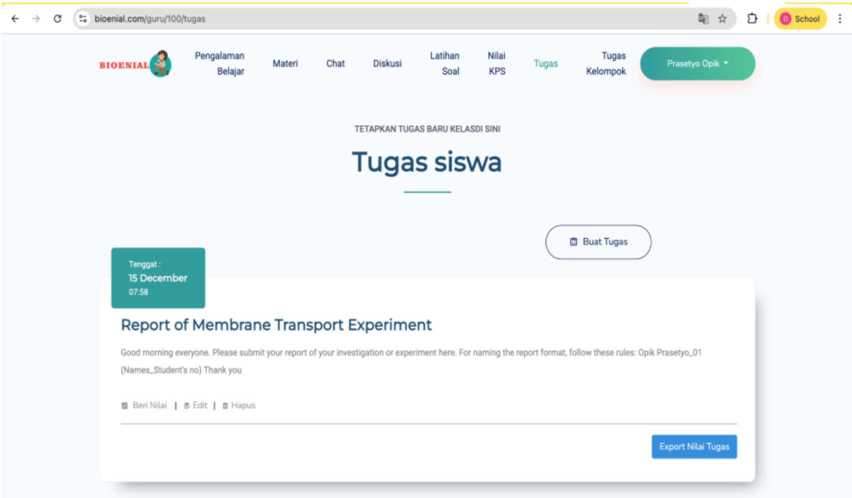

Figure 5. Assignment management interface on the *Bioenial* website

Figure 5 presents the assignments management interface on the *Bioenial* website, which allows teachers to create, edit, and organize students' tasks. The interface displays the assignment title, submission deadline, and task description, providing structured guidance for students. This feature supports teachers in managing learning activities and monitoring students task completion during the biology learning process. Moreover, the platform provides an assessment menu to support scoring process and evaluation of students' learning outcomes, as illustrated in Figure 6.

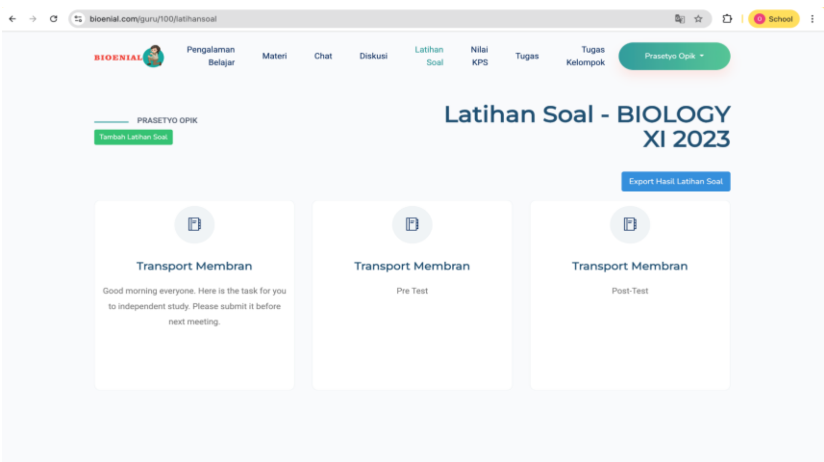

Figure 6. Practice exercise interface on the *Bioenial* website

Figure 6 presents the practice exercise interface in the *Bioenial* website where teachers can create and manage assessments such as pre-test and post-test related to the biology topics, such as transport membrane. The interface allows teachers to add new question sets, export students' practice results, and organize learning tasks into structured modules. This feature supports students' independent practice and enables teachers to monitor students' understanding of biological concepts during the learning process.

The superior learning outcomes achieved by students in the BDL class supported by the Bioenial website may be attributed to its integrated design, which was specifically developed to support biology learning and inquiry-oriented instruction. Bioenial combines learning materials, discussion forums, assignments, assessments, and glossary features within a single learning environment, allowing students to access learning resources and activities more efficiently. This integration may reduce extraneous cognitive load and strengthen the continuity between online and face-to-face learning activities(Müller & Wulf, 2024; Taylor et al., 2022).

In addition, the platform supports key inquiry processes embedded in the BDL model. Structured learning materials facilitate concept exploration, discussion forums promote scientific communication and collaborative knowledge construction, while assessment and assignment features provide continuous monitoring and feedback. These features may enhance students' conceptual understanding and engagement in biology learning, which could explain the higher learning outcomes achieved compared with the use of Google Classroom.

The *Bioenial* website serves as a learning medium to enhance the quality of the biology learning process and improve learning outcomes within the BDL model. A learning media such as a website is considered adequate if it meets several criteria: a menu that facilitates interaction among students, a group manager feature, the ability to facilitate teacher-assigned tasks, and a format for assessment accessible to both teachers and students (Arora & Arora, 2021; Fresen, 2018). The *Bioenial* website fulfills all these criteria, offering students access to learning objectives, a menu for learning materials, a chat and discussion feature for interaction, a task menu for accessing assignments, an assessment menu to measure knowledge and skills, and a glossary that explains key terms (Sugiharto et al., 2025). Furthermore, the combination of the BDL model with the *Bioenial* website makes instructional and cognitive processes, such as informing learning objectives, focusing students' attention, recalling prior knowledge, providing guidance, promoting student investigation, evaluating, and providing feedback more effective in improving biology learning outcomes (Gogineni et al., 2019).

Various studies have shown that technology-based learning media can improve students' biology learning outcomes, creativity, and motivation (Hariadi et al., 2022; Zhong et al., 2022). The integration of technology into the learning process facilitates both teachers and students. It provides teachers access to a broader range of resources for finding teaching materials and designing more innovative and interactive instructional strategies. Meanwhile, students benefit from easier access to the literature necessary for learning. These advantages ultimately have a positive impact on students' learning outcomes, consistent with the findings of this study.

From a practical perspective, the findings of this study suggest that biology teachers may consider integrating BDL strategies with dedicated web-based learning platforms to support inquiry-based and student-centered learning. The structured combination of face-to-face instruction, online learning activities, and collaborative investigation can help students engage more actively in the learning process and construct biological concepts more meaningfully. At the institutional level, schools may support the implementation of such approaches by providing adequate digital infrastructure and professional development opportunities that enhance teachers' competencies in designing and managing blended learning environments.

Several limitations of this study should be acknowledged. First, the study involved students from a single school, which may limit the generalizability of the findings to other educational contexts. Second, the intervention was conducted on a specific biology topic, namely membrane transport, and therefore the effectiveness of the BDL model across different biology topics remains to be further investigated. Third, this study focused primarily on cognitive learning outcomes and did not examine other important variables such as science process skills, critical thinking, scientific literacy, motivation, or student engagement. Consequently, future studies involving larger and more diverse samples, multiple biology topics, and broader educational outcomes are recommended to provide a more comprehensive evaluation of the effectiveness of the BDL model.

CONCLUSION

This study demonstrated that the implementation of the Blended-Discovery Learning (BDL) model significantly improved students' biology learning outcomes. All groups showed higher post-test scores than pre-test scores; however, students who learned through the BDL model integrated with the Bioenial website achieved the highest learning outcomes, followed by those who learned through the BDL model supported by Google Classroom, while the conventional Discovery Learning group obtained the lowest scores. These findings indicate that integrating Discovery Learning, blended learning, and Station Rotation activities within a dedicated web-based learning environment can provide more meaningful learning experiences and better support students' conceptual understanding in biology.

The results highlight the potential of the BDL model supported by specialized digital platforms as an effective instructional approach for biology education in the digital era. However, this study was limited to a single biology topic and a relatively small sample from one school. Therefore, future research is recommended to examine the effectiveness of the BDL model across different biology topics, educational levels, and learning outcomes, including science process skills, critical thinking, scientific literacy, and student engagement.

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