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# Validation and Practicality of Biotechnology Teaching Materials Ethnoscience Based to Improve Students' Entrepreneurial Interests

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**ABSTRACT**

*The aim of this research is to produce ethnoscience-based biotechnology teaching materials that meet valid and practical requirements to facilitate students in learning about fermentation material. This research is development research (R&D) which is motivated by the need and understanding of ethnoscience-based biotechnology for students and the limited teaching materials to support learning. The development model used is the ADDIE approach (Analysis, Planning, development, implementation and evaluation). Data collection instruments in this research were observation sheets, interview sheets, validation sheets, and student response questionnaires. The data collection techniques used are validation analysis and practicality analysis. Ethnoscience-based biotechnology teaching materials were validated by 3 validators and revised according to suggestions from the validators, and tested on 18 chemistry education students to see the practicality of the teaching materials. The validation results for teaching materials were 81.5% in the valid category and the product trial results were 83.33% in the very practical category. The results of data analysis show that the ethnoscience-based biotechnology teaching materials developed have met the valid and practical criteria for use by chemistry education students at The Teacher Training and Education Faculty (FKIP) of Universitas Serambi Mekkah.*

**Keywords:** *teaching materials, biotechnology, ethnoscience, entrepreneurship*

## 1. INTRODUCTION

Higher education is required to produce graduates who are ready to face the world of work, not only mastering knowledge, but also having the spirit to open up employment opportunities. The very rapid development of science and technology demands that the world of education be able to produce graduates who are not only academically intelligent, but also creative, innovative and have an entrepreneurial spirit (Abdillah, 2024). Higher education plays a strategic role in shaping the character of students so they are able to adapt (Aldiansyah, 2019) and compete in the global era, including in terms of creating jobs through entrepreneurship (Purba et al., 2023).

Biotechnology, as a branch of science that is applicable and has potential in developing economically valuable products, is very relevant to be integrated into entrepreneurship learning (Fitriah, et al. (2012).). Biotechnology learning still tends to be theoretical and less relevant to the local context. This is the reason for students' low entrepreneurial understanding and interest in developing the potential of biotechnology as an entrepreneurial field. The ethnoscience approach, namely combining local knowledge with modern science (Endang, 2022), is a solution that can increase the relevance and attractiveness of learning. By highlighting local wisdom in teaching materials, students not only learn biotechnology concepts, but also understand the potential of local resources as basic ingredients for community empowerment innovation (Tanjung & Fahmi, 2024). Through the integration of ethnoscience, students better understand the potential of local resources for innovation in valuable biotechnology products.

Teaching materials have a very important role in learning and play an important role for both lecturers and students as a representation of the lecturer's explanations in the learning process. With teaching materials, students can study independently anywhere and at any time according to their individual learning pace and can choose the learning sequence as a guide for students to carry out all activities in the learning process (Akmal &

Saputra, 2020). Teaching materials are developed based on indicators such as the quality of learning materials, content, use of language, constructivity of teaching materials, and quality of teaching materials.

To ensure that the teaching materials developed are of good quality, a validation process is needed by experts and practical trials through limited implementation in the field. The results of this validation and practicality become the basis (Sukorini et al., 2019) in ensuring that ethnoscience-based biotechnology teaching materials are truly effective in increasing students' entrepreneurial interest. This research aims to develop, validate, and test the practicality of ethnoscience-based biotechnology teaching materials to increase students' entrepreneurial interest. This research was carried out to produce teaching materials that are not only valid and practical, but also capable of being a bridge between science and local culture and fostering the development of students' entrepreneurial spirit.

## 2. METHODS

This research used a research and development (R&D) approach which used the ADDIE development model which consists of Analysis, Design, Development, Implementation and Evaluation. The development of teaching materials in this research with the ADDIE design can be seen in the following picture:

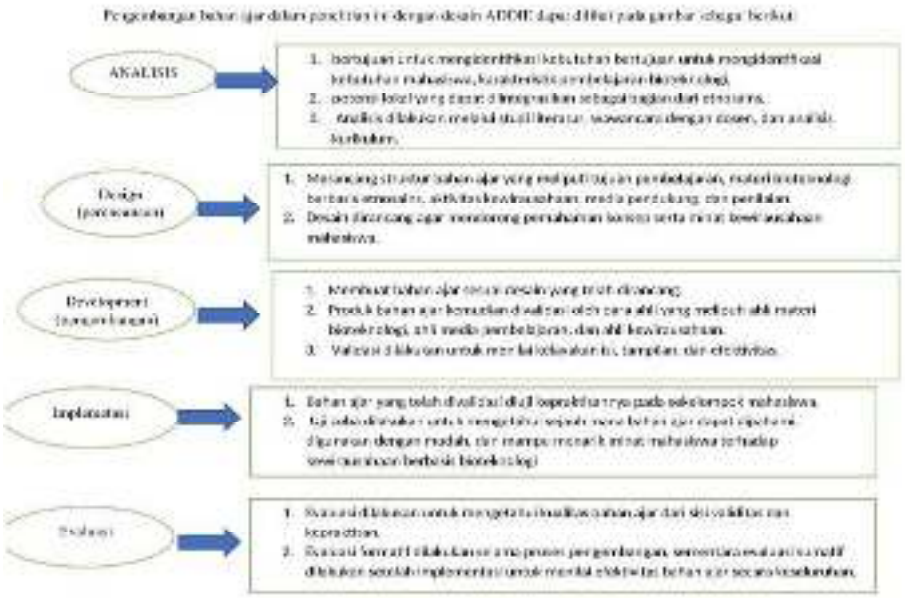


**Figure 1**. **EDDIE model (modified from Widiawati et al., 2017).**

The research focused on the validation process and practicality testing of ethnoscience-based biotechnology teaching materials. The instruments used were expert validation sheets, student practicality questionnaires, observations and interviews. For analysis, data obtained from validation analysis and practicality were analyzed using quantitative descriptions by looking at the suitability of ethnoscience-based biotechnology teaching materials which were determined by score interpretation categories (very valid, valid, less valid and invalid), while practicality was seen from the percentage of students' positive responses to the use of ethnoscience-based biotechnology teaching materials. The trial was carried out on 18 Chemistry Education students at the Faculty of Teacher Training and Education, Universitas Serambi Mekkah.

To determine the validity or suitability of ethnoscience-based biotechnology teaching materials, assessment sheets were used by experts (validators), both experts in material, content, language, constructivity of

teaching materials, and quality of teaching materials. This assessment used a Likert scale with the results calculated using the validity index formula:

**Table 1. Rating Scale.**

| Score value | Category |
|---|---|
| 4 | Very worthy |
| 3 | Decent |
| 2 | Not worthy |
| 1 | Not worth it |

Source: Akbar (2017).

The data analysis technique used to analyze valuation data adapted from Akbar, 2017 is as follows:

$$Va = \frac{TSa}{TSh} x\ 100\%$$

**Description**:

Va: Validation Score Percentage

TSa: Total score obtained

TSh: The highest total score used

The validation analysis criteria used can be seen in Table 2 as follows:

**Table 2. Validation criteria for biotechnology teaching materials.**

| Intervals | Categary |
|---|---|
| 85% < Va ≤ 100% | Very Valid |
| 70% < Va ≤ 85% | valid |
| 50% < Va ≤ 70% | Not valid |
| 10% < Va ≤ 50% | Invalid |

Source: Akbar (2017).

The practicality analysis also used a formula adapted from Akbar, 2017 as follows:

$$Vp = \frac{TSp}{TSh} x\ 100\%$$

**Descriptions**:

Vp : Percentage of scores from the questionnaire sheet

TSp: Total earned from users

TSh: The highest total score obtained

**Table 3. Criteria for the practicality of biotechnology teaching materials.**

| Intervals | Category |
|---|---|
| 85% < Va ≤ 100% | Very practical |
| 70% < Va ≤ 85% | Practical |

| | |
|---|---|
| 50% < Va ≤ 70% | Not practical |
| 10% < Va ≤ 50% | Not practical |

Source: Akbar (2017).

## 3. RESULTS AND DISCUSSION

Ethnoscience-based biotechnology teaching materials by three experts provided suggestions and revisions with improvements to teaching materials such as additions, namely: 1) content about fermentation by discussing *asam sunti* (a dried, semi-dried, and sometimes powdered form of *Averrhoa bilimbi*), 2) addition of material about ethnoscience that highlights local wisdom, 3) procedures for making *asam sunti* up to product design that wa ready to be used for business by the students, and 4) use of language in accordance with *EYD* (Enhanced Spelling System). The validation results of biotechnology teaching materials by three experts (validators) were 81.5% in the category "very valid" and requiring minor revisions, so that the teaching materials developed were included in the category "very valid" and suitable for use in the learning process with slight revisions in aspects of the learning material.

The validation results of ethnoscience-based biotechnology teaching materials obtained by material experts are shown in Table 4 below:

**Table 4. Average Validation Results of Ethnoscience-Based Biotechnology Teaching Materials.**

| No. | Statements | Maximum Score | Validator Retreat | Validation Percentage | Category |
|---|---|---|---|---|---|
| 1. | Quality of Learning Materials | 4 | 2,78 | 69,5% | Valid |
| 2. | Fill | 4 | 3,29 | 82,3% | Very valid |
| 3. | Use of Language | 4 | 3,22 | 80,5% | Very valid |
| 4. | Modular Contrivism | 4 | 3,33 | 83,3% | Very valid |
| 5. | Physical Quality of Modules | 4 | 3,67 | 91,8% | Very valid |
| | ***Average score*** | | ***3,26*** | ***81,5%*** | ***Very valid*** |

### Product Trial

From the results of the student response questionnaire to ethnoscience-based biotechnology teaching materials, an analysis of the practicality of ethnoscience-based biotechnology teaching materials can be carried out based on the average score of 16 statements with a rating scale by 18 students. Interpretation of the average practicality score for each student has been calculated finally between the values, namely from 2.875 to 3.813, so the practicality scores can be classified based on the following categories:

**Table 5. Practicality Categories.**

| Average score | Practicality Category |
|---|---|
| 3,25 – 4,00 | Very good |
| 2,50 – 3,24 | Quite practical |

| | |
|---|---|
| < 2,50 | Not practical |

Based on Table 2, it shows that the classification results for each number can be categorized as very practical, around 15 people with a score of 3.25 – 4.00, those categorized as quite practical are 3 people with a score of 2.50 – 3.24 and those categorized as less practical are 0 people with a score < 2.50. So the percentage of practicality can be seen in table 3 below:

**Table 6. Practicality Percentages.**

| Category | Number of Students | Percentage of Practicality |
|---|---|---|
| Very practical | 15 | 83,33% |
| Quite practical | 3 | 16,67% |
| Not Practical | 0 | 0% |

Based on these results, 83.33% of students considered that ethnoscience-based biotechnology teaching materials were very practical to use in learning. There were no students who rated the teaching materials as less practical, indicating that in general these teaching materials were very suitable for use in terms of practicality. This can be seen from the image below:

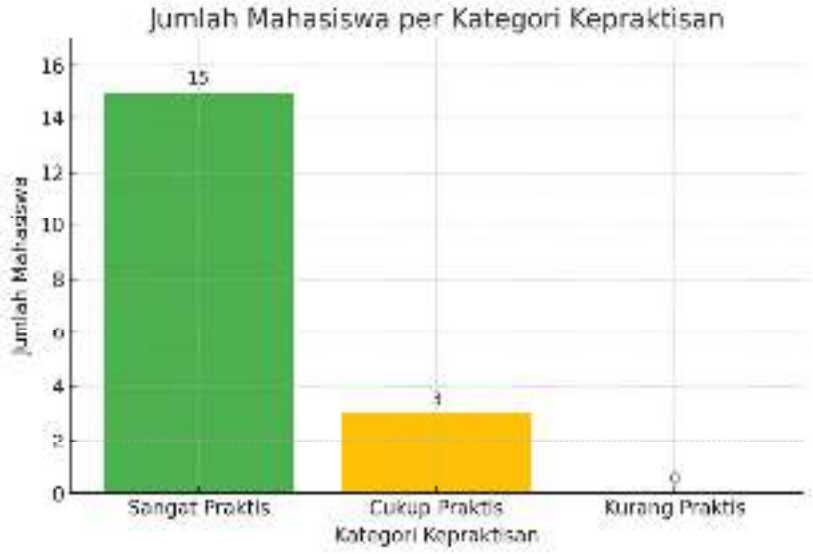


**Figure 2. Result of ethnoscience-based biotechnology teaching materials**

## 4. CONCLUSION

Based on the results of data analysis from observation sheets, interviews, validation and student response questionnaires, it can be concluded that the ethnoscience-based biotechnology teaching materials developed have met the criteria for validity and practicality. The validation results by a team of experts totaling 3 people as validators showed a presentation of 81.5% in the valid category, while the results of trials on 18 chemistry education students obtained a practicality percentage of 83.33% in the Practical category. Thus, this teaching material is suitable for use in the ethnoscience-based biotechnology learning process for chemistry students at the Teacher Training and Education Faculty of Universitas Serambi Mekkah. It is recommended that further research

be carried out involving a larger number of subjects and at different levels of education, such as middle school students, to see the effectiveness of this teaching material at large.

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