



## Development of Biology Learning Modules Based on Character Education on Ecosystem Material in Class X

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### Abstract

Students often encounter difficulties in comprehending biology material, particularly when it comes to ecosystem topics. Learning modules, which serve as teaching resources, have the potential to incorporate character education values. The objective of this study was to create a biology learning module that is valid, practical, and effective, while also focusing on character education for students. The research methodology employed was the Research and Development approach using the 4D model (Define, Design, Develop, Disseminate). Instruments employed in this study included needs analysis through interviews with teachers and questionnaires distributed to students, as well as validation sheets for media experts, material experts, and character education experts. Practicality sheets and an effectiveness sheet, in the form of a character assessment questionnaire, were also utilized. As a result, the study produced a character education-based biology learning module that was deemed highly valid, with a percentage score of 92% from media experts, 90% from material experts, and 87% from character education experts. The practicality results revealed that the module was highly practical, with a percentage score of 89% based on the biology teacher's response, and 90% based on student responses. Moreover, there was a 21% increase in character values among students, with initial data of 54% rising to 75%, suggesting that the character education-based biology module effectively influenced students' character values. Based on the findings of this study, it can be concluded that the learning outcomes achieved by students using the developed module were valid, practical, and effective in facilitating learning activities focused on ecosystem material.

**Keywords:** Biology Learning Module; Character Education; Ecosystem Material

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## INTRODUCTION

Education holds great significance in Indonesia as it plays a crucial role in the development of a better society. It serves as a preventive measure to internalize moral values and character, ultimately contributing to the creation of virtuous individuals (Maisaroh & Untari, 2024). The cultivation of character education values is directly linked to the moral crisis prevalent in society, which encompasses various negative phenomena such as diminishing sense of responsibility, student conflicts, declining honesty, lack of manners, diminishing tolerance, truancy, and academic dishonesty (Fahdini et al., 2021).

Character education is a systematic approach aimed at instilling fundamental values in students, which involves fostering awareness, understanding, concern, and a strong commitment to the practice of these values. These values pertain to an individual's relationship with God, oneself, fellow humans, the environment, as well as society and the nation (Citra, 2012). Additionally, character education has the potential to enhance students' independence, creativity, and nationalistic spirit. It also creates a supportive learning environment by

promoting attitudes of honesty, creativity, and a strong sense of nationalism (Erwenta et al., 2018). The primary objective is to develop students' decision-making abilities, cultivate virtuous behavior, and enable them to wholeheartedly embrace goodness in their daily lives (Suardin et al., 2023).

The Ministry of National Education has formulated 18 character values in the grand design of character education, including religiousness, honesty, tolerance, discipline, hard work, creativity, independence, curiosity, democracy, national spirit, love for the country, respect for achievement, friendship/communication, love for peace, love for reading, environmental care, social care, and responsibility (Siregar & Ulfa, 2022). The Ministry of Education and Culture of the Republic of Indonesia, in accordance with the strengthening of character education (PPK), has identified five key characters as the main focus of PPK, namely religiousness, nationalism, integrity, collective cooperation (gotong royong), and independence (Kemendikbud, 2018).

According to Anggriana et al. (2022), the learning process in character education involves the transfer of knowledge and values, where character education values are instilled in students through various subjects. One such subject capable of instilling character education values is Biology. Modules are learning tools that are designed to help students achieve specific learning objectives in a structured manner. The use of modules can enhance student competence and facilitate more planned and active learning experiences. Additionally, modules provide students with opportunities to assess their mastery of the material within each unit (Ulfa et al., 2023). Development of character-based modules aims to enhance the quality of education in Indonesia. As a teaching resource, modules have the potential to incorporate character education values. These modules serve as systematic and engaging learning tools, encompassing materials, methods, limitations, and evaluation strategies (Noperi et al., 2021).

A study conducted at MAS Al-Washliyah 22 Tembung found that Biology teachers commonly rely on worksheets as their primary instructional media. However, these worksheets often lack visually appealing images and simplified explanations elucidating the material. Consequently, students display less interest in learning and reading. Observations of class X students reveal difficulties in comprehending the subject matter, which can be attributed to its complexity and challenging nature.

Interviews with Biology teachers indicate that student learning outcomes are low, with only 30% demonstrating satisfactory performance. Moreover, several students exhibit poor behavior, such as lateness, incomplete assignments, littering, and leaving class during instructional hours. Hence, it is crucial to integrate character education values into Biology instruction to address these concerns. Enhancing character education is essential to improving student behavior. To address these issues, the development of a character-based Biology learning module is proposed (Solekhah, 2020).

Previous research conducted by Raqzitya and Agung (2022) successfully developed character-based E-modules as a science learning resource. Suhandri and Syahwela (2024) created teaching materials for Islamic-interacted mathematics to foster student character development. Marcelina and Amelia (2023), Husni et al. (2023), and Y. Farid et al. (2022) produced thematic learning modules centered on character education. Additionally, Suwanda et al. (2023) developed character-based digital comic media, which proved to be valid, practical, and effective in enhancing character values. Previous research has not conducted any specific studies on character education-based biology learning modules in ecosystems. This presents an opportunity for further research focusing on the development of these modules. The selection of ecosystem material for this study is based on the perspective of a biology teacher at MAS Al-Washliyah 22 Tembung, who believes that ecosystem material is highly suitable for integrating character education due to students' close relationship with the environment. Ecosystem material refers to the study of the interdependent relationship between living organisms and their environment within a functional unit. To enhance understanding of

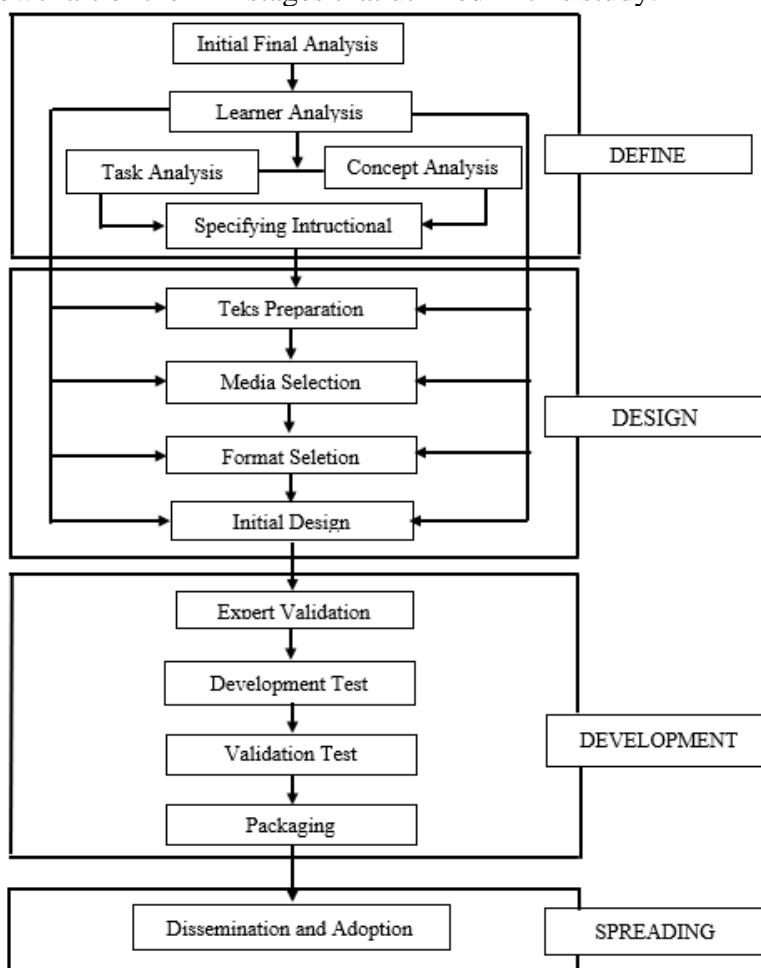
ecosystem material, teaching materials in the form of character education-based learning modules have been developed (Solikha et al., 2022).

The objective of this module is to bring about positive changes in student behavior and attitudes, as well as to support the development of better attitudes and skills. Based on the background and identified issues, the researcher aims to create a valid, practical, and effective character education-based biology learning module.

**METHOD**

**Research Design and Procedures**

This study employed the research and development method (Research and Development) with Thiagarajan's 4D approach (Define, Design, Develop, Disseminate) (Thiagarajan, 1974). The research was conducted at MAS Al-Washliyah 22 Tembung, with the participants being students of class X MIA at MAS Al-Washliyah 22 Tembung. The research instrument included a needs analysis, which consisted of an interview sheet for teachers and a questionnaire for students. Additionally, a validation sheet involving media experts, material experts, and character education experts was used to test the validity of the media. Furthermore, a student response questionnaire was employed to assess the practicality of the media. Figure 1 presents the flowchart of the 4-D stages that utilized in this study.



**Figure 1.** Flowchart of the 4-D stages

Initially, an analysis was conducted to identify and understand the fundamental issues for the development of the desired product. Subsequently, a student analysis was carried out by distributing questionnaires to evaluate their needs related to the challenges they faced. Concept analysis involved interviews with biology teachers to discuss difficult teaching materials and determine the content to be included in the learning media. Additionally, an analysis of learning

objectives was conducted to determine the indicators of learning achievement based on Permendikbud No. 37 of 2018, which outlines the learning standards for biology subjects.

At the design stage, the learning module was designed using Microsoft Word and Canva. The module's content was derived from biology modules and textbooks for class X, based on the 2013 curriculum. The design of the biology learning module focused on various aspects, including the preface, table of contents, image list, concept map, introduction, learning standards, learning indicators, learning objectives, module usability instructions, material content, summary, and exercise questions. Furthermore, in the Expert validation stage, the media, materials, and character education produced was validated by experts. Additionally, product trials were conducted, limited to the students of class X MIA at MAS Al-Washliyah 22 Tembung. The validated learning module was tested and distributed to the students of class X MIA at MAS Al-Washliyah 22 Tembung.

### Data Collection Instruments

In the development of character education-based biology learning modules, four types of techniques were employed to collect data: 1) Interview sheets for teachers were used to gather information about the learning process in the classroom, serving as the foundation for the research during the define stage. 2) Expert validation sheets were utilized to assess the validity and practicality of the biology learning module. Expert validation involved one media validation expert, one material validation expert, and one character education validation expert. 3) A response questionnaire sheet was employed to evaluate the feedback of students and biology teachers regarding the module's usage. 4) A character value questionnaire sheet aimed to measure students' religious attitudes, curiosity, tolerance, environmental care, and responsibility in learning biology.

### Data Analysis Technique

The data analysis technique aims to obtain a valid, practical, and effective learning module by using quantitative data (validity, practicality, and effectiveness), as well as qualitative data (comments, criticisms, and suggestions). The validity analysis uses the results of validators from media experts, material experts, and character education experts. The validation sheet will be checked by the instrument validator before further validation is carried out by each validator. The results of this validation process will then be analyzed using the Likert scale calculation in Table 1.

**Tabel 1.** Likert Scale Rating Guidelines (R. Rahmadina & Tambunan, 2019)

Score	Assessment Criteria
4	Very Good
3	Good
2	Less Good
1	Not Very Good

The data collection method uses a validation approach, which is then analyzed descriptively qualitatively based on ideal assessment categories. This process involves calculating the percentage of indicators of problem aspects in each category on the developed media.

Based on research (Ikhwan & Kuntjoro, 2021) explains the formula used in the following percentage of product success.

$$\text{Indeks } 100\% = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

Based on the calculation using the formula above, a number in the form of percent is obtained. The score is then converted into a classification in the form of a percentage. Furthermore, the validation results are calculated based on the criteria that can be seen in Table 2.

**Tabel 2.** Validation Assessment Results Criteria

Percentage (%)	Assessment Criteria
86-100	Very Valid
71-85	Valid
50-70	Less Valid
0-49	Invalid

(Source: (Putri &amp; Saino, 2020))

Analysis of the practicality of the character education-based learning module developed can be seen based on the results of teacher and student responses. The goal is to find out the responses of teachers and students during the learning process. The learning module assessment can be seen in table 3.

**Tabel 3.** Practicality Assessment Results Criteria

Percentage (%)	Assessment Criteria
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Less Practical
21% - 40%	Not Practical

(Source: (Lestari et al., 2020))

The purpose of this character value is to determine the high, medium, or low character in students. which can be seen in Table 4.

**Tabel 4.** Character Value Assessment Criteria Students

Percentage (%)	Response Category
80,1% - 100%	Very High
60,1% - 80%	High
40,1% - 60%	Medium
20,1% - 40%	Low
0,0% - 20%	Very Low

(Source: (Hidayati et al., 2020))

## RESULTS AND DISCUSSION

### Define

In the defining stage, interviews were conducted with biology teachers and field observations were made regarding the implementation of learning in class X MIA. This activity yielded several problems in biology learning, including: Firstly, students' lack of understanding of the concept of ecosystem. Secondly, many students faced difficulties in comprehending the relationship between living things and their environment. Thirdly, the school's teaching materials were limited to LKS. Fourthly, students displayed poor behavior, such as neglecting assignments, lacking a sense of responsibility, showing intolerance, skipping class, and sleeping during lessons. Based on the results of these interviews, a character education-based biology learning module was developed for ecosystem material, with the aim of fostering religious character values, curiosity, responsibility, environmental care, and tolerance.

### Design

In this stage, the development of the character education-based learning module was initiated. The objective of this phase was to create comprehensive teaching materials, which included various components. These components encompassed a cover page designed using the Canva application, a preface, a table of contents, a concept map, learning goals and objectives, instructions for usage, and a range of instructional content focused on character values, such as religion, responsibility, curiosity, environmental care, and tolerance. Additionally, exercise questions, reflection activities, feedback mechanisms, a bibliography, a

glossary, an answer key, and the author's biography were also integrated into the module. The purpose of this stage was to establish a solid foundation for the subsequent stages of the module development process.



Figure 2. Cover view and Module table of contents view

**Develop**

This stage aimed to develop module products in alignment with the revised feedback provided by the validators. The module was designed to be valid, practical, and effective based on the revisions suggested by the validators. The panel of validators included three experts, namely media experts, material experts, and character education experts, as indicated in Tables 5, 6, and 7.

Tabel 5. Media Expert Validation Result

Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
Graphics	29	32	91%	Very Valid
Presentation	26	28	93%	Very Valid
<b>Score Obtained</b>		<b>55</b>		
<b>Maximum Score</b>		<b>60</b>		
<b>Percentage</b>		<b>92%</b>		
<b>Category</b>		<b>Very Valid</b>		

Tabel 6. Material Expert Validation Result

Aspect	Score Obtained	Maximum score	Percentage (%)	Category
Content Of Material	48	52	92	Very Valid
Presentation	6	8	75	Valid
<b>Score Obtained</b>		<b>54</b>		
<b>Maximum Score</b>		<b>60</b>		
<b>Percentage</b>		<b>90%</b>		
<b>Category</b>		<b>Very Valid</b>		

**Tabel 7.** Character Education Expert Validation Result

Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
Verse Suitability With The Material	19	20	95%	Very Valid
Suitability Of Character Education With The Material	16	20	80%	Valid
<b>Score Obtained</b>		<b>35</b>		
<b>Maximum Score</b>		<b>40</b>		
<b>Percentage</b>		<b>87%</b>		
<b>Category</b>		<b>Very Valid</b>		

Based on the findings presented in the above table, media validation conducted by Mrs. Dr. Nirwana Anas, M.Pd, yielded a revision-based validity percentage of 92%, falling into the "very valid" category. The material expert validation, carried out by Mrs. Rasyidah, M.Pd, resulted in a validity percentage of 90%, also classified as "very valid" after revision. The character education expert validation, conducted by Mrs. Dr. Zulfiana Herni, MA, yielded a validity percentage of 87%, falling into the "very valid" category after revision.

Research conducted by (Giawa et al., 2022) also indicated that media experts assigned a score of 94% to the module, categorizing it as "highly feasible." Material experts assigned a score of 91%, also categorizing it as "highly feasible." Linguists assigned a score of 94%, also categorizing it as "highly feasible." The findings from this study suggest that the module has been thoroughly validated by all expert validators. Similar research conducted by (Erita, 2022) demonstrated that the development of this module was deemed valid based on the assessment of media experts, with a validity percentage of 75%, and was deemed highly valid based on the assessment of material experts, with a validity percentage of 92%. The researchers suggest that, on average, the learning modules developed meet the validation requirements, making them suitable for use in various teaching materials and learning resources.

**Tabel 8.** Results Of Teacher Response Questionnaire

Aspect	Score Obtained	Maximum Score	Percentage (%)	Category
Fill	18	20	90	Very Practical
Character Value	11	12	92	Very Practical
Graphics	28	32	87	Very Practical
Presentation	25	28	89	Very Practical
<b>Score Obtained</b>		<b>82</b>		
<b>Maximum Score</b>		<b>92</b>		
<b>Percentage</b>		<b>89%</b>		
<b>Category</b>		<b>Very Practical</b>		

**Tabel 9.** Results Of Student Response Questionnaire

Number Of Respondents	Score Obtained	Maximum Score	Percentage (%)	Category
36 Siswa	1694	1872	90%	Very Practical

The practicality of the module was determined by analyzing the response questionnaire completed by biology teachers and grade X students, as well as their statements and feedback on the developed biology learning module. This practicality assessment was carried out subsequent to the validation of the learning module by expert validators.

According to the data collected from biology teachers at Mas Al-Washliyah Tembung (Table 8), the results of the biology teacher response questionnaire indicated that the module was highly practical, receiving a percentage score of 89%. The character education-based module was classified as highly practical due to its applicability in the learning process.

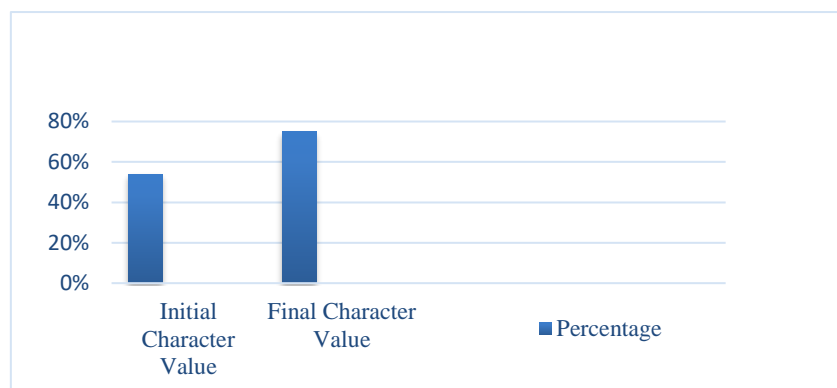
In order to evaluate the practicality of the module, a questionnaire was administered to 36 students. The student response questionnaire results, as shown in Table 9, demonstrated a total score of 1694 out of a maximum score of 1872, resulting in a percentage score of 90% and a classification of "very practical." Thus, the character education-based module was deemed to meet the criteria for practicality.

According to the findings of Farihah et al. (2022), modules are considered to be a valuable resource for both teachers and students in the learning process. Modules empower students to learn independently and regulate the pace of their learning.

**Tabel 10.** Results of Analysis of Character Education Values in Students

Character Type	Initial Score	Final Score	Maximum Score	Initial Percentage	Final Percentage
Religious	248	329	432	57%	76%
Curiosity	148	208	288	51%	72%
Environmental Care	146	221	288	51%	77%
Responsibility	153	213	288	53%	74%
Tolerance	80	107	144	55%	74%
<b>Intial Score</b>			<b>775</b>		
<b>Final Score</b>			<b>1.075</b>		
<b>Maximum Score</b>			<b>1.440</b>		
<b>Initial Percentage</b>			<b>54%</b>		
<b>Final Percentage</b>			<b>75%</b>		

Based on the results of the analysis of students' initial and final character values above, it can be seen more clearly, the results are presented in Figure 3.



**Figure 3.** Tabulation of Students' Initial and Final Character Values

The effectiveness of the learning module was evaluated based on the results of the character value questionnaire to assess the impact of using a character education-based biology module on students. The questionnaire consisted of 10 questions that covered aspects such as religion, curiosity, environmental care, responsibility, and tolerance. A total of 36 students participated in this study.

According to Table 10, the assessment results indicate that the initial distribution of the religious character value questionnaire yielded a moderate percentage of 57%. After the students read the character education-based ecosystem module, there was a significant increase observed in the second distribution of the questionnaire after the product trial, with a high percentage of 76%. Similarly, the initial distribution of the curiosity character value questionnaire obtained a moderate percentage of 51%. After the students read the character education-based ecosystem module, there was an increase observed in the second distribution of the questionnaire after the product trial, with a high percentage of 72%.

Likewise, the initial distribution of the environmental care character value questionnaire obtained a moderate percentage of 51%. After the students read the character education-based



ecosystem module, there was an increase observed in the second distribution of the questionnaire after the product trial, with a high percentage of 77%. Furthermore, the initial distribution of the responsibility character value questionnaire obtained a moderate percentage of 53%. After the students read the character education-based ecosystem module, there was an increase observed in the second distribution of the questionnaire after the product trial, with a high percentage of 74%. Lastly, the initial distribution of the tolerance character value questionnaire obtained a moderate percentage of 55%. After the students read the character education-based ecosystem module, there was an increase observed in the second distribution of the questionnaire after the product trial, with a high percentage of 74%.

The research results obtained from the second questionnaire distribution on student character values revealed a high percentage of 75%. This indicates that the character education-based biology module on ecosystem material can influence student character, with a 21% increase compared to the initial data on student character values (54%). This finding aligns with a previous study conducted by Suwanda et al. (2023) on the development of character education-based digital comic learning media focusing on the excretory system. The researchers suggested that the character education-based learning module yielded a high percentage of 66% in terms of student character values. Therefore, this study demonstrates that character education-based modules on ecosystem material can influence student character values.

The dissemination stage is implemented after the product development stage. During this stage, the researchers conducted a socialization process to distribute the character education-based learning modules to the students of Class X MIA 1 at MAS Al-Washliyah Tembung.

## CONCLUSION

Based on the conducted research, the validity, practicality, and effectiveness of the character education-based biology learning module have been assessed. The validity test involved three experts: media experts, material experts, and character education experts. The media expert's assessment yielded a highly valid score of 92%, while the material expert and character education expert both obtained very valid scores of 90% and 87% respectively. Regarding the practical test, the biology module was deemed highly practical with a score of 89%. Furthermore, student response scores indicated a high level of practicality at 90%. The implementation of the character education-based biology module yielded a 21% increase in student character values. The initial data indicated a character value of 54%, which rose to 75% after the module was introduced. Thus, it can be concluded that the character education-based biology module effectively enhances student character values.

## RECOMMENDATION

For future research, it is recommended to enlarge the sample size and broaden the scope of the biology learning materials for class X that were not covered in the development of the character education-based module.

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