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Development of Creative Thinking Skills Instruments based on local wisdom in Ecology Material

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ABSTRACT

Creative thinking skills emphasize the aspects of fluency, flexibility, originality, and detail. This study aims to develop a local wisdom-based Creative Thinking Skills Instrument on Ecology Material in the Biology Education Study Program of HKBP Nommensen University, Pematangsiantar. The development stage of the local wisdom-based Creative Thinking Skills instrument is needs analysis, the second stage is designing the local wisdom-based Creative Thinking Skills instrument, the third stage is Development. The validity test obtained a score of 44.67 with valid criteria. The results of a limited trial of the local wisdom-based Creative Thinking Skills instrument in biology learning on ecology material showed that there were 7 (35%) questions that had very high validity, 8 (40%) questions had high validity, 4 (20%) questions had sufficient validity, and 1 (5%) had low validity. From the results of the limited trial, the local wisdom-based Creative Thinking Skills instrument in biology learning was very suitable for use in biology learning on ecology material. Furthermore, from the results of a limited trial of the local wisdom-based Creative Thinking Skills instrument, an average score of 0.724 was obtained with valid criteria. Furthermore, the reliability test results of the local wisdom-based creative thinking skills instrument in a limited product trial obtained $\alpha = 0.972$, with very high criteria. This indicates that this local wisdom-based creative thinking skills instrument is highly valid and reliable for development in biology learning on ecological material.

INTRODUCTION

Biology learning in the 21st century is expected to equip students with several skills, including innovative, critical, creative thinking, problem-solving, literacy, and leadership (Rohmah, Afini Atika, 2020). In addition, Biology education plays an important role in aspects of life and technological development to improve human resources (Matsna, et al., 2023). Based on research results (Priyambodo, et al., 2021), it is known that creative thinking skills in Indonesia are still relatively low, this fact is confirmed directly from the results of observations of the 2021 Global Innovation Index. Indonesia is ranked 87 out of 132 countries, and also science learning in the 21st century according to the National Science Teacher Association states that students must have several skills, one of which is creative thinking, but in reality, creative thinking skills in Indonesia are relatively low. Low creative thinking skills are influenced by teacher-centered teaching and learning activities (Ichsan, Reza Nurul, et al., 2021), making the learning process less enjoyable (Matsna, et al., 2023). They stated that teachers are unable to create questions that encourage creative thinking skills. Furthermore, students struggle to understand matters related to analysis, evaluation, and creation in biology learning (Umami & Rusdi, 2021). Ecology is a compulsory course in the biology education study program at HKBP Nommensen University, Pematangsiantar, which must be completed by students in accordance with the grade completion criteria. In learning ecological biology, students experience many learning difficulties (Dama, RMENL, 2021).

Interviews with lecturers at HKBP Nommensen University, Pematangsiantar, revealed that the learning instruments used do not emphasize measuring creative thinking skills based on local wisdom. The instruments used still focus on assessing learning outcomes solely on completing questions related to the course material, without considering the components of creative thinking skills. Therefore, creative thinking skills are considered low because they are teacher-centered, based on the notes provided, and the lack of updating of answers to questions in the learning process (Andini, et al.,2024). According to (Rohmah and Afini Atika, 2020), creative thinking has four important components: (i) fluency, (ii) flexibility, (iii) originality, and (iv) elaboration. According to (Fitriyah, A., & Ramadani, S.D, 2021), creative thinking skills are skills that can solve problems with new or different solutions. It is hoped that creative thinking can open students' perspectives from various perspectives, enabling them to identify and solve real-life problems based on local wisdom. Creativity according to (Zein, et al., 2022) is someone who is able to produce new creations by having deterministic, individualistic, independent, enthusiastic, and producing something new. In the learning process activities, creative thinking skills need to be improved so that students can be trained and progress. It

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can be concluded that creative thinking skills, finding new ideas about an existing problem, whether in the form of ideas or solutions that can be applied that can solve problems in real life. Efforts to improve the creative thinking skills of students in Biology courses, according to (Azza, et al., 2023) the use of learning media, learning instruments and methods must be adapted to students in strengthening local culture/wisdom not only improves skills in knowledge but also the character of students in facing the future. The combination of education and local wisdom can create meaningful learning. Based on the explanation above, this study aims to produce a valid and reliable local wisdom-based Creative Thinking Skills instrument in biology learning on ecological material.

Problem Statement

What is the validity and reliability of the local wisdom-based Creative Thinking Skills instrument in biology learning, particularly in the ecology topic, in the Biology Education Study Program at HKBP Nommensen University, Pematangsiantar?

Problem-Solving Approach

The development of the local wisdom-based Creative Thinking Skills instrument describes the validity and reliability of the local wisdom-based Creative Thinking Skills instrument. Each student and even teacher can develop possible answers. Thus, this local wisdom-based Creative Thinking Skills instrument provides an opportunity for all students to explore and think creatively according to their personality and environment, as well as to collect and analyze comprehensive data to solve the problems they face.

State of the Art and Novelty

Numerous studies have examined creative thinking, but each unit/campus certainly has its own characteristics related to this theme. This includes the causes of collaboration, who is involved, the stages encountered during collaboration, commitment, obstacles encountered, and the authority of each party involved. Furthermore, the focus of the problem studied, which is related to creative thinking skills in a forum, has not been widely explored by previous researchers. There are four indicators of student creative thinking: fluency, flexibility, originality, and elaboration. In this study, only two indicators were measured: fluency and flexibility. Students are considered to have met the fluency indicator if they are able to think creatively, generating a variety of possible answers and finding them correct. Students are considered to have met the flexibility indicator if they are able to think creatively using a variety of different ways to solve problems and finding them correct. Furthermore, students are considered to have met the novelty indicator if they are able to think creatively fluently and flexibly, providing new ideas or answers that are correct or answers that are not commonly offered by students of their age level.

LITERATURE REVIEW

Research results (Rohmah, et al., 2020) state that not many lecturers have developed creative thinking skills test instruments, especially those related to students' local wisdom, which have not been emphasized at all in biology learning on ecology material (Santoso B.P., and Wulandari F.E. 2021). Research results (Rahmawati & Trimulyono, 2021) state that the development of creative thinking skills instruments in biology learning encourages students to think creatively and scientifically. Research (Setiawan, E., & Indana, S. 2021) states that the development of creative thinking skills instruments based on local wisdom in learning encourages students to be more active in learning. Valid and reliable learning instruments help the quality of student learning on creative thinking skills questions (Rahmi, T., et al., 2021). Research results (Setiawan, E., & Indana, S. 2021) explain that providing appropriate questions will stimulate students' creative thinking skills in solving problems. Not only that, the right creative thinking skills instrument will encourage students to think critically, innovatively and creatively in learning (Supriyatin, S, et al., 2023); (Widyaningsih, et al., (2021).

METHOD

Research Type

This research is a Research & Development (R&D) study using the ADDIE model developed by Dick & Carry (Boyman, et al., 2020). The ADDIE model has five stages of development: Analysis, Development, Implementation, and Evaluation. This research aims to describe the phenomena or research data systematically and truthfully, even though the data obtained is numerical (Eka Rahmawati, 2022).

Research Time and Location

This research will be conducted in the odd semester of the 2024/2025 academic year, in the Biology Education Program, HKBP Nommensen University, Pematangsiantar.

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Research Sample

The research sample consists of four biology education lecturers. Data collection in this study was conducted through tests and validation questionnaires.

Procedure

The research procedures implemented in this study include three stages:

1. The initial/preparatory stage, which involves developing the instrument, validating the content of the research instrument, and making revisions;
2. The implementation stage involved teaching using the Local Wisdom-Based Creative Thinking Skills Instrument for Ecology. A questionnaire was administered to four biology lecturers to determine the validity and reliability of the instrument.
3. The final stage/reporting the results involved processing the collected data, describing the results, and drawing conclusions.

Data, Instruments, and Data Collection Techniques

Data collection in this study involved a validation test and questionnaire. The test aimed to determine students' local wisdom-based creative thinking skills in biology learning on ecology. The questionnaire aimed to determine the feasibility of the local wisdom-based creative thinking skills questions. The instrument used for validation consisted of 20 items analyzed using Minitab version 18. Local wisdom-based creative thinking skills encompassed students' abilities to analyze (C4), evaluate (C5), and create (C6). Data collection techniques were obtained by analyzing the instrument's validity and reliability. Instrument validity consisted of content, language, and material validity tests. To carry out content validity, use the Gregory formula with the criteria shown in Table (1). Next, the instrument reliability is calculated using the Cronbach's Alpha formula with the criteria shown in Table 2.

Table 1. Content Validity Criteria

Validity Criteria	
5 ÿ × ÿ8	Not Valid
9 ÿ × < 12	Less Valid
13 ÿ × < 16	Valid
17 ÿ × < 20	Very Valid

Source: (Kahar, 2017)

The table above is a conversion guideline for determining the level of content validity based on scores obtained from expert assessments (usually using instruments such as Aiken's V or Gregory validation sheets).

Table 2. Question Reliability Criteria

Reliability Criteria	
0,80 - 1,00	Very high
0,60 - 0,79	High
0,40 – 0,59	Currently
0,20 – 0,39	Low
0,00 – 0,19	Very Low

Source: Arikunto dalam Kahar (2017)

In the context of research or data collection, reliability refers to the consistency of a measuring instrument (question) in producing consistent data. A reliable question will yield the same or very similar answers or scores when asked to respondents repeatedly under similar conditions.

RESULT

The results of the development of the Creative Thinking Skills instrument based on local wisdom on ecological material in the biology education study program at HKBP Nommensen University, Pematangsiantar. The first stage is needs analysis, curriculum analysis, and student needs analysis. Ecology material evaluation questions. The second stage is designing the Creative Thinking Skills instrument based on local wisdom in accordance with the Basic Competencies (KD) and Core Competencies (KI) of the ecology material. Next, the third stage is Development. At this stage, the instrument is validated through content validation, language validation, and material validation by biology lecturers and teachers. The validation results of the Creative Thinking Skills Instrument based on local wisdom on the ecology material can be seen in Table 3.

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Table 3. Validation Results of Creative Thinking Instruments Based on Local Wisdom

No	Validation	Score	Percentage (%)	Criteria
1	Contents	42	83	Valid
2	Language	45	87	Valid
3	Material	47	90	Very Valid
	Average	44,67		Valid

Based on Table 3, it is explained that the content validation score obtained a score of 42 with valid criteria, the language validation score was 45, the material validation score was 47 and the average value of the validity test obtained a score of 44.67 with valid criteria. This indicates that the Creative Thinking Skills instrument based on local wisdom is suitable for use in learning biology for grade X on ecology material. The next stage is implementation. At this stage, the instrument that has been validated by experts and revised is then tested on a limited basis to students by giving creative thinking questions. The results of the limited trial validation can be seen in Table 4.

Table 4. Validation Results of Local Wisdom-Based Creative Thinking Instruments for Limited Tests

Index	Criteria	Limited Product Trial	
		Frequency	%
0.81-1.00	Very High	7	35
0.61-080	High	8	40
0.41-0.60	Currently	4	20
0.21-0.40	Low	1	5
0.00-0.20	Very Low	0	0
Amount		20	100

Based on Table 4, the results of a limited trial of the local wisdom-based Creative Thinking Skills instrument in biology learning on ecology topics show that 7 (35%) questions had very high validity, 8 (40%) questions had high validity, 4 (20%) questions had sufficient validity, and 1 (5%) had low validity. The limited trial results indicate that the local wisdom-based Creative Thinking Skills instrument in biology learning is highly suitable for use in biology learning on ecology topics. Furthermore, the limited trial results of the local wisdom-based Creative Thinking Skills instrument obtained a low r-value of 0.270, while the highest r-value of 0.958, with very high validity. The average score was 0.724, with valid criteria. Furthermore, the reliability test results of the local wisdom-based Creative Thinking Skills instrument in biology learning on ecology topics can be seen in Table 5.

Table 5. Reliability Test Results

Product Trial	α	Criteria
Limited Product	0.972	Very Hight

Table 5 explains that the reliability test results for the local wisdom-based creative thinking skills instrument in the limited product trial obtained an α of 0.972, representing a very high criterion. This indicates that the local wisdom-based creative thinking skills instrument is highly valid and reliable for development in biology learning, particularly in ecology.

DISCUSSION

Developing a local wisdom-based creative thinking skills instrument in biology learning is highly feasible. A local wisdom-based creative thinking skills instrument is crucial for teachers in developing students' higher-order thinking skills (Supriyatin et al., 2023).

Developing a valid and reliable local wisdom-based creative thinking skills instrument will foster students' critical and creative thinking skills in learning (Elfira, I., & Santosa, TA. 2023). In developing a local wisdom-based creative thinking skills instrument for biology learning, questions must refer to indicators of analyzing, evaluating, and creating (Matsna, Maratul, 2023), so that students can think creatively in their learning.

(Andini, et al., 2024) stated that a local wisdom-based creative thinking skill instrument that has good validity, reliability, and difficulty index values will result in appropriate use to measure students' higher-order thinking skills. The results of the validity test obtained an average score of 0.724 and a reliability of 0.972 with very high criteria. The use of appropriate local wisdom-based creative thinking skill instruments in biology learning will be able to be used in evaluating the quality of student learning (Supriyatin, et al., 2023). (Eka Rahmawati, 2022) stated that the development of local wisdom-based creative thinking skill instruments can encourage students to solve problems related to questions based on local wisdom-based creative thinking skills in biology learning more easily. Local wisdom-based creative thinking skills help students in solving difficult questions on ecological and environmental materials. A valid and reliable creative thinking skills instrument based on local wisdom will be able to measure students' scientific literacy levels in biology learning. (Ansori, AZ 2020) stated that developing a creative thinking skills instrument based on local wisdom can improve students' cognitive dimensions and thinking characteristics in biology learning. Therefore, the

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development of this instrument has a positive impact on both teachers and students in ecology (Umami & Rusdi, 2021).

CONCLUSION

Based on this research, it can be concluded that the local wisdom-based creative thinking skills instrument has a validation value of 0.724, which is considered sufficient, and a reliability value of 0.972, which is considered high. These findings indicate that the local wisdom-based creative thinking skills instrument is highly valid and reliable for use in ecology materials. Therefore, the local wisdom-based creative thinking skills instrument is highly suitable for development in biology learning on ecology and environmental materials in schools.

REFERENCES

Ahmad, IF, & Syafii, A. (2020). Trends in the Application of Higher-Order Thinking Skills in Islamic Religious Education in Madrasahs and Schools: A Systematic Literature Review. Journal of Islamic Education, 9(2), 195–216. https://doi.org/10.14421/jpi.2020.92.195216

Ahmad, S., Prahmana, RCI, Kenedi, AK, Helsa, Y., Arianil, Y., & Zainil, M. (2018). Higher-Order Thinking Skills Instrument. Journal of Physics: Conference Series, 943(1). https://doi.org/10.1088/1742-6596/943/1/012053

Almelweth, H. (2022). The Effectiveness of Proposed Geography Teaching Strategies through the Application of Artificial Intelligence in Developing High-Order Thinking Skills and Achievements of Secondary School Students. Pegem Egitim and Ogretim Dergisi, 12(3), 169–176. https://doi.org/10.47750/pegegog.12.03.18

Andini, I., Karmila, W., & Nurhaedah. (2024). Application of the Problem-Based Learning (PBL) Model to Improve the Creative Thinking Skills of Fourth-Grade Students at the UPTD SPF SD 219 Madekkang, Soppeng Regency. Pinisi Journal of Education, 1–5.

Ansori, AZ (2020). Analysis of Biology Questions Based on Cognitive Process Dimensions and Heat Characteristics. Mandala Education Scientific Journal, 6(2), 190–199.

Apriliana Rusly Haniah1, Aman2, RS (2020) Integration of character education and higher-order thinking skills in history learning. Journal of Education and Learning (EduLearn), 14(2), 183–190. https://doi.org/10.11591/edulearn.v14i2.15010

Azza, Brillian Delila, Maria Ulfah, and Nanik Widayati. 2023. "161. Application of the Culturally Responsive Teaching (CRT) Approach in Improving Soft Skills and Student Activeness in High School Biology Learning." Proceedings of the National Seminar on Teacher Professional Education, 1464–73 https://conference.upgris.ac.id/index.php/psnppg/article/view/4132.

Boyman, SN, Jamal, MB, Razali, NA, & Aziz, SA (2020). The ADDIE Model Design Process for 21st-Century Teaching and Facilitation Activities (Pdpc) in the National Studies Module. International Journal of Psychosocial Rehabilitation, 24(09), 2115–2124

Dama, RMENL (2021). Development of a Higher Order Thinking Skills (HOTS)-Based Instrument to Train Students' Critical Thinking Skills in Biology. Jurnal Normalita, 9(2), 188–194

Elfira, I., & Santosa, T.A. (2023). Literature Review: Utilization of the PjBL Model in Science Education to Enhance Creativity and Critical Thinking Skills. Jurnal Penelitian Pendidikan 133–143. https://doi.org/10.29303/jppipa.v9i1.2555

Eka Rahmawati Guntur Trimulyono, D. (2022). Validity of Higher Order Thinking Skills (HOTS) Assessment Instrument in Biodiversity Materials. Bioedu: Scientific Periodical of Biology Education, 11(1), 138–147. https://ejournal.unesa.ac.id/index.php/bioedu

Fitriyah, A., & Ramadani, S. D. (2021). The Effect of Project-Based Learning (PjBL)-based STEAM learning on creative and critical thinking skills. Inspiratif Pendidikan, 10(1), 209–226.

Ichsan, Reza Nurul, et al. 2021. Human Resource Management (HRM) Teaching Materials. CV. Sentosa Deli Mandiri

Matsna, Maratul. 2023. "Improving Critical Thinking Skills of Grade VII D Students of SMPN 19 Semarang in Ecology Subject Through Problem-Based Learning Based on Socio-Scientific Issues." National Science Seminar XIII, no. 373: 373–80.

Priyambodo, Mugi, Riezky Maya Probosari, and Nurma Yunita Indriyanti. 2021. "Correlation between Self-Confidence and Adversity Quotient with Creative Thinking Skills of Grade VIII Students on the Subject of Motion and Force." Journal of Phenomenon 11 (2): 231–44.

Rahmi, T., Suroso Mukti Leksono, & Annisa Novianti Taufik. (2021). Implementation of the Use of Open-Ended Problem-Based E-LKPD on the Theme of Global Warming to Train the Creative Thinking Skills of Grade VII Students. Journal of Mathematics and Natural Sciences Education, 14 (1), 269–275. https://doi.org/10.37630/jpm.v14i1.1499

Rohmah, Afini Atika, 2020, Students' Creative Thinking Skills in Solving Open-Ended Problems Reviewed from Learning Styles at MTsN 2 Tulungagung, Department of Mathematics Education, Faculty of Education and Teacher Training, Tulungagung State Islamic Institute.

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Volume 5, Number 2, April 2026
https://doi.org/10.47709/ijmdsa.v5i2.8595

Santoso B.P., and Wulandari F.E. (2021). The Effect of Project-Based Learning Combined with Problem-Solving Methods on Students' Creative Thinking Skills. Journal of Banua Science Education, 1: (1). http://jbse.ulm.ac.id/index.php/JBSE.

Setiawan, E., & Indana, S. (2021). Validity of Project-Based Student Worksheets (LKPD) on Spermatophyta Plant Classification Material to Train Creative Thinking Skills in Grade 10 High School Students. Biology Education Scientific Periodical (BioEdu), 10(2), 250–256. https://doi.org/10.26740/bioedu.v10n2.p250-256

Suprapto, N. et al. (2020) 'A Systematic Review of Photovoice as Participatory Action Research Strategies', International Journal of Evaluation and Research in Education (IJERE), 9(1), pp. 101–105. doi: 10.11591/ijere.v9i1.xxxxx.

Supriyatin, S., Rahayu, S., Suhadi, A. P., & Simarmata, R. N. (2023). Integration of Steam-PJBL in Science Learning at SMP Negeri 3 Karangmojo, Bantul–Yogyakarta: Simple Microscope Project. Applied Journal of Abdimas, 8(1), 102. https://doi.org/10.25273/jta.v8i1.13909

Umami & Rusdi, (2021) Development of a test instrument to measure Higher Order Thinking Skills (HOTS) oriented to the Programme for International Student Assessment (PISA) in students

Widyaningsih, N., Komalasari, M. D., Purnomo, H. (2021). Training in Creating Online-Based Interactive Learning Media for Elementary School Teachers. Indonesian Journal of Community and Service (IJOCS). 1(2). 347-361.

Zein, L. S. H., Setiono, S., & Windyariani, S. (2022). The Effect of the STEMA Approach on the Creative Thinking Skills of 8th Grade Junior High School Students on the Digestive System. Biodik, 8(2), 90–102. https://doi.org/10.22437/bio.v8i2.16990