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Validity of the Development of PjBL-Based Science Teaching Modules Containing Ethno-STEAM to Empower Creative Thinking Skills on Ecology and Biodiversity Materials in Indonesia

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Abstract: Biodiversity in Indonesia is a science material that is closely related to environmental conditions, daily life events, and natural characteristics in Indonesia. Ethno-STEAM content is a local wisdom-based learning approach that connects theory and skills in the fields of Science, Technology, Engineering, Arts, and Mathematics. Mastery of material for junior high school students is expected to be able to apply their knowledge to the environment through STEAM, be able to solve problems, become logical thinkers, and be able to link culture and local wisdom with learning. This study aims to describe the validity of teaching modules in science learning to empower students' creative thinking skills at the junior high school level. The development of PjBL-based science teaching modules with Ethno-STEAM content uses the 4D model development research approach. The validity in this study includes the validity of the material with an acquisition of 0.98, media experts of 0.95, learning experts of 0.90 and language of 0.95, the four validations have been validated by 7 expert and practical validators and are included in the very valid category. The validity of the Ethno-STEAM-loaded test instrument using a written test and analyzed using Aiken's validity which has been adjusted to the creative thinking indicators obtained an average validity test of 0.94. It is concluded that the science teaching module is suitable for use as a PjBL-based learning media and ethno-STEAM content to empower students' creative thinking skills.

Keywords: Creative Thinking; Ethno-STEAM; Project Based Learning; Science Teaching Module

Introduction

The Merdeka Curriculum is an initiative to increase the flexibility and relevance of education in Indonesia with a more independent and competency-based approach, this curriculum emphasizes the development of 21st century skills needed to face global challenges. The Ministry of Education and Culture (Kemendikbud, 2022) states that 21st century learning must teach the 6C skills, namely character, citizenship, critical thinking, creativity, collaboration, and communication. With this basis, 21st century education is expected to develop superior knowledge, skills, attitudes and values competencies. The implementation of the Merdeka curriculum in the education sector requires the learning process to be maximally designed to be more creative (Aisyah, 2023). The concept of an independent learning curriculum provides a foundation for education that is more adaptive, oriented towards skill development, and allows learners to take an active role in their learning

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process (Lestari, 2022). Based on Circular Letter Number 1 of 2020, it is explained about the independent learning policy in determining students' graduation, "*Merdeka Belajar*" or "Freedom of Learning", which is freeing educational institutions and encouraging students to innovate and encourage creative thinking.

Science learning with all the processes in it will be more meaningful if studied contextually by involving students to explore and collaborate in achieving these competencies. Science learning can foster students' creative thinking skills to solve problems in everyday life through scientific methods. The design of science learning in schools is designed through good science teaching modules to facilitate in-depth understanding of scientific concepts and their application in everyday life. The curriculum recognizes the importance of preserving Indonesia's diverse cultural heritage, ensuring that students develop a strong sense of national identity and an appreciation of their local traditions (Hasibuan, 2022). The socio-cultural diversity in Indonesia can be used as a strong reference in connecting local science knowledge with science learning. technology in the teaching and learning process that will help create a more interactive, dynamic, and interesting learning environment for learners (Hasibuan, 2022).

Local culture *(kearifan lokal)* is integrated to strengthen students' cultural identity and character, and support the achievement of the Pancasila Learner Profile. This is done through local content, P5 projects, and integration in various subjects. One of the efforts to integrate culture with science education is through ethnoscience and the STEAM (Science, Technology, Engineering, Art, and Mathematic) approach in the science learning process. This effort can be realized through the development of independent curriculum teaching modules designed according to the environmental context and local culture of students. The process of learning science in schools is inseparable from learning plans that are systematically organized for implementation. This brings up the integration of local wisdom and cultural values into the science learning process. Teaching modules are learning devices or learning designs based on the curriculum that are applied with the aim of achieving predetermined competency standards (Maulidiya, 2019). So that the content of Ethno-STEAM integration can be used as a new integration in learning to hone and develop students' skills to provide ideas and ideas to become more creative and can direct students in developing critical thinking skills, problem solving skills and collaborating through real situations based on culture with science concepts. As part of 21st century skills, creative thinking is essential in various fields such as economics, citizenship, and globalization, which are closely interconnected. Listiana (2023) research states that creative thinking is important to develop because it can train students to develop their mindset. Creative thinking needs to be honed so that students are fluent and flexible in thinking, able to analyze a problem from various points of view, and able to generate many ideas. Finding and analyzing facts and data to investigate problems and solve problems requires creative thinking skills, the relationship of creative thinking in learning prepares students to become reliable problem solvers. Efforts to improve students' creative thinking skills need to improve their understanding of problems, fluency, flexibility, and innovation in problem solving (Salhuteru, 2025). The results of the Global Creativity Index survey last year stated that the Creative Thinking Skills of students in Indonesia are still recorded low, this fact was confirmed by Indonesia in 2015 ranked 115 out of 139 countries (Global Creativity Index, 2015).

Based on research (Reynawati, 2018) the cause of the problem of low students' Creative Thinking Skills is that teachers in general have not implemented learning that emphasizes the process of thinking skills, especially creative thinking. In addition, teachers still use traditional learning models that are still teacher centered. In line with research conducted by Rizal (2018) that the cause of the low ability of students' higher-level thinking is because the learning model applied by the teacher is still conventional. Based on preliminary studies conducted in March 2023 at one of the junior high schools in Wonogiri Regency, it shows that learning still often uses the lecture method so that learning is still centered on the teacher and the lack of creativity of students ranging from skills and thinking. This is indicated by the low learning outcomes with an average grade VII of 68 which means that it is still in the category of less because it is below the school's average standard of completeness. In addition, the understanding of students who are still less critical and creative when asked questions orally through interviews in class. This is due to the lack of learning variations in the classroom, especially in science subjects whose scope is based on experimental science.

Other case studies on science learning that focuses on Ethnoscience content integrated with the STEAM approach are still lacking due to the lack of student involvement in learning, less varied methods, and teaching materials sourced from textbooks from schools. In addition, science materials that have not included local local culture, so it needs to be reviewed to foster students' interest in learning and creative thinking in learning.

Based on these problems as well as the demands of the times and the industrial revolution 4.0, and concerns about the loss of culture in the mindset of future generations, led to the integration of STEAM and ethnoscience or known as Ethno-STEAM which is

packaged in the form of teaching modules as a teacher's teaching guide with teaching materials and student worksheets through the science project method. Based on the description above, the researchers developed a Pjbl-based science teaching module with Ethno-STEAM content to empower creative thinking skills on Ecology and Biodiversity material in Indonesia.

Method

The development of this PjBL-based science teaching module with Ethno-STEAM content uses the R&D (research and development) method, specifically the three-dimensional model (4-D model), to be specific, namely define, design, develop, and disseminate (Hasanah, 2020). The information collection method used surveys and tests. Then, the data was analyzed using a questionnaire technique. The hypothesis begins at the deffine stage, which is the first stage of the research and development process. This stage leads to preliminary research or observations such as school selection and needs analysis. Researchers conducted an initial analysis by collecting data from teachers and students through interviews. Then at the design stage. This second stage is useful for designing prototypes or initial sketches of teaching modules. The third stage is the develop stage, this third stage is the approval or validation stage. This examination includes several validators, especially media, material, and language specialists who will be carried out by these experts to conduct validation. The fourth stage, desseminate, is done by distributing to junior high school science teachers in several schools. The type of data analysis technique that will be discussed in this study uses qualitative research.

Qualitative descriptive research is a method that involves collecting data to study and support discussion of other research findings (Kriyantono, 2022). This research aims to produce content validation on ethnoscience-fueled PjBL-based Science Teaching Modules including: media validation, material validation, learning expert validation, language validation, and test instrument validation. This research was located at SMPN 1 Giriwoyo and SMPN 2 Baturetno involving 2 classes in each school consisting of experimental and control classes with a total of VII grade students in the 2024 school year.

This research consists of several stages, namely: initial analysis, preparation of content validation sheet, and content validation results. The analysis stage begins with observations during learning, interviews with science teachers and students and preliminary studies. The stage of preparing the validation sheet was carried out on the product developed which was then validated by lecturers/practitioners in accordance with experts in their fields to assess the validity of the content of the learning device components. The research instrument was further developed based on the previous instrument which was adjusted and adapted to the needs of the researcher. Validators provide input and suggestions to be used as the basis for improving product revisions until it is declared feasible to be implemented in learning. Data analysis techniques using qualitative descriptive analysis techniques include: content validity used in the form of media validation sheets, material validation sheets, learning device validation sheets and language validation sheets. Before the instrument is used in preliminary research, it must pass the validation stage to ensure that it can reliably measure critical thinking skills. The validation process was carried out by 7 experts consisting of 4 professional science teachers and 3 lecturers.

The validation used 4 assessments with 8 raters. This statement is declared valid for use after revision according to the validator. Criteria for assessing the validity of learning devices as in Table 1. The validation results from several expert validators were then analyzed using Aiken's V (Azwar, 2012) as follows Formula 1 and 2.

$$V = \frac{\sum S}{[n(c-1)]} \quad (1)$$

$$S = \sum ni\ (r - Lo) \quad (2)$$

Description:
Lo : Lowest validity assessment number
C : Highest validity assessment number
r: The number given by the assessor
n : Number of experts

Table 1. Interpretation of validity (Arikunto & Damayanti, 2013)

Correlation Coefficient	Validity Criteria
0.81 – 1.00	Very good
0.61 – 0.80	Good
0.41 – 0.60	Fair
0.21 – 0.40	Low
0.00 – 0.20	Very Low

Result and Discussion

This research has the result of creating a PjBL teaching module product with Ethno-STEAM content on ecology and biodiversity in Indonesia class VII at the Junior High School level. With the concept of project-based learning design with STEAM-integrated local wisdom content equipped with learning flow,

integration, LKPD, teaching materials, media, and assessment in accordance with the independent curriculum.

Preliminary Analysis Stage

The preliminary study conducted an initial analysis aimed at 8 science teachers with different institutions in Wonogiri district through Google Form and in two schools, namely SMP Negeri 1 Giriwoyo and SMP Negeri 2 Baturetno through direct observation and interviews with science teachers. In addition, the results of observations through interviews, it was found that ecological material is relatively important material because learning is directly related to everyday life, so it needs learning that can trigger students to be able to solve environmental problems. After interviews with several students also said that learning was less interesting. In addition, the broad scope of the material makes students bored in learning it.

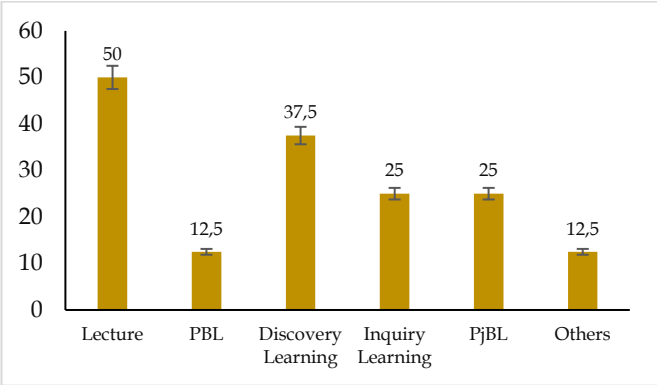

Figure 1. Observation results through questionnaires

Students at the time of observation did not pay attention to the teacher's explanation, lack of learning support facilities and lack of motivation for students to take part in the learning process. The lack of interest in learning of students affects the value obtained besides that it does not empower the creative thinking ability of students. The completeness of the value given by the school is 75 while the value of students is still a lot below the completeness that has been given. Therefore, this PjBL-based science teaching module with Ethno-STEAM content is needed to assist in teaching and learning activities.

Content Validity Preparation Stage

At this stage, the design of the PjBL teaching module with Ethno-STEAM content on ecology and biodiversity in Indonesia was made. The design begins with the selection of materials, learning strategies, and assessment methods used. The selection of essential materials is adjusted to the analysis of learner needs in accordance with the demands of the achievements in the independent curriculum. Ecology and Biodiversity material in Indonesia in this science teaching module is made in an integrated manner with project-based learning with Ethno-STEAM content because this material requires a very broad understanding of concepts and is closely related to environmental issues. So that it will make it easier for students to understand the material through the application of concepts in the form of projects and make students think more creatively to foster the character of environmental care**.**

The project-based science module combined with the Ethno-STEAM approach consists of local wisdom content with the concepts of Knowledge, Technology, Engineering, Art, and Mathematics which are the basis for this learning so that the concepts of Ecology and Biodiversity in Indonesia can be applied as a basis for knowledge (S), technology (T) as a medium to help students in making projects, engineering (E) as a step for students in building their projects, art (A) and Mathematics (M) as a basic concept of calculation in the application of Ecology and Biodiversity in Indonesia in projects made by students. Revealed that Project Based Learning (PjBL) integrated with STEM (Science, Technology, Engineering and Mathematics) can increase student interest in learning, learning becomes more meaningful so that it can improve student mastery of concepts (learning outcomes). In this development, Ethnoscience content is added with an art element approach as a novelty system and strategy to empower students' creative thinking through the project. Here are some designs of PjBL-based teaching modules with Ethno-STEAM content on Ecology and Biodiversity in Indonesia.

Figure 2. Cover Design and Integration Scheme

Teaching Module Development Stage (Content Validation Results)

PjBL-based science teaching modules with ethno-STEAM content are developed in an integrated manner with ecology and biodiversity materials. After the science teaching module is developed, the next stage is

the development stage. The teaching modules developed must first be validated by validators who are experts in their fields. The results of this teaching module were validated by 7 validators consisting of 3 Sebelas Maret University lecturers and 4 education practitioners consisting of 2 principals and 2 professional science teachers. Expert validation in addition to knowing the feasibility is also to revise the teaching module to be as expected and easy to use. The validity test results were then analysed using Aiken's V. Media validation was carried out by five expert validators with seven aspects that must be validated from the teaching modules developed. The results of the assessment of each aspect given by the validator were then analysed using the Aiken's V formula. The following can be described the results of the media validation test presented in Table 2.

Table 2. Results of Media Validation Test with Aiken's V on Teaching Module Development

Aspect	Score	V Table	Describe
Module Size	0.93	0.87	Valid
Cover Design	0.96	0.87	Valid
Content Design	0.95	0.87	Valid
Self Instructional	0.93	0.87	Valid
Stand Alone	0.93	0.87	Valid
Adaptive	0.93	0.87	Valid
User Friendly	1	0.87	Valid
Average Score			0.95

Based on Table 2, it shows that there are 7 aspects of media validation with 30 statement items related to media variables which are tested by media experts to 5 validators. The validity test results were then analyzed based on the V table value of 0.87. The statements were declared valid with an average of 0.95 including very high validity, thus indicating that the teaching modules developed were suitable for use in accordance with the model and curriculum used. In the design aspect, it shows that the teaching module is in accordance with the content of Ethnoscience.

The results of media expert validation of the PjBL teaching module with Ethno-STEAM content obtained an average score of 25 items greater than the V table, which means it is included in the very high validity category. Media experts provide suggestions related to synchronizing the composition of colors and writing so that they are clearly visible. Based on the results of media validation, all aspects of valid statement items are in a very high category and can be used as a research instrument to measure the Draft 1 science teaching module for field trials. Input from experts was used as a guideline to improve the Draft 1 (Revision 1) science teaching module. Meanwhile, the material validation results are outlined in Table 3.

Table 3. Results of Material Validation Test with Aiken on Teaching Module Development

Aspect	Score	V Table	Describe
Relevance	0.98	0.87	Valid
The accuracy and currency of the material	0.97	0.87	Valid
Completeness of material presentation	0.95	0.87	Valid
Scientific systematics	1	0.87	Valid
Suitability of student center material	0.97	0.87	Valid
Way of presentation	1	0.87	Valid
Average Score			0.98

Material validation was carried out by five expert validators. The purpose of this material validation is to determine the accuracy and suitability of the learning material developed in the teaching module whether it is in accordance with the learning needs through six validated aspects. The results of material validation of the PjBL teaching module with Ethno-STEAM content obtained an average score of 0.98 from 30 items greater than the V table of 0.87 which means it is included in the very high validity category.

Table 4. Results of Learning Expert Validation Test with Aiken on Teaching Module Development

Aspect	Score	V table	Description
Teaching module identity	0.83	0.78	Valid
Format of teaching module matrix	0.97	0.78	Valid
Learning objectives	0.88	0.78	Valid
Selection and organization of materials	0.92	0.78	Valid
Selection of resources, media, and materials	0.98	0.78	Valid
Approach, model, and method	0.88	0.78	Valid
Activities according to the syntax of ethno-steam PjBL	0.83	0.78	Valid
Assessment tool	0.90	0.78	Valid
Appendix	0.88	0.78	Valid
Average score			0.90

The material expert gave an opinion related to ecological material at Junior High School (SMP) that it has a lot of coverage than elementary school and integrates into real phenomena in the surrounding environment. All ecological material should have a more visible part of its integration. Material experts also

ensure that all discussions of ecological material can be understood by students by combining it with the content of local wisdom around so that learning is more meaningful. Meanwhile, the learning validation results are described in Table 4.

Based on the results of learning expert validation of the PjBL teaching module with Ethno-STEAM content, the average calculated V value of 25 items is greater than V table, which is 0.90, which means it is included in the very high validity category. All material validity criteria in the teaching module are declared valid. Therefore, based on these results, all statement items can be used as research instruments to measure the PjBL science teaching module with Ethno-STEAM content Draft 1 for field trials. Meanwhile, the results of learning validation are described in Table 5.

Table 5. Results of Language Expert Validation Test with Aiken Against Teaching Module Development

Aspect	Score	V table	Description
Communicative	0.93	0.87	Valid
Dialogical and interactive	0.93	0.87	Valid
Conformity with indonesian language rules	0.96	0.87	Valid
Appropriate to student development	0.93	0.87	Valid
Consistency and order of thinking	096	0.87	Valid
Use of terms and symbols	1	0.87	Valid
Average score			0.95

Based on the results of the linguist validation of the PjBL teaching module with Ethno-STEAM content, the average V score of 0.95 from 11 items is greater than the V table of 0.87, so it is included in the very high validity category. Linguists give opinions on the use of language used moderately, colorfully, interestingly enough writing rules, but there are still some sentences that are still ambiguous. In addition, linguists also provide input that the teaching modules developed are always guided by the use of EYD. Then, the use of alphabets in multiple choices begins with lowercase letters with a full stop 4 times, and the clarity of the letters on each plot, the size of the letters are aligned.

At the needs analysis stage, interviews with science teachers and through a Google Form-based questionnaire were conducted. Based on the expert validity analysis, it can be concluded that the PjBL teaching module with ethno-STEAM content is valid, so this teaching module can be used by educators as a learning tool. The use of learning media in the classroom is expected to foster student curiosity so that student interest in learning increases. Learning media is a tool used to convey messages and information in the learning process (Tambunan, 2021). The teaching module developed is implemented in learning that involves science and technology as a learning resource and interactive worksheet for students, making it easier to achieve learning objectives. According to Nurhayati (2021), STEM-based E-modules can foster critical thinking and provide competitive competencies in the 21st century. The STEM approach refers to the integration of science, technology, engineering principles, and mathematics. The advantages of this developed product are its integration of ethnoscience and the addition of art elements in its STEM approach. Supported by research (Listiana, 2023), which states that the effectiveness of e-modules in training students' creative thinking skills is in the effective category with a high category, and e-modules are quite efficient in use in learning to improve creative thinking skills.

Table 6. Test Instrument Validation Results

Aspect	Score	V Table	Description
Suitability of sub. Indicator with question	0.94	0.87	Valid
Suitability of indicator with answer	0.94	0.87	Valid
Language	0.93	0.87	Valid
Presentation	0.96	0.87	Valid
Average Score			0.94

In the independent curriculum, culture and local wisdom play an important role in supporting science subjects with many actual natural phenomena. The implication is that an educator must stimulate students by using culture and local wisdom as a medium for student learning, by utilizing technology as an intermediary. According to Nurhayati (2021) culture, art, and local wisdom found in the surrounding community can stimulate students' curiosity and creativity. Naturally and instinctively, students behave as scientists, who not only recognize something as a theory, but are able to relate it to the life around them. According to Yuliana (2017) by studying the peculiarities found in a society, students can understand the natural events around them and can relate them to the fields studied by these students.

Module validity is conducted to create a good learning product that is relevant to the theoretical content and to ensure the effectiveness of the product used in the learning process. Content validity is a process to see the extent to which a measurement tool accurately represents the construct being measured. This is considered important evidence that strengthens the validity of measurement tools, such as research instruments (Adom et al., 2020). Previous studies have

also tested validity with several methods such as, Aiken's V (Azmi, 2023) and product moment correlation (Mulyana & Desnita, 2023). The set of contents of the interactive teaching module device must be relevant and aligned with the variable indicators, namely the ethno-STEAM project base. The selection of the Project Based Learning model is very appropriate to be applied based on consideration of the selection of learning strategies to foster students' creative thinking skills. The PjBL model is a new breakthrough in education that emphasizes contextual learning by utilizing complex activities (Masruroh, 2021). Project-based learning is a learning approach that gives students the freedom to plan learning activities, carry out projects collaboratively, and ultimately produce work products that can be presented to others (Hartini, 2017). In integrated Project-Based Learning (PjBL) based science learning, students are not only invited to understand science concepts theoretically, but also develop critical thinking skills, creativity, and collaboration through project-based activities (Sahjat, 2025).

The implementation of learning in schools is expected to create meaningful learning for students because students can be actively involved in discovering new knowledge for themselves through their learning experiences (Malikah, 2023). Active student involvement makes the learning process student-centered or better known as student centered learning. The existence of material expert validation aspects related to student centered learning makes the role of learning in the classroom even more important with the interaction between students and teachers as learning facilitators. Thus, the developed science teaching module pays great attention to the content of the material by adjusting the content of the material to the development of science and choosing topics or case examples through project work that are in accordance with students' daily lives. This is in accordance with the opinion of Daryanto (2013) that one of the characteristics of the module is adaptive, namely the module can adapt to the development of science and technology and is flexible / flexible to be used in various hardware. In addition, the material suitability sub-indicator discusses the completeness, breadth and depth of the material. This is in accordance with one of the characteristics of the module is self contained, namely when all the learning material needed is contained in the module. The purpose of this concept is to provide opportunities for students to study the learning material thoroughly, because the learning material is packaged into a complete unit. Every instruction and information exposure that appears is helpful to the user and the use of simple language, easy to understand, and using commonly used terms is one form of user friendly.

Based on the results of learning validation, expert validators assess that the teaching modules developed are in accordance with the learning outcomes and the level of development of students starting from the presentation of material, PjBL syntax and the content of Ethno-STEAM developed. Based on the results of language validation, expert validators assessed that the teaching module had used good and correct Indonesian language, was easy to understand because it used simple language, and was communicative. Word selection has been adjusted to the level of cognitive and emotional development of junior high school students, as well as the suitability of other aspects. Thus, the teaching module developed is suitable for use in learning because it has met the requirements in the use of good and correct language order. This can also be seen from the results of Putri (2018) research which states that the products produced contain modes and approaches that are in accordance with valid criteria. Furthermore, (Azmi, 2023) explains that instruments that have been tested for validity so that they meet valid criteria can be used to improve students' thinking skills.

The creative thinking test instrument consists of multiple choice questions with indicators of creative thinking and higher order thinking. The questions are also made to adjust the local wisdom around and the STEAM element approach, so that the questions are relevant to current real phenomena so that students can think creatively to solve problems in the problem. Based on the results of the validation of the Ethno-STEAM-loaded test instrument, creative thinking in the teaching module that has been developed is in accordance with the aspects assessed by the creative thinking indicators contained in the pre-test and post-test questions. Creative thinking indicators adopted from Torrance (1972) in assessing creative thinking skills, namely Fluency, namely the ability to generate ideas in solving problems, Flexibility, namely the ability to produce solutions according to certain conditions, Originality, namely the ability to generate ideas in problem solving, and Elaboration, namely the ability to develop problem solving coherently. The results of expert validation stated that of the 4 aspects assessed were valid and in accordance with the indicators of creative thinking with the Wonogiri Regency Ethno-STEAM-charged question instrument which was prepared according to questions that facilitated higher-level thinking skills. The results of this test instrument validation have implications for the feasibility of the test to be tested on students to measure creative thinking skills and have fulfilled the variables of empowering creative thinking and Etno-STEAM content.

Conclusion

The PjBL-based science teaching module has been validated as an effective and feasible tool to empower students' creative thinking skills, with a high validity score in the media aspect of 0.95, material experts of 0.95, learning experts of 0.90, linguists of 0.95, and creative thinking test instruments of 0.94. Therefore, this module is ready to be further tested for effectiveness. This module can be implemented in science learning practices in junior high schools to shape the character and creative thinking of students by paying attention to the culture that must be preserved. This research is limited to the topic of Local Wisdom of Wonogiri Regency, Central Java and further researchers can expand this science teaching module to cover other regional cultural topics. This research contributes to project-based learning with science topics that refer to cultural preservation so as to connect local wisdom with scientific understanding, helping to educate the younger generation about local culture in Wonogiri through school learning.

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Conceptualization, M. A. P., S. Y., and B.; methodology, M. A. P; validation, S. Y., and B.; formal analysis, M. A. P., S. and B. ; investigation, M. A. P..; resources, M. A. P., S. Y., S.; data curation, M. A. P., S. Y. , and B: writing—originaldraft preparation, M. A. P.; writing—review and editing, S. Y., S.; visualization, M. A. P., S. Y. , B. All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

References

Adom, D., Mensah, J. A., & Dake, D. A. (2020). Test, Measurement, and Evaluation: Understanding and Use of the Concepts in Education. *International Journal of Evaluation and Research in Education*, *9*(1), 109–119. https://doi.org/10.11591/ijere.v9i1.20457

Aisyah, S. (2023). *Validitas Pengembangan Modul Berbasis Project Based Learning (PJBL) pada Mata Kuliah Rekayasa Pola di Prodi PKK-Tata Busana FT UNM*. LP2M-Universitas Negeri Makassar. Retrieved from https://shorturl.asia/Zk2xe

Arikunto, S., & Damayanti, R. (2013). *Dasar-dasar Evaluasi Pendidikan* (2nd ed.). Jakarta: Bumi Aksara.

Azmi, N. (2023). Development of Physics Learning Assessment Instrument in Project-Based Learning Model to Improve 4C Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(4), 1798–1804. https://doi.org/10.29303/jppipa.v9i4.3174

Azwar, S. (2012). *Reliabilitas dan validitas edisi 4*. Yogyakarta: Pustaka Pelajar.

Daryanto, D. (2013). *Menyusun modul bahan ajar untuk persiapan guru dalam mengajar*. Yogyakarta: Gava Media.

Hartini, A. (2017). Pengembangan Perangkat Pembelajaran Model Project Based Learning Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar. *ELSE (Elementary School Education Journal) : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, 6–16. https://doi.org/10.30651/else.v1i2a.1038

Hasanah, U. (2020). Uji Validitas Pengembangan Media Pembelajaran Berbasis Macromedia Flash Pada Materi Penyajian Data. *Prosiding Seminar Nasional Penelitian Dan Pengabdian Masyarakat*, 384–387. Retrieved from http://prosiding.unirow.ac.id/index.php/SNasPPM/article/view/446

Hasibuan, H. A. (2022). Peran Modul Berbasis Kearifan Lokal Untuk Mendukung Pendidikan Merdeka Belajar. *Seminar Nasional Pendidikan Dasar*, *1*(1), 1–10. https://doi.org/10.34007/ppd.v1i1.201

Kemendikbud. (2022). *Mengenal Peran 6C dalam Pembelajaran Abad ke-21*. Kemendikbud. Retrieved from https://shorturl.asia/IM9XP

Kriyantono, R. (2022). *Teknik praktis riset komunikasi kuantitatif dan kualitatif: Edisi Kedua*. Jakarta: Prenada Media.

Lestari, S. F. (2022). Mewujudkan Merdeka Belajar: Studi Kasus Program Kampus Mengajar di Sekolah Dasar Swasta di Jakarta. *Jurnal Basicedu*, *5*(6), 6426–6438. https://doi.org/10.31004/basicedu.v5i6.1679

Listiana, L. F. (2023). Development and Validation of Learning Strategy for Creative Thinking Skills Empowerment: STEM-BasedE-Modules. *Jurnal Penelitian Pendidikan IPA*, *9*(Special Issue), 477–483. https://doi.org/10.29303/jppipa.v9iSpecialIssue.6003

Malikah, B. (2023). 5 Subtema 1 Kelas III Sekolah Dasar Analisis Kevalidan Pengembangan Ensiklopedia Tematik Tema. *Conference Of Elementary Studies*, 158–167. Retrieved from https://journal.um-surabaya.ac.id/Pro/article

Masruroh, L. (2021). Efektivitas Model Problem Based Learning Melalui Pendekatan Science Education for Sustainability dalam Meningkatkan Kemampuan Kolaborasi. *Jurnal Tadris IPA*

Indonesia, 179–188. https://doi.org/10.21154/jtii.v1i2.171

Maulidiya, M. (2019). The effect of problem based learning on critical thinking ability in mathematics education. *Journal of Physics: Conference Series*, *1157*(4). https://doi.org/10.1088/1742-6596/1157/4/042063

Mulyana, V., & Desnita, D. (2023). Empirical Validity and Reliability of the Scientific Literacy Assessment Instrument Based on the Tornado Physics Enrichment Book. *Jurnal Penelitian Pendidikan IPA*, *9*(5), 3961–3967. https://doi.org/10.29303/jppipa.v9i5.3290

Nurhayati, E. A. (2021). Pengembangan E-Modul Kimia Berbasis STEM Dengan Pendekatan Etnosains. *Chemistry Education Practice*, *4*(2), 106–112. https://doi.org/10.29303/cep.v4i2.2768

Putri, L. T. (2018). Efektivitas Model Pembelajaran Berbasis Proyek (Project Based Learning) Terhadap Keaktifan Dan Kemampuan Berpikir Kreatif Siswa Kelas X SMAN 2 Semarang. *Jurnal Penelitian Pembelajaran Fisika*, *6*(2), 38–43. https://doi.org/10.26877/jp2f.v6i2.2590

Reynawati, A. (2018). Penerapan model problem-based learning pada materi pencemaran lingkungan untuk melatihkan keterampilan berpikir kreatif siswa. *Jurnal Pendidikan Sains (PenSa)*, *6*(2), 325–329. https://doi.org/10.31004/basicedu.v8i5.8469

Rizal, M. A. (2018). Development of student worksheet problem-based learning model to increase higher order thinking skills. *IOSR International Journal of Research & Method in Education (IOSR-JRME*, *8*(2), 59–65. https://doi.org/10.9790/7388-0802045965

Sahjat, S. M. (2025). Science E-Book Development Using Project-Based Learning (PjBL) Model Integrated with Pancasila Student Profile. *Jurnal Penelitian Pendidikan IPA*, *11*(1), 910–922. https://doi.org/10.29303/jppipa.v11i1.9632

Salhuteru, C. P. (2025). Integrated PjBL-STEAM Jigsaw on Critical Thinking and Creative Thinking of Students: A Biotechnology Study. *Jurnal Penelitian Pendidikan IPA*, *11*(1), 910–922. https://doi.org/10.29303/jppipa.v11i1.9632

Tambunan, S. A. (2021). Analisa Kebutuhan Pengembangan Media Pembelajaran Pada Mata Pelajaran Konstruksi dan Utilitas Gedung di Kelas Desain Permodelan dan Informasi Bangunan SMK Negeri 1 Percut Sei Tuan. *Junal Pendidikan Teknik Sipil*. Retrieved from https://www.researchgate.net/publication/35

Torrance, E. P. (1972). Predictive Validity of the Torrance Tests of Creative Thinking. *The Journal of Creative Behavior*, *6*(4), 236–262. https://doi.org/10.1002/j.2162-6057.1972.tb00936.x

Yuliana, I. (2017). Pembelajaran berbasis etnosains dalam mewujudkan pendidikan karakter siswa sekolah dasar. *Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, *1*(2), 98–106. https://doi.org/10.30651/else.v1i2a.1051