

# Development of Blended - Learning Instructional Package of Biology Senior High School Class XI in Improving Learning Achievement and Problem - Solving Skill

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**Abstract:** *The objectives of this research aims to: (1) discovering the validity level of the Blended Learning package for 11th-grade high school biology in enhancing learning outcomes and problem-solving skills.; (2) assessing the practicality of the 11th-grade high school biology Blended Learning package in improving learning outcomes and problem-solving skills; (3) evaluating the effectiveness of the 11th-grade high school biology Blended Learning package in enhancing learning outcomes and problem-solving skills. This research employs the Research and Development (R&D) approach with the ADDIE development model. The Blended Learning package was created using Microsoft Word and Canva and subsequently developed and validated for testing with the students. The research findings indicate that (1) The 11th-grade high school biology Blended Learning package is considered valid for improving learning outcomes and problem-solving skills; (2) The 11th-grade high school biology Blended Learning package is considered practical for enhancing learning outcomes and problem-solving skills; (3) The 11th-grade high school biology Blended Learning package is deemed effective for improving learning outcomes and problem-solving skills.*

**Keywords:** Blended Learning; Learning Achievement; Problem-Solving Skill.

## 1. Introduction

Independence of education is an idea currently advocated in various aspects of education. Improvements and developments in all aspects are now being undertaken to create the expected educational atmosphere, which is learning that frees both educators and learners. Educators no longer need to be bothered with all administrative matters that actually waste time. The logical consequence of the complexity of administrative duties is that educators do not have enough time to develop their knowledge and skills. Teaching, now based on stages (known as phases), emphasizes the character formation process so that learners have skills instead of just memorizing theories.

The character of learners is also shaped according to the values of Pancasila Scholars. Learners are formed so that they can prepare themselves to face life based on life skills and moral values. The process of forming identity is evident from the integration and collaboration of further developed learning achievements. The younger generation formed by this education is expected to be resilient to the dynamic changes of the times. Learners and educators are heading towards a revolution in the education sector; the current development is evident in the use of IT-based devices and jobs assisted by the Internet of Things (IoT) and Artificial Intelligence (AI). Education can be further developed with technological advances, but in reality, there is unintentional

and intentional misuse of IT.

The younger generation in Indonesia is entering an era of rapid information development with the presence of the internet, especially in the field of education. Although learners are adept at using gadgets, they often spend time on social media engaging with content of limited educational value. Instead of deepening their knowledge or honing their interests and talents, learners spend their time unproductively. Educators are not diligent enough in upgrading their knowledge and skills through the internet. Many teachers also behave like today's teenagers, actively scrolling through social media without any benefits, ultimately making it difficult for them to keep up with current trends.

With the advancement of the current era, it needs to be balanced with the development of paradigms in the education process. Learners should be able to easily find learning sources. Many electronic books (e-books), instructional videos, and even online courses can be accessed without leaving home and spending money. Learners can actively develop knowledge so that students can think critically and analytically. Educators can explore various effective teaching methods, learning strategies, and more that can shape effective learning, with references or literature reviews.

The advantage of blended learning is that learners do not

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experience boredom due to the variety of online and offline learning methods (Zebua and Harefa, 2022: 258). Learners can be more independent in seeking teaching materials due to the wider and more flexible access to learning materials through data search platforms. Educators have the flexibility to develop learning activities. Blended learning activities need to be supported by learning tools and materials developed to suit the conditions of learners.

Learning is the process of teaching and learning activities that occur between students and teachers. The quality of learning outcomes depends heavily on the learning process, so efforts to improve and develop the situation and factors related to the learning process must be made. The old paradigm that considered students as objects of learning must be replaced with the new paradigm that students are subjects of learning. Paradigm is a mindset and perspective on something (Jayawardhana, 2017: 16-17).

Blended learning is implemented with a composition of utilizing information technology and various traditional teaching methods. Allen and Seaman (2007:5) distinguish types of learning based on the use of online media.

**Table 1:** Classification of learning strategies based on e-learning utilization

E-Elearning Usage	Learning Type	Explanation
0%	Traditional	No online technology at all - only through lectures or writing
1% - 29%	Web Facilitated	Essential face-to-face learning assisted by internet technology, use of course management systems (CMS) and web pages for collecting assignments, accessing materials and so on
30% - 79%	Blended Learning	Learning that combines online and face-to-face modes. Substantial material is taught face-to-face and in online discussions proportionally
>80%	Online	Learning is almost entirely or entirely carried out in cyberspace. There are almost no face-to-face activities

Bell (2009) states that in online learning, the appropriate learning theory is connectivism. Connectivism is the thesis that knowledge is distributed across networks of connections, and therefore, learning consists of the ability to build connections and traverse these networks.

Blended learning encourages learners to be self-directed in seeking instructional materials, organizing content according to their understanding, and monitoring learners' abilities in assignments (Harb and Krish, 2020: 44). Cognitivism supports blended learning related to self-discovery learning, where learners independently explore aspects of the curriculum taught. Self-reflection can be applied in blended learning, where learners can identify the strengths and weaknesses of learning through evaluation features in e-learning or peer and direct assessments by educators in face-to-face learning.

Information Processing Theory is a conceptual framework in educational psychology that addresses the human process of processing received information. One of its concepts is

independent learning, where educators can provide alternative learning sources for learners to use (Moos, 2023: 6). In blended learning, the information processing process can be enhanced by educators utilizing online learning resources and conducting online learning using online learning applications or virtual laboratories.

The development of blended learning activities aims to address the foundational issues faced. Learners and educators can understand blended learning and can use technology in the field of learning. Commonly used online learning applications also lack the development of some essential features in learning. Therefore, it is deemed necessary to implement a Blended Learning-based package to achieve optimal learning outcomes and problem-solving skills.

The research objectives to be achieved in this study are as follows: 1) To determine the validity level of the Blended Learning biology package for high school grade XI to improve learning outcomes and problem-solving skills, 2) To determine the practicality level of the Blended Learning biology package for high school grade XI to improve learning outcomes and problem-solving skills, 3) To determine the effectiveness level of the Blended Learning biology package for high school grade XI to improve learning outcomes and problem-solving skills.

## 2. Method

This study employs a Research and Development approach. This research adopts the ADDIE (Analyze, Design, Develop, Implement, Evaluate) model of research and development. The terms specified in this research and development include a Learning Package consisting of Lesson Plans and Student Worksheets for face-to-face learning, as well as an Online Learning Management System (LMS). The Blended Learning used is of the flex type, where online and face-to-face learning are conducted simultaneously. The research subjects involved in this study are 33 high school students from SMA Nasional Makassar and 2 biology teachers. Data collection in the development of the learning package uses non-test techniques for validity and practicality testing, and test techniques for effectiveness testing. Data analysis techniques consist of descriptive statistics for validity and practicality testing..

## 3. Results

The developed blended learning package consists of Lesson Plans (RPP), Student Worksheets (LKPD), and Learning Management System (LMS). The Lesson Implementation Plan is designed using the Flex-type blended learning model. Student worksheets are crafted with problem-based learning and cooperative learning approaches. The learning management system is built using the open-source and user-friendly Moodle (Modular Objected Oriented Dynamic Learning Environment) application. Product validity is assessed by evaluating each component based on predefined standards in respective assessment sheets. The final section of the questionnaire includes the overall product validity results along with suggested improvements if deemed

necessary by expert validators.

**Table 2:** Validity Testing of Blended Learning Lesson Plan

No	Komponen	Validator I		Validator II	
		Score	Category	Score	Category
1	Writing systematics	4.50	Highly Valid	5.00	Highly Valid
2	Concept of Learning Goal Indicator	4.67	Highly Valid	4.67	Highly Valid
3	Concept of Instructional Goal	4.00	Valid	4.33	Highly Valid
4	Media and Learning Source	4.67	Highly Valid	4.67	Highly Valid
5	Concept of Learning Phase	4.67	Highly Valid	4.50	Highly Valid
6	Concept of Evaluation	4.60	Highly Valid	5.00	Highly Valid
7	Concept of Layout	4.50	Highly Valid	4.75	Highly Valid
8	Concept of Integration	4.50	Highly Valid	5.00	Highly Valid

**Table 3:** Validity Testing of Blended Learning Student Worksheet

No	Component	Score of Validator I	Category	Score of Validator II	Category
1	General Didactic Prerequisite	4.55	Highly Valid	4.64	Highly Valid
2	Special Didactic Prerequisite	4.40	Highly Valid	4.40	Highly Valid
3	Constructive Prerequisite	4.63	Highly Valid	4.50	Highly Valid
4	Technical Prerequisite	4.50	Highly Valid	4.88	Highly Valid
5	Content Expendiency	4.67	Highly Valid	4.67	Highly Valid

**Table 4:** Validity Testing of Learning Management System (LMS) Blended Learning

No	Component	Score of Validator I	Category	Score of Validator II	Category
1	Instructional Goal	4.00	Valid	5.00	Highly Valid
2	Concept of Content	4.00	Valid	4.00	Valid
3	Concept of Didactics	4.00	Valid	5.00	Highly Valid
4	Concept of Layout	5.00	Highly Valid	4.60	Highly Valid
5	Technical Concept	4.50	Highly Valid	4.50	Highly Valid
6	Media Interaction Design Concept	4.67	Highly Valid	4.67	Highly Valid
7	Concept of Media	4.00	Valid	4.00	Valid
8	Concept of Communication	4.00	Valid	4.00	Valid
9	Concept of Test and Evaluation	4.50	Highly Valid	4.50	Highly Valid
10	Concept of Maintenance	4.00	Valid	4.00	Valid
11	Administration	4.33	Highly Valid	4.33	Highly Valid
12	Activity	5.00	Highly Valid	5.00	Highly Valid
13	Concept of Competency Level	5.00	Highly Valid	5.00	Highly Valid

**Table 5:** Student Learning Achievement

N-Gain Score	Category	Total	Percentage
$g > 0.7$	High	13	33%
$0.3 < g < 0.7$	Mid	16	41%
$0.3 < g$	Low	10	26%
Total		39	100%

**Table 6:** Student Problem Solving Skill Score

Psychomotoric Score	Category	Amount	Percentage
3.25 – 4.00	Very Good	16	41%
2.51 – 3.24	Good	22	56%
1.76 – 2.50	Bad	1	3%
$< 1.75$	Worse	0	0%
Total		39	100%

**Table 7:** Implementation Description using Blended Learning Instructional Package

No	Implementation Criteria	Student Response	
		Yes	No
1	Learning Activities	90%	10%
2	Instructional Source	94%	6%
3	E-Learning Usage	87%	13%

**Table 8:** Student Response to student worksheet of blended Learning

No	Assessment Component	Score	Category
1	Content Expendiency	3.99	Practical
2	Appearance	4.03	Practical
3	Language	4.19	Practical
4	Acessibility	4.01	Practical

**Table 9:** Student Response to student worksheet of Blended Learning

No	Assessment Component	Score	Category
1	Content Expendiency	4.35	Highly Practical
2	Appearance	4.19	Practical
3	Language	4.41	Highly Practical
4	Acessibility	4.26	Highly Practical

**Table 10:** Teacher Response to Lesson Plan of blended Learning

No	Assessment Component	Score	Category
1	Content Expendiency	4.92	Highly Practical
2	Appearance	4.80	Highly Practical
3	Language	5.00	Highly Practical
4	Acessibility	5.00	Highly Practical

**Table 11:** Student Response to student worksheet of Blended Learning

No	Assessment Component	Score	Category
1	Content Expendiency	4.83	Highly Practical
2	Appearance	5.00	Highly Practical
3	Language	5.00	Highly Practical
4	Acessibility	5.00	Highly Practical

#### 4. Discussion

The developed blended learning package consists of Lesson Plans (RPP), Student Worksheets (LKPD), and Learning Management System (LMS). The Lesson Implementation Plan is designed using the Flex-type blended learning model. Student worksheets are crafted with problem-based learning and cooperative learning approaches. The learning management system is built using the open-source and user-friendly Moodle (Modular Objected Oriented Dynamic

Learning Environment) application. Product validity is assessed by evaluating each component based on predefined standards in respective assessment sheets. The final section of the questionnaire includes the overall product validity results along with suggested improvements if deemed necessary by expert validators.

The developed Blended Learning Lesson Implementation Plan meets the validity criteria for all its components. Blended learning, as incorporated in the lesson plan, is evident in the division of learning activities between online and face-to-face sessions. The basic competencies of the Grade XI high school biology material are examined through curriculum analysis. Learning objectives are formulated based on each sub-topic's core competency, which is then developed into learning objectives. The lesson plan prepares students and teachers even before the class begins, enabling students to study beyond the classroom using the provided online learning platform or by freely searching online.

The developed Blended Learning Student Worksheet meets the validity criteria for all its components. The student worksheet's content is organized around learning objectives, problem orientation, student activities, and reference sources for each sub-topic. The front page of the student worksheet includes the cover, student identity, and table of contents. Assessed components include general didactic, special didactic, construction, technical, and content feasibility aspects. The assessment highlights the need for more specificity in the special didactic requirements related to student activities, especially those conducted online.

The LMS assessment involves multiple components as e-learning is an audiovisual medium encompassing nearly all traditional instructional media specifications. User interaction components, such as media and communication, suggest that the LMS user interface needs simplification, as some students may require more time to understand the displayed e-learning features. The provided features related to maintenance also need simplification for ease of use by students.

In general, the use of the Moodle e-learning platform enhances students' problem-solving abilities compared to other platforms. However, the use of Moodle in problem-based learning yields similar results to other online media. The Moodle LMS is effective in student assessment. Its use also facilitates educators in learning administration. The added maintenance concept in the LMS makes it easier for students to monitor their learning progress. Competency levels help educators measure students' understanding, serving as a basis for the development of blended learning.

Effective blended learning improves learning outcomes, as indicated by the normalized gain scores falling within the medium and high ranges. Blended learning in the class utilizes both physical and digital instructional media, such as audiovisual materials and pdf-format books available online or through the downloadable LMS. The use of student worksheets and LMS can enhance visual-spatial learning processes. Blended learning effectiveness is also evident in student responses during blended learning,

utilizing student worksheets and the LMS.

The use of Moodle as an e-learning platform enhances the effectiveness of learning. The features in the Biologia Studia LMS train students in conducting online discussions and introduce them to the basics of digital administration through quizzes, assignments, and online evaluations. The flexibility of blended learning in utilizing various learning devices, models, instructional media, and learning approaches can improve students' learning outcomes, thinking skills, and scientific literacy.

Student problem-solving skills are trained and honed during face-to-face learning through class discussions. Discussions involve analyzing cases from the student worksheet, tailored to problem-based learning steps. Blended learning, known for utilizing online instructional media, allows students to freely explore learning materials online. The use of student worksheets during face-to-face learning guides students to identify issues in a case and discuss them with classmates to find solutions.

The implementation of blended learning is viewed from students' perceptions of learning activities, the use of teaching materials, and e-learning utilization. Learning activity sub-components, such as stating learning objectives, organizing groups in class, conducting and guiding face-to-face discussions, are fully implemented. The evaluation sub-component is nearly fully implemented according to all respondents, except for a few students who consider the final evaluation results do not fully represent their academic abilities. Blended learning assessment seems to complicate assessing cognitive, psychomotor, and affective aspects when relying solely on online instructional media.

The use of teaching materials is almost entirely implemented. Student worksheets are utilized during face-to-face learning and complemented by the use of the LMS for assignments and introducing students to information technology in Massive Open-Online Course (MOOC) learning. The use of electronic student worksheets, combined with other teaching materials, has yet to be fully perceived by two students. Electronic student worksheets can be an alternative to facilitate blended learning, as they are effective instructional materials.

The implementation of e-learning is reasonably well-perceived, although the implementation percentage is the lowest among the other components. The introduction of the LMS before starting learning and its use in class is fully implemented, although the use in assignments and available features is not maximized by students. Moodle is commonly used in schools due to its ease of use and features customizable to the school's needs.

Problem-based learning is a curriculum reference proven by numerous studies, including those integrated with other learning strategies and models, such as blended learning. The content feasibility aspect is somewhat lacking, as a small fraction of students find the use of student worksheets not easy. The use of student worksheets is still infrequent in previous classes, so students need to adapt to using student worksheets. The appearance aspect of student worksheets is



practical, considering the appealing colors and images that capture students' interest.

Student responses to the practicality of various aspects of the LMS in blended learning fall into the practical category. The highest responses are for the language and ease of use aspects, as the language and instructions for using LMS features are easy to understand. The use of the LMS helps students enhance their skills in utilizing online learning technology and provides a meaningful experience in learning that combines information technology and communication skills in the same class session. The content feasibility aspect is somewhat lacking, as a small fraction of students find the LMS material presented not entirely suitable for the indicated learning indicators on the LMS user interface.

In contrast to students' views on the practicality of teaching materials, educators assess RPP and LMS as teaching tools. Overall, educators' responses to the practicality of blended learning RPP fall into the very practical category. The highest responses are for the ease of use aspect, and the lowest response is for appearance. The ease of use aspect has a high value because the learning steps used are easy to understand and help students develop problem-solving skills by finding problems in the given articles according to the topics and practicing discussion skills and the use of blended learning technology.

The appearance of RPP is somewhat lacking because some RPP displays are dominated by monotonous colors but are still attractive enough. Learning adjustments and assignments can be facilitated by blended learning. Student worksheets have problem-based learning steps that are easy for students to implement, thus developing problem-solving skills and the ability to search for solutions during class discussions.

Content feasibility is somewhat lacking, as some students consider the LMS material presented not entirely suitable for the indicated learning indicators on the LMS user interface. The use of the LMS is infrequent in previous classes, and educators are still learning to adapt e-learning as part of blended learning. The introduction of the learning management system as a blended learning medium is conducted through workshops to enable educators to effectively implement blended learning (Abrori, 2023: 31-38).

## 5. Conclusion

This research also concludes that: 1) The Blended Learning biology package for Grade XI high school has been validated as effective in improving learning outcomes and problem-solving skills, 2) The Blended Learning biology package for Grade XI high school is declared Practical for improving learning outcomes and problem-solving skills, 3) The Blended Learning biology package for Grade XI high school is declared Effective for improving learning outcomes and problem-solving skills.

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