BIOSFER: Jurnal Tadris Biologi Vol. 15 No. 1 (2024) 1-14

BIOSFER: JURNAL TADRIS BIOLOGI
p-ISSN: 2086-5945 (print), e-ISSN: 2580-4960 (online), DOI 10.24042/biosfer.v15i1.22412
http://ejournal.radenintan.ac.id/index.php/biosfer/index

Development of an Ethnoscience Based E-Module on the Diversity Material of Medicinal Plants of the Bugis Tribe

Muhammad Ansar Apriansyah[1*], St. Humaerah Syarif[2], Novia Anugra[3], Muhamad Nikmatullah[4]

[1, 2, 3] Institut Agama Islam Negeri Parepare, Indonesia
[4] Ecology and Ethnobiology Research Center, National Research and Innovation Agency, Indonesia

ARTICLE INFO

Article History
Received : 23-02-2024
Accepted : 15-06-2024
Published : 30-06-2024

Keywords:
Biodiversity; Bugis tribe; E-module; Ethnoscience; Medicinal Plants.

***Correspondence email:**
muhammadansarapriansyah@iainpare.ac.id

ABSTRACT

Advancements in educational technology demand the use of electronic learning media that still prioritize local potential. The aim of this research is to determine the steps for developing, validity and practicality of an ethnoscience-based e-module on the biodiversity of medicinal plants of the Bugis tribe. This research is development research (R&D) adopting the ADDIE development model. Data analysis techniques consist of quantitative descriptive analysis and qualitative descriptive analysis. Based on the research and development results, the validity percentage of the e-module was obtained: 85.27% by material validator I, 94.74% by material validator II, 84% by media validator I, 90% by media validator II, and 86.67% by the language validator, categorized as 'Highly Valid.' The practicality test of the e-module, obtained from teacher responses, was 86.25% and from student responses, 90.62%. The developed product is categorized as Practical and suitable for use.

Pengembangan E-Modul Berbasis Etnosains pada Materi Keanekaragaman Hayati Tumbuhan Obat Suku Bugis

ABSTRAK: *Kemajuan di bidang teknologi pendidikan menuntut digunakannya media pembelajaran elektronik yang tidak meninggalkan potensi lokal. Tujuan penelitian ini adalah untuk mengetahui langkah pengembangan, kevalidan, dan kepraktisan e-modul berbasis etnosains pada materi keanekaragaman hayati tumbuhan obat suku Bugis. Penelitian ini merupakan penelitian pengembangan (R&D) dengan mengadopsi model pengembangan ADDIE. Teknik analisis data terdiri atas analisis deksriptif kuantitatif dan analisis deksriptif kualitatif. Berdasarkan hasil penelitian dan pengembangan diperoleh data persentase kevalidan e-modul yaitu sebesar 85,27% oleh validator materi I, 94,74% oleh validator materi II, 84% oleh validator media I, 90% oleh validator media II, dan 86,67% oleh validator Bahasa, dengan katagori "Sangat Valid". Untuk uji kepraktisan e-modul diperoleh dari respon guru sebesar 86,25% dan respon siswa sebesar 90,62%. Kategori produk pengembangan Praktis dan layak untuk digunakan.*

INTRODUCTION

The 21st century generation is synonymous with technological developments that have an impact on human life patterns (Rianto et al., 2021). Progress in the 21st century is marked by the rapid development of science and

technology in life (Silaban et al., 2022). In the 21st century, the world is also experiencing increasingly rapid and competitive changes (Wilujeng & Putri, 2020). Currently, the world is facing a transition from the era of Industrial Revolution 4.0 to Society (5.0) (Yasir et al., 2022), namely an era where world society is entering accelerated change in various aspects or fields (Alim et al., 2020). One aspect that is developing rapidly in the 21st century is the field of technology (Haulia et al., 2022). In order to face world challenges in a fast-paced era like today, superior and high-quality human resources are needed (Abdullah et al., 2021).

Education is a very important aspect in improving the quality of human resources (Pratiwi, 2018). Apart from that, education is also a frontline aspect of a country (Supriyadi & Martini, 2020) and is the spearhead of a country. The more a country's education develops, the bigger and more advanced the country will be (Nurhidayanti et al., 2022). Through education, the state seeks various ways to educate the nation's generation (Wekke & Astuti, 2017). Realizing the importance of the education sector, every country is competing to improve the quality of education so that it can compete in the global world (Nenohai et al., 2022). Improving the quality and quality of education is the main focus point in every country, including Indonesia (Samiasih et al., 2017). In Indonesia, various educational policies have been launched by the Indonesian government, such as improving the curriculum (Wekke & Astuti, 2017). The development process in education must follow various curriculum changes (Marjanah et al., 2022). Changes in the curriculum and paradigm in the education system give rise to many problems that occur in the process of learning activities in the world of education (Mahyuny et al., 2022). Various educational problems occur in Indonesia, one of which is science learning outcomes which are still relatively low (Walidah et al., 2023).

From 2000 to 2018, Indonesian students' abilities in science were still below the average of other countries (Rusilowati et al., 2021). Based on the PISA report released in 2019, Indonesian students' science scores were ranked 70th out of 78 countries. This score decreased from the 2015 PISA test, when the science score of Indonesian students was ranked 64th (OECD, 2019). This low science learning outcome needs attention from all parties (Hikmawati et al., 2021).

Science is often seen as a difficult subject for students because it contains a lot of monotonous memorization Rosyidah et al. (2013) accompanied by foreign terms Sekar & Raida (2022) and learning that is not based on experience (Susilawati et al., 2018). Students also think that science learning is only limited to theoretical learning without knowing the benefits that can be used in real life (Sekar & Raida, 2022). The difficulty of students understanding science concepts in learning requires appropriate learning innovations (Siswoyo, 2021). Science learning in schools is generally still focused on book material (Solheri et al., 2022). Many educators only provide monotonous materials and teaching materials. This makes students bored in following the learning process, so that the learning process becomes ineffective and inefficient (Fatkhiyani & Dewi, 2020).

As science and technology develop, learning processes that are interesting and enjoyable for students can be designed by utilizing technology. Progress in the field of educational technology requires the use of electronic learning media (Hastuti et al., 2020). Modules are a form of learning media that can be presented in print or electronic form (Riza et al., 2020). The use of e-modules in learning has important benefits for educators and students (Aulianingsih et al., 2021). Apart from that, e-modules are also believed to be able to help students learn independently (Haspen & Syafriani,

2022). So, it can increase student independence (Munir et al., 2022).

Apart from problems related to learning media, difficulties in understanding concepts in science learning are also caused by students having difficulty connecting experiences from the surrounding environment as learning resources (Wibowo, 2022). Currently, science teachers must be able to design topics that are relevant to students' daily lives in order to produce meaningful learning for students (Kasi et al., 2022). Teachers can utilize nature and phenomena that occur in the surrounding environment as a science learning resource (Sanova et al., 2022). One of them is local wisdom which can be used as a learning resource in science learning (Hikmawati et al., 2022).

Indonesia is a country that has various ethnicities and cultures (Nurhasnah et al., 2022) which has local regional wisdom and is an invaluable asset (Citra et al., 2022). Along with current technological developments, cultural elements are little by little starting to be forgotten and local culture is experiencing a shift and is often even neglected (Novarlia, 2023). In fact, today's students are more familiar with foreign cultures and less understanding of the culture and local wisdom of Indonesian society (Nenohai et al., 2022). Therefore, it is important to keep students loving their local culture (Moriolkosu et al., 2020). Currently, science learning has been linked to daily life activities, but it is still rare for science learning to truly reveal the cultural realities around students (Risdianto et al., 2021). The content of the material taught is also not widely integrated with culture (Solheri et al., 2022). Learning resources that link culture with material are also still limited in number (Ihsan & Pahmi, 2022). So schools play an important role in introducing local culture by integrating culture through ethnoscience learning (Anis et al., 2021).

With ethnoscience, students can understand scientific concepts (Yusnitasari et al., 2020). The ethnoscience-based science learning process emphasizes local wisdom and problems that exist in society, so that students are able to solve problems faced in everyday life (Aisyah & Khotimah, 2023). An ethnoscience-based learning process is also a solution to overcome students' problems with scientific phenomena in their environment (Zuyina & Widodo, 2020). Apart from that, ethnoscience will make it easier for students to explore facts and phenomena that exist in society and integrate it with science (Nenohai et al., 2022).

One of the learning materials in science is biodiversity (Rahma et al., 2023). Biodiversity, especially the diversity of medicinal plants, is related to local culture and knowledge. The diversity of medicinal plants is not only useful for traditional medicine but also for science, especially as teaching materials. Teaching materials based on medicinal plant diversity can play a role in developing and increasing participants' understanding of learning material (Walid et al., 2022).

One of the ethnic groups in Indonesia that still has a strong traditional healing culture using medicinal plants is the Bugis tribe. The Bugis tribe is one of the largest tribes in South Sulawesi province (Samad et al., 2021). Even though they have a high level of knowledge about traditional medicine, research has never been carried out on the development of teaching materials that link the diversity of medicinal plants used and exploited by the Bugis tribe of South Sulawesi with science learning, especially on biodiversity material.

Based on this explanation, research was carried out which aimed to develop ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe, and to determine its validity ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe, as well as to determine the level of practicality ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe in learning.

METHOD

This research applies a type of Research and development. Development research, namely research carried out to test a product and then research it to develop it to make it better (Abubakar, 2021). The development model applied is a development model ADDIE. Development style ADDIE consists of five stages, namely Analyze, Design, Development, Implementation dan Evaluation (Branch, 2009).

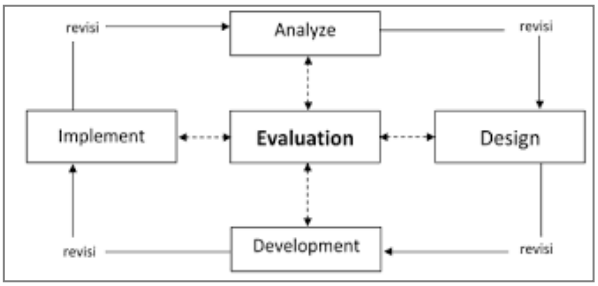

Figure 1. Development style *ADDIE*

The subject of this research is ethnoscience based science learning e-module on the biodiversity of medicinal plants of the Bugis tribe. Meanwhile, the test subjects in this research were class X students of SMA Negeri 6 Sidrap. The module was created with the help of the Canva application and *flipbookpdf.net* to import a pdf file into *flipbook*. Development and test locations Ethnoscience based learning e-modules on the biodiversity of medicinal plants of the Bugis tribe, South Sulawesi, were carried out at SMA Negeri 6 Sidrap which is located in Arawa sub-district, Watang Pulu sub-district, Sidenreng Rappang district.

This research was carried out in stages over a period of 3 months starting from October 2023 to January 2024 to obtain information and collect data that was necessary and in accordance with what the researchers needed. In this development research, several respondents were involved, namely material experts, media experts, language experts and users. Data collection techniques were carried out using interview methods, questionnaires and validation sheets. Data analysis techniques consist of product validity data analysis and product practicality data analysis. Validity data analysis is calculated using the product validity percentage formula:

$$P = \frac{x}{xi}\ x\ 100\%$$

(Akbar, 2010)

Information:
P = Percentage of each criterion
x = Score for each criterion
xi = Maximum score for each criterion

The product percentage results are then categorized according to the criteria in the following table.

Table 1. Product Validity Criteria

Validity Criteria	Validity Level
81% - 100%	Very Valid
61% - 80%	Valid
41% - 60%	Fairly Valid
21% - 40%	Less Valid
0% - 20%	Invalid

(Sugiyono, 2015)

Temporary Practicality data The e-module is carried out using teacher and student response data. The procedures for implementing practical data analysis are as follows.

Calculate the average response value for each statement with the formula:

$$\bar{R} = \frac{\sum p}{n}$$

Information:
$\bar{R}$ = average response value
$\sum p$ = number of values
n = number of respondents

After that, calculate the percentage of the average response value for each statement with the formula:

$$\%\bar{R} = \frac{R}{5} \times 100\%$$

Information:

$\%\bar{R}$ = percentage of average response value

$\bar{R}$ = average response value

Next, match the average percentage of response values with the response categories, namely as follows:

Tabel 2. Response Level Category Criteria

Response Criteria	Response Rate
$80\% \leq \bar{R} \leq 100\%$	Very Strong
$60\% \leq \bar{R} < 80\%$	Strong
$40\% \leq \bar{R} < 60\%$	Strong Enough
$20\% \leq \bar{R} < 40\%$	Weak
$0\% \leq \bar{R} < 20\%$	Very Weak

(Riduwan, 2010)

RESULTS AND DISCUSSION

1. Analyze

Analysis of student needs was carried out on class X.5 students at SMA Negeri 6 Sidrap by distributing instruments online use help *Google form.* Based on the results of the analysis of student needs, several problems in learning were found, namely that the Biology textbook used did not link learning to the lives of students around them. From the results of this analysis, it was found that 81.48% of students stated that biodiversity material was material that was difficult to understand.

Analysis of teacher needs was carried out by direct interviews with class X Biology subject teachers. Based on the results of the interview, it was stated that teaching materials were needed in the form of e-modules that implement the environment around students.

2. Design

Product Selection

Suitable teaching materials based on the results of the analysis of teacher needs and student needs are ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe. The module is designed with the help of the application canva and applications flipbookpdf.net to import a pdf file into flipbook.

Format Selection

Format selection the e-module is adjusted to the rules of preparation e-module. The following are the elements in question: 1) Cover, 2) Foreword, 3)List of contents, 4) Concept maps, 5)Learning Components, 6)Learning materials, 7) Summary, 8) Evaluation, 9)Answer key, 10) Glossary, and 11)Bibliography/References.

Figure 2. Cover Display Design e-module

3. Development

The development stage is carried out to assess the product and validate the product *e*-modules produced based on the comments, input, and suggestions of experts or validators. Product evaluation is evaluated by two material experts, two media experts, and one linguist.

Table 3. Material Expert Validation Result I

Assessment Aspects	Maximum Score	Total Score	Validity (%)
Curriculum Aspects	10	8	**85,27**
Aspects of Material Presentation	35	32	
Aspects of Material Completeness	25	23	
Language Aspects	25	18	
Amount	**95**	**81**	

The assessment of material expert validation results I is at a media validity

percentage of 85.27% and shows the validity level category of "Very valid".

Table 4. Material Expert Validation Result II

Assessment Aspects	Maximum Score	Total Score	Validity (%)
Curriculum Aspects	10	8	
Aspects of Material Presentation	35	34	
Aspects of Material Completeness	25	23	**94,74**
Language Aspects	25	25	
Amount	**95**	**90**	

The material expert validation results assessment II is at a material validity percentage of 94.74% and shows the validity level category of "Very valid".

Table 5. Media Expert Validation Results I

Assessment Aspects	Maximum Score	Total score	Validity (%)
Graphic Aspects	70	59	
Aspects of User Convenience	15	12	**84%**
Benefit Aspect	15	13	
Amount	**100**	**84**	

The assessment of media expert validation results I is at a media validity percentage of 84% and shows the validity level category of "Very valid".

Table 6. Media Expert Validation Results II

Assessment Aspects	Maximum Score	Total score	Validity (%)
Graphic Aspects	70	63	
Aspects of User Convenience	15	13	**90**
Benefit Aspect	15	14	
Amount	**100**	**90**	

The media expert II validation results assessment is at a media validity percentage of 90% and shows the validity level category of "Very valid".

Table 7. Linguist Validation Results

Assessment Aspects	Maximum Score	Total score	Validity (%)
Aspect of Straightforwardness	15	12	**86,67**
Communicative Aspect	5	4	
Dialogical and Interactive Aspects	10	9	
Aspects of suitability for student development	10	9	
Aspects of Conformity to Language Rules	10	8	
Aspects of Terminology	10	10	
Amount	**60**	**52**	

The language expert's validation results assessment is at a language validity percentage of 86.67% and shows the validity level category of "Very valid".

4. Implementation

At this stage, field trials are carried out to determine the suitability and success of the product. To find out the practicality of the product, it is done by looking at the teacher's response and the student's response to the product e-module.

At this stage, field trials are carried out to determine the suitability and success of the product. To find out the practicality of the product, it is done by looking at the teacher's response and the student's response to the product e-module. The results of the teacher's response to the modules developed can be seen in table 8.

Table 8. Teacher Response Assessment Results

Assessment Aspects	Maximum Score	Total score	Persentase (%)
Curriculum Aspects	10	8	
Aspects of Material Presentation	35	28	
Aspects of Material Completeness	25	21	
Language Aspects	20	17	**86,25**
Graphic Aspects	45	41	
Aspects of User Convenience	10	10	
Benefit	15	13	

Assessment Aspects	Maximum Score	Total score	Persentase (%)
Aspect			
Amount	**160**	**138**	

The value obtained from the teacher's response to the ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe was 86.25% and was in the "Very Strong" practicality level category.

Apart from assessing teacher responses, student response assessments are also carried out to measure user responses to the product ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe. The results of the student response assessment can be seen in table 9.

Table 9. Student Response Assessment Results

Assessment Aspects	Total Student Scores	Total Ideal Score	Percentage (%)
Aspects of Material Presentation	605	675	89,63
Graphic Aspects	494	540	91,48
Language Aspects	128	135	94,81
Benefit Aspect	608	675	90,07
Amount	**1835**	**2025**	**90,62**

The value obtained from the results of students' responses to the ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe had an average response of 90.62% and was in the "Very Strong" practicality level category. Apart from that, student response data can also be presented with the average response results for each aspect. The average response results for each aspect can be seen in table 10.

Table 10. Average Response Results for Each Aspect

Assessment Aspects	Percentage	Practicality Level
Aspects of Material Presentation	89,63%	Very strong
Graphic Aspects	91,48%	Very strong
Language Aspects	94,81%	Very strong
Benefit Aspect	90,07%	Very strong

Based on the results of assessing student responses in each aspect, it can be seen that the assessment results are in a percentage above the 80% interval so that the level of practicality the e-module was declared “very strong”.

5. Evaluation

At this stage an evaluation is carried out to improve and revise the product ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe. Product revisions or improvements e-modules developed were based on comments and suggestions from material expert validators, media expert validators and language expert validators. The validator's comments and suggestions can be seen in Table 11.

Table 11. Validator Comments and Suggestions

Validator	Comments and Suggestions
Member of Material I	1. Under the title the e-module doesn't need to be in all capital letters, just the first letter as well as in the concept map section 2. Add examples of ecosystems that are actually in the environment around students and the environment where medicinal plants are located
Material Expert II	1. Add reference sources in classification 2. Improve glossary layout
Media Member I	1. The cover is made more interesting and not too many 2. Heading section e-module and year on each page do not need to be included
Media Member II	1. The cover design is made more interesting and not too crowded 2. Add source information to the image 3. Improve the procedure for writing bibliography
Linguist	1. The word "You" is always preceded by a capital letter 2. Foreign languages and Bugis languages must be written in italics 3. Scientific names must be written in italics 4. The beginning of the paragraph must be indented 5. Subtitles do not need to be

Validator	Comments and Suggestions
	italicized
	6. Correct the command sentences in the medicinal plant procedure text

DISCUSSION

Product validity Ethnoscience based e-modules on the biodiversity of medicinal plants of the Bugis tribe are measured based on expert validation results.

Material validation is carried out by assessing four categories of aspects, namely curriculum aspects, material presentation aspects, material completeness aspects, and language aspects. According to Puspita et al. (2024), the product must meet several aspects before being tested by students. Based on the validation results by material expert I, a validity percentage of 85.27% was obtained. The results of the material expert validation assessment I are included in the "very valid" validity level category. Meanwhile, the final validation results by material expert II obtained a validity percentage of 94.74%. The results of the validation assessment by material expert II are included in the "very valid" validity level category. Hasairin et al., (2023) argue, that products that have been declared high by validators must still be improved according to the advice of experts.

Material validation is carried out by assessing four categories of aspects, namely curriculum aspects, material presentation aspects, material completeness aspects, and language aspects. Media validation is carried out by assessing three categories of aspects, namely graphic aspects, user-friendliness aspects, and usefulness aspects. Based on the final validation results by media expert I, a validity percentage of 84% was obtained. The results of the media expert validation assessment I were included in the "very valid" validity level category. Meanwhile, the final validation results by media expert II obtained a validity percentage of 90%. The results of the validation assessment by media expert II were included in the "very valid" validity level category. The material in the product is one of the important aspects in development (Saragih & Tanjung, 2023). Science materials relate to daily life so that students are able to relate to scientific issues and can relate concepts and apply them in their lives (Mahendri et al., 2023).

Language validation is carried out by assessing six categories of aspects, namely straightforward aspects, communicative aspects, dialogical and interactive aspects, aspects of suitability to student development, aspects of suitability to language rules, and aspects of term use. Based on the validation results by language experts, a validity percentage of 86.67% was obtained. The results of the language expert validation assessment are in the "very valid" validity level category.

Based on the assessment results from material expert validators, media experts and language experts, it was found that the product validity level was assessed e-module is in the interval percentage above 81% so it can be said that the product The ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe is very valid and can be used and tested in the field. This is in accordance with the product validity guidelines put forward by Sugiyono (2015) who said that the category criteria are very valid or a product is declared very valid if it is in the validity percentage with an interval of 81% - 100%

Product practicality Ethnoscience based e-modules on the biodiversity of medicinal plants of the Bugis tribe are measured based on the results of assessing teacher responses and student responses. This product can help students in understanding scientific concepts so as to develop critical thinking in their daily activities and future (Haka et al., 2020). In addition, it can help teachers in the learning process. Ethnoscience based e-modules can also support the learning process by conducting independent research on problems in the form of science-based culture around the student environment (Handoko et al., 2024).

Teacher response assessment is carried out by assessing seven categories of aspects, namely curriculum aspects, material presentation aspects, material completeness aspects, language aspects, graphic aspects, ease of use aspects, and usefulness aspects. Based on the results of the teacher response assessment, a percentage of 86.25% was obtained. The results of the teacher's response assessment were in the "very strong" practicality level category. Meanwhile, assessment of student responses is carried out by assessing four categories of aspects, namely material presentation aspects, graphic aspects, language aspects, and usefulness aspects. Based on the results of the assessment of student responses, an average percentage of 90.62% was obtained. The results of the student response assessment were in the "very strong" practicality level category.

Based on the results of the assessment of teacher responses and student responses to e-module, it is obtained that the assessment of the level of practicality of the product e-module is in the interval percentage above 80% so it can be said that the product The ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe has a very strong level of practicality. This is in accordance with the product practicality guidelines put forward by Riduwan (2010) who said that the criteria for the level of practicality of a category product are very strong if the user response assessment is in a percentage with an interval of 80% - 100%. Ardianti et al. (2023) dan Wardani et al. (2023)Argue that modules must motivate readers by utilizing interesting things such as content, image design that can support the learning process. This is in line with the module can facilitate students through science-based cultural knowledge (Claridades & Guevarra, 2021).

CONCLUSIONS AND SUGGESTIONS

Development ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe applying the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation). Product validity Ethnoscience based e-modules on the biodiversity of medicinal plants of the Bugis tribe were determined based on validation results by experts. Product assessment The e-module is assessed by two material experts, two media experts, and one language expert. The validation results by experts show that the interval percentage value is above 81%, so it can be said that the product ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe is very valid. Meanwhile, the practicality of the product Ethnoscience based e-modules on the biodiversity of medicinal plants of the Bugis tribe are determined based on the results of teacher responses and student responses. The results of the teacher response assessment obtained a percentage of 86.25% and the results of the student response assessment obtained an average percentage score of 90.62% and were in the very strong practicality level category. From the results of the assessment of the teacher's response and the student's response, then the ethnoscience based e-module on the biodiversity of medicinal plants of the Bugis tribe was stated to be very practical and suitable for use as a learning resource.

REFERENCES

Abdullah, A., Danial, M., & Anwar, M. (2021). Pengembangan E-Modul Asam Basa Berbasis Problem Based Learning melalui Google Classroom pada Sekolah Menengah Kejuruan (SMK). *CER : Chemistry Education Review*, *5*(1), 86–99.

Abubakar, R. (2021). *Pengantar Metodologi Penelitian*. SUKA Press.

Aisyah, N., & Khotimah, H. (2023). Implementation of ethnosains in science learning in madrasah ibtidaiyah. *Jurnal Pendidikan Dasar Nusantara*, *8*(2), 321–334.

Akbar, S. (2010). *Instrumen Perangkat Pembelajaran.* Rosdakarya Offset.

Alim, Sarwi, & Subali, B. (2020). Implementation of Ethnoscience-based Guided Inquiry Learning on The Scientific Literacy and The Character of Elementary School Students. *Journal of Primary Education*, *9*(2), 139–147.

Anis, M., Sarwi, S., & Rozi, F. (2021). Development of Rembang Regency Ethnoscience-Based Integrated Thematic Teaching Material to Improve Concept Mastery. *Journal of Primary Education*, *10*(1), 60–70.

Ardianti, S. D., Wanabuliandari, S., & Tanghal, A. B. (2023). Implementation the Ethnoscience-Based Smart Module To Improve Students' Patriotism. *Jurnal Pendidikan IPA Indonesia*, *12*(2), 293–300. https://doi.org/10.15294/jpii.v12i2.43789

Ardianti, S. D., & Raida, S. A. (2022). The Effect of Project Based Learning with Ethnoscience Approach on Science Conceptual Understanding. *Journal of Innovation in Educational and Cultural Research*, *3*(2), 207–214. https://doi.org/10.46843/jiecr.v3i2.89

Aulianingsih, I., Vitrianingsih, D., & Yuliani, H. (2021). Validitas E-Module IPA Terintegrasi Nilai-Nilai Agama Islam pada Pokok Bahasan Energi di SMP Kelas VII. *Jurnal Ilmiah Pendidikan Fisika*, *5*(1), 1–9.

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springerb Science Business Media.

Citra, N. F., Suprapto, N., & Admoko, S. (2022). Exploration of Physics Concepts in Milkfish Cultivation as An Ethnoscience Study in Sidoarjo. *Berkala Ilmiah Pendidikan Fisika*, *10*(1), 107–118. https://doi.org/10.20527/bipf.v10i1.12404

Claridades, K. C., & Guevarra, P. M. (2021). Socio-Cultural Context in Localizing a Learning Module in Life Science : Basis for Enhancing Basic Science Process Skills of Grade 8 Learners of Dagatan National High. *Journal of Science and Mathematics Education in Southeast Asia*, *44*(December), 81–105.

Fatkhiyani, K., & Dewi, R. A. K. (2020). The development of the textbook of basical science concept contained ethnoscience. *Jurnal Prima Edukasia*, *8*(2), 156–165.

Haka, N. B., Anggoro, B. S., Hamid, A., Novitasari, A., Handoko, A., & Puspita, L. (2020). The Development of Biology Module Based on Local Wisdom of West Lampung: Study of Ecosystem Material. *Journal of Physics: Conference Series*, *1467*(1). https://doi.org/10.1088/1742-6596/1467/1/012013

Handoko, A., Pratama, A. O. S., Haka, N. B., Puspita, L., Wulandari, E., Marzuki, Z. A. W., & Anggoro, B. S. (2024). Creative thinking: The Effect of Green School-Based Project Based Learning (PjBL) Model. *E3S Web of Conferences*, *482*. https://doi.org/10.1051/e3sconf/202448204016

Hasairin, A., Hartono, A., & Hasim, H. (2023). Development of a Lichens Pocketbook in Low-Level Organism Taxonomy Course. *Biosfer: Jurnal Tadris Biologi*, *14*(1), 01–09. https://doi.org/10.24042/biosfer.v14i1.16604

Haspen, C. D. T., & Syafriani. (2022). Praktikalitas dan Efektifitas E-Modul Fisika SMA Berbasis Inkuiri Terbimbing Terintegrasi Etnosains Untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik. *Jurnal Penelitian Dan Pembelajaran Fisika*, *8*(1), 10–16.

Hastuti, P., Thohiri, R., & Panggabean, Y. (2020). Pengembangan E-Module Berbasis Problem Based Learning Mata

Pelajaran Ekonomi Kelas X SMA Negeri 1 Percut Sei Tuan Tahun Ajaran. *PEMBELAJAR: Jurnal Ilmu Pendidikan, Keguruan, Dan Pembelajaran*, *4*(2), 60–65.

Haulia, L. S. N., Hartati, S., & Mas'ud, A. (2022). Learning Biology Through the Ethnoscience-PBL Model : Efforts to Improve Students' Scientific Thinking Skills. *Scientiae Educatia: Jurnal Pendidikan Sains*, *11*(2), 119–129.

Hikmawati, Suastra, I. W., & Pujani, N. M. (2021). Ethnoscience-Based Science Learning Model to Develop Critical Thinking Ability and Local Cultural Concern for Junior High School Students in Lombok. *Journal of Research in Science Education*, *7*(1), 60–66. https://doi.org/10.29303/jppipa.v7i1.530

Hikmawati, Sutrio, Wahyudi, & Syahidi, K. (2022). Effects of Learning with Ethnoscience Context on Learning Outcomes in Cognitive Aspects of Prospective Physics Teacher Students. *Journal of Research in Science Education*, *8*(6), 2793–2801. https://doi.org/10.29303/jppipa.v8i6.2388

Ihsan, M. S., & Pahmi, M. Z. (2022). Development of Etnoscience-Based Interactive IPA Module to Improve Critical Thinking Ability. *Jurnal Inovasi Pendidikan Dan Sains*, *3*(3), 83–88.

Kasi, Y. F., Widodo, A., & Samsudin, A. (2022). Teachers Learning in Technology-Ethnoscience Professional Development and Its Impact on TPACK. *Journal of Research in Science Education*, *8*(6), 3083–3088. https://doi.org/10.29303/jppipa.v8i6.2420

Mahendri, R. P., Amanda, M., Latifah, U., Rawas, S., Teknik, F., & Padang, U. N. (2023). *Journal of Hypermedia & Technology-Enhanced Learning (J-HyTEL)*. *1*(1), 1–15.

Mahyuny, S. R., Nursamsu, Hasruddin, & Muslim. (2022). Development of Students Worksheet Learning Tools Made by Ethnoscience Based on Science Literacy. *Journal of Research in Science Education*, *8*(4), 2001–2007. https://doi.org/10.29303/jppipa.v8i4.1949

Marjanah, Atmaja, T. H. W., Pandia, E. S., Nursamsu, & Manurung, N. (2022). Development of Biodiversity Practicum E-Module to improve Science Process Skills. *Journal of Research in Science Education*, *8*(4), 1868–1873. https://doi.org/10.29303/jppipa.v8i4.1951

Moriolkosu, A. D., Handayani, S. S. D., & Sunarso, A. (2020). Ethnomathematics and Ethnoscience Analysis of Aru Culture Related to Mathematics and Science Concepts at Elementary School. *Educational Management*, *9*(2), 163–171.

Munir, S., Fitrianti, W., & Megasari, R. (2022). Interactive E-Module : The Economic Learning Solutions in High School During the Covid-19 Pandemic. *Jurnal Pendidikan Ilmu Sosia*l, *32*(2), 140–154.

Nenohai, J. A., Rahayu, S., & Dasna, I. W. (2022). Validity and effectiveness of chemical practicum e-modules of various applications with ethnoscience approach in chemical learning : Analysis review. *Jurnal Pendidikan Kimia*, *14*(2), 70–78.

Novarlia, I. (2023). Implementasi Etnosains sebagai Sumber Belajar Antropologi Budaya di Prodi Industri Pariwisata. *Journal on Education*, *05*(03), 7357–7362.

Nurhasnah, Lufri, & Asrizal. (2022). Effect Size Analysis of the Implications Ethnoscience Approach to the Improvement of 21 st Century Skills in Science Learning. *JIPI (Jurnal IPA Dan Pembelajaran IPA)*, *6*(3), 287–299.

Nurhidayanti, Anwar, M., & Danial, M. (2022). Pengembangan E -Modul Reaksi Reduksi dan Oksidasi Berbasis Discovery learning untuk Meningkatkan Hasil Belajar Peserta Didik Kelas X MIPA SMA Negeri 11 Bone. *CER : Chemistry Education Review*, *6*(1), 39–47.

OECD. (2019). *PISA 2018 Results (Volume I): What Students Know and Can Do*. PISA OECD Publishing.

Pratiwi, I. (2018). Pengembangan E-Modul Pembuatan Stop Motion Kelas XII Multimedia di SMK Negeri 1 Godean. *Jurnal Elektronik Pendidikan Teknik Informatika Volume*, *7*(4), 1–12.

Puspita, L., Abdurrahman, Jalmo, T., Maulina, D., Komarudin, Luthfi, N. F., & Rakhmawati, I. (2024). PBL-STEM Integrated Interactive E-Module in Improving Creative Thinking Skills and Collaboration Skills: Needs Analysis in Biology Education. *E3S Web of Conferences*, *482*, 1–8. https://doi.org/10.1051/e3sconf/202448204009

Rahma, K. A., Nugroho, A. S., & Mulyaningrum, E. R. (2023). E - Modul Keanekaragaman Hayati Sebagai Implementasi Hasil Penelitian Jenis Tumbuhan Obat dan Pemanfaatannya Desa Kayen. *Titian Ilmu: Jurnal Ilmiah Multi Sciences*, *15*(1), 71–75.

Rianto, V. M., Setyosari, P., & Sulton. (2021). Penelitian Dan Pengembangan E-Module Geometri Berdasarkan Fase Pembelajaran Geometri. *Edcomtech: Jurnal Kajian Teknologi Pendidikan*, *6*(2), 288–300. https://doi.org/10.17977/um039v6i12021p288

Riduwan. (2010). *Skala Pengukuran Variabel- Variabel Penelitian*. Jawa Barat : Alfabeta.

Risdianto, E., Dinissjah, M. J., Nirwana, N., Sutarno, M., & Putri, D. H. (2021). Analysis of student responses toward ethnoscience based Direct Instruction learning model in learning physics applying Rasch Model Approach. *Journal of Physics: Conference Series PAPER*, 1–7. https://doi.org/10.1088/1742-6596/1731/1/012081

Riza, M., Firmansyah, R. A., Zammi, M., & Djunaidi. (2020). Pengembangan modul kimia berbasis kearifan lokal Kota Semarang pada materi larutan asam dan basa. *JIPVA Jurnal Pendidik. IPA Veteran*, *4*(1), 25–38.

Rosyidah, A. N., Sudarmin, & Siadi, K. (2013). Pengembangan Modul Ipa Berbasis Etnosains Zat Aditif Dalam Bahan Makanan Untuk Kelas Viii Smp Negeri 1 Pegandon Kendal. *Unnes Science Education Journal*, *2*(1), 133–139.

Rusilowati, A., Sundari, & Marwoto, P. (2021). Development of integrated teaching materials vibration, wave and sound with ethnoscience of bundengan for optimization of students' scientific literation. *Journal of Physics: Conference Series*, 1–7. https://doi.org/10.1088/1742-6596/1918/5/052057

Samad, S., Suganda, D., Darmayanti, N., & Yasraf Amir Piliang... (2021). Pragmatics Study in Therapeutic Communication of Buginese Traditional Medicine for Children in South Sulawesi Indonesia. *Oversea.Onlinecnki.Net*, *04*, 249–264. https://doi.org/10.17605/OSF.IO/QSNCX

Samiasih, R., Sulton, & Praherdhiono, H. (2017). Pengembangan E-Module Mata Pelajaran Ilmu Pengetahuan Alam Pokok Bahasan Interaksi Makhluk Hidup Dengan Lingkungannya. *Edcomtech*, *2*(2), 119–124.

Sanova, A., Syahri, W., Yusnidar, & Afrida. (2022). Pelatihan Penyusunan Modul Kimia Berbasis Kearifan Lokal bagi

Guru SMA di Sungai Penuh Jambi. *Jurnal Pengabdian UNDIKMA: Jurnal Hasil Pengabdian & Pemberdayaan Kepada Masyarakat*, *3*(3), 561–567.

Saragih, P. P., & Tanjung, I. F. (2023). Development of STEM-Based Environmental Change Module to Enhance Environmental Literacy. *Biosfer: Jurnal Tadris Biologi*, *14*(1), 89–98. https://doi.org/10.24042/biosfer.v14i1.17884

Silaban, R., Elvia, R., & Solikhin, F. (2022). Pengembangan e-modul kimia berorientasi literasi sains pada materi kesetimbangan kimia di sma negeri 3 bengkulu tengah. *ALOTROP, Jurnal Pendidikan Dan Ilmu Kimia*, *6*(2), 180–189.

Siswoyo, A. A. (2021). Developing Thematic Learning Module Based on Ethnoscience Oriented Outdoor Learning Strategy To Improve Student'S Learning Outcomes in Primary School. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *13*(1), 237–250. https://doi.org/10.14421/al-bidayah.v13i1.283

Solheri, S., Azhar, M., & Yohandri, Y. (2022). Analysis of ethnoscience integrated environmental literacy for junior high school. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *8*(2), 178–188.

Sugiyono. (2015). *Metode Penelitian dan Pengembangan*. Jawa Barat : Alfabeta.

Supriyadi, P. I. D., & Martini, C. (2020). Kajian Etnosains pada Indigenous Science Suku Malind dalam Upaya Pengembangan Pembelajaran IPA Kontekstual Papua. *J. Pendidik Fis. Tadulako Online*, *8*(1), 13–17.

Susilawati, Setiawan, N., & Khoiri, N. (2018). Development of Learning Device based Ethnoscience for Heat Material in Kabupaten Tegal. *Journal of Education and Learning (EduLearn)*, *12*(3), 392–398. https://doi.org/10.11591/edulearn.v12i3.6981

Walid, A., Winarni, E. W., Yanti, F. A., Firdaus, M. L., Suherman, & Zulkarnain. (2022). Ethnoscience-Based Module : Biodiversity Materials in Lembak Tribe. *JTK: Jurnal Tadris Kimiya*, *7*(2), 300–308.

Walidah, M., Evendi, & Rahmatan, H. (2023). Penerapan Lembar Kerja Peserta Didik Berbasis Etnosains untuk Meningkatkan Hasil Belajar di SMP Negeri 8 Banda Aceh. *Indonesian Journal of Science Education*, *11*(1), 84–95.

Wardani, K. S. K., Astria, F. P., & Nurwahidah, N. (2023). Development of Ethnoscience-Based Science Education Module Using a Case Based Learning Model. *Jurnal Penelitian Pendidikan IPA*, *9*(SpecialIssue), 473–478. https://doi.org/10.29303/jppipa.v9ispecialissue.6123

Wekke, & Astuti, R. W. (2017). Kurikulum 2013 di Madrasah Ibtidaiyah : Implementasi di Wilayah Minoritas Muslim. *Tadris Jurnal Keguruan Dan Ilmu Tarbiyah*, *02*(1), 33–39.

Wibowo A. M. (2022). Changing the Concept of Prospective Primary Education Teachers through Ethnoscience-based Critical Thinking. *Al Ibtida: Jurnal Pendidikan Guru MI*, *9*(2), 382–391.

Wilujeng, I., & Putri, T. S. Y. (2020). Development of SETS E-Module Integrated with POE Model for Science Learning. *Journal of Educational Science and Technology*, *6*(2), 252–264.

Yasir, M., Haq, A. T. Al, & Parmin. (2022). Ethnoscience-Based Mind Mapping Video Using Indigenous Knowledge to Practice Student ' s Science Literacy Ability. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *12*(1), 26–39.

Yusnitasari, A., Sarwi, & Isnaeni, W. (2020).

Concept Mastery of Ethnoscience-Based Integrated Science and Life Skills Development of Elementary School Students. *Journal of Primary Education*, *9*(1), 93–101.

Zuyina, A. V., & Widodo, W. (2020). Validity Of Ethnoscience Booklet Media In The Region Of Ponorogo On Sound Wave Sub Material. *Pensa E-Jurnal : Pendidikan Sains*, *8*(2), 178–182.