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Feasibility of Conventional Biotechnology Practicum Guide Based on Physics, Chemistry, and Organoleptic Test Results of Cincalok

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ABSTRACT

The practicum guide is a guideline for conducting practicum activities. Cincalok was chosen as the practicum guide because of its closeness to the local wisdom of the students, so that the concept of conventional biotechnology can be understood contextually. The use of locally-based fermented products supports relevant learning, and strengthens students' appreciation of local culture and food resources. This study aims to analyze the feasibility of teaching materials for practical guides on conventional biotechnology sub-material regarding the results of physical, chemical, and organoleptic tests of cincalok in West Kalimantan. The research design used was quantitative descriptive. The feasibility test was conducted in three stages, namely instrument validation, media validation, and data analysis. The validators consisted of five people, namely two lecturers from the Biology Education Study Program and three biology teachers from grade X high school. The validation results obtained a CVR value of 0.99 and a CVI value of 0.99, indicating that all aspects of the practical guide assessment were valid. This shows that the practical guide that was created met the criteria in terms of format, language, and content. The practical guide that met the validity criteria could be used in the next stage to evaluate its effectiveness.

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INTRODUCTION

Biology material at the senior high school level covers various topics, including innovations in the field of biology. Through biology learning, students gain an understanding of scientific concepts. Students can develop scientific process skills, such as observing, classifying, measuring, and estimating (Mahmudah, Makiyah, and Sulistyaningsih 2019; (Agustina et al. 2019) Guswita et al. 2018). These skills can be applied in various contexts, both in the surrounding environment and in the laboratory (Asih 2017; Simanjuntak, Rohiat, and Elvinawati 2017). Understanding biological concepts and scientific skills is crucial for supporting advancements in science and technology, including conventional biotechnology, which is one of the subtopics in the E phase of 10th-grade high school (Ministry of Education, Culture, Research, and Technology, 2022).

According to Permendikbud No. 37 of 2018, students in Biology subjects are expected to be able to apply scientific work procedures to process, analyze and present information in both concrete and abstract realms. This competency includes the ability to develop skills that have been learned in school and use appropriate scientific methods. Practicum is a learning activity designed to test and apply theories both inside and outside the laboratory (Agustina et al. 2019). The science process skills approach allows students to understand the main concepts while honing science skills, fostering scientific attitudes, and critical thinking skills (Pontoh, Warouw, and Rondonuwu 2023). Practicum activities can encourage students to plan, observe, analyze data, estimate, use tools and materials, convey observation results, and ask questions (Suryaningsih 2017).

During the biology teaching and learning process, a method is needed that can help students achieve the competencies set in the curriculum. One method that can equip students is the practicum method. Practical activities allow students to understand scientific concepts, facts, and procedures, so that they can improve science skills (Juraidah, Nasir, and Fahruddin 2023). Practicums in biology material will increase students' curiosity and scientific attitudes towards events, and encourage them to think critically when identifying alternative solutions to a problem (Suryaningsih 2017).

Based on interviews with biology teachers at SMA Negeri 8 Pontianak, the material taught includes the definition of conventional biotechnology, examples of conventional biotechnology products, and the role of bacteria in conventional biotechnology processes. Teachers also conduct practical experiments to clarify the concepts taught. The laboratory activity conducted was tempe fermentation, accompanied by a video tutorial. However, to date, no laboratory activities have been conducted using local products from West Kalimantan, such as cincalok.

Cincalok is a fermented product made from small shrimp (rebon) that is commonly found in West Kalimantan. Cincalok is made using traditional methods by mixing rebon shrimp, salt, and sugar, then incubating the mixture in a sealed container for 3–7 days (Nofiani and Ardiningsih 2018). The addition of salt during fermentation can limit the growth of unwanted microorganisms while promoting the growth of salt-tolerant Lactobacillus bacteria (BAL) (Barcenilla et al. 2022).

BAL is crucial in the fermentation process as it helps prevent spoilage and preserve food. LAB converts carbohydrates into lactic acid, creating an acidic environment that inhibits the growth of pathogenic microorganisms during the fermentation process (Azzahra, Maherawati, and Fadly 2024).

Traditional fermented products such as cincalok from West Kalimantan can serve as an example in understanding the concept of conventional biotechnology. Cincalok not only reflects local cultural heritage but also serves as a learning resource that bridges scientific knowledge and local wisdom. By incorporating it into practical exercises, students can gain a deep understanding of the fermentation process while recognizing the potential of local resources. Therefore, a specialized laboratory manual is needed that discusses the production process of cincalok as one of West Kalimantan's traditional fermented products, enabling students to connect biotechnology theory with practical applications relevant to local wisdom. Through the laboratory manual, it is hoped that students will not only be able to understand the concept of conventional biotechnology but also analyze its various applications in daily life.

Practical guidelines are a guide for conducting practical activities, including explanations, tools and materials, work steps, planning, implementation, data analysis, and reporting (Budiarti and Oka 2017)(Ningsih, Daningshih, and Marlina 2022). Practical guidelines are appealing because students conduct experiments directly to sharpen their thinking skills. Practical guides involve students directly, enabling them to think critically and understand biotechnology concepts accurately because there are procedures for conducting practical work. These practical guides are used to help students easily understand the theory that has been taught, seek more information about conventional biotechnology, and apply biotechnology in their lives.

Based on the research results of Budiarti and Oka (2017), the average percentage of student responses was 85.71 which is included in the very good category. This finding indicates that the designed practicum guide received a positive response from students. The existence of a practicum guide provides a useful contribution in supporting the learning process between teachers and students. The advantages of the practicum guide can introduce students to the local wisdom of fermented cincalok products typical of West Kalimantan in conventional biotechnology learning. In addition, the practicum guide guides students to make cincalok fermentation products that utilize local resources and conduct pH tests and introduce simple organoleptic tests. The practicum guide is arranged systematically to make it easier for teachers and students.

This study provides a novel contribution by developing a cincalok-based conventional biotechnology practicum guide that has been validated using CVR and CVI metrics. This approach differs from previous studies, which generally used other fermented products or did not employ Lawshe's content validation method. The validated practicum guide strengthens the integration of local wisdom into high school biology learning. In addition, the product serves as a prototype that can be replicated and implemented across various schools to support standardized biotechnology practicum activities.

RESEARCH METHODS

The method used in this study is quantitative descriptive. The descriptive method in research aims to describe a phenomenon or situation in detail and accurately. This approach focuses on presenting objective data based on observation without attempting to influence or change the phenomenon being studied. The descriptive analysis process begins with the collection of relevant data through various methods. Once the data has been collected, it is processed and presented in an easily understandable format, such as tables. The next stage involves a critical assessment of the data, in which important information is extracted, analyzed, and explained (Alfatih 2017).

This descriptive study discusses the development of teaching materials in the form of practical guides, which will be analyzed for their suitability for application in conventional biotechnology sub-subjects. Suitability in this study focuses on the validation of practical guides assessed by validators. The feasibility analysis consists of three stages, namely instrument validation, media validation, and data analysis. The data analyzed covers three aspects, namely format, language, and content. Each aspect consists of several indicators with a total of 10 assessment items.

The laboratory manual was created using the Canva application, Microsoft Word, a printer, A4-sized HVS paper with 80 gsm, supporting books and articles, and various images from the internet that could enhance the content. The components of the laboratory manual were modified from Zakiah, Maisura, and Makawiyah (2022) and consist of the laboratory title, theoretical basis, laboratory objectives, equipment and materials, procedures, results and discussion, conclusions, and references.

Instrument validation used the Guttman scale in the form of a checklist with two answer choices, 'Yes' (score 1) and 'No' (score 0). The validation was carried out by two validators from the Biology Education Study Program, FKIP Untan. The results of the instrument validation were categorized into Suitable for Use (SU), Suitable for Use and Improved (SUI), and Not Suitable for Use (NSU) (Sugiyono, 2015). Instrument validation was carried out by 2 biology education lecturers.

After validating the instrument, the next step was to validate the practicum guide. This validation was conducted by five expert validators consisting of two biology education lecturers and three high school biology teachers. The purpose of this validation was to evaluate the feasibility of the practicum guide as teaching material within the learning process. The validation instrument assessed three main aspects, format, language, and content, and each aspect consisted of several assessment items such as clarity of practicum objectives, accuracy of conceptual explanations, and appropriateness of procedural steps. Each item was rated using a four-point Likert scale: Very Good (4), Good (3), Less Good (2), and Not Good (1). In accordance with the Lawshe method, scores of 3 and 4 were categorized as “essential/agree” and were used in calculating the Content Validity Ratio (CVR) for each item to ensure transparency in the content validation process.

The validation data were analyzed using the Content Validity Ratio (CVR) analysis method according to Lawshe (1975) with the following formula:

$$CVR = \frac{NE - \frac{N}{2}}{\frac{N}{2}}$$

Description:

CVR	=	*Content Validity Ratio*
Ne	=	Number of validators who agree per criterion (considered to agree if the value of each criterion reaches 3.00-4.00; if < 3.00, then considered to disagree)
N	=	Total number of panelists/validators.

Provisions on the CVR index according to Lawshe (1975):

1) If the number of respondents who gave a very good or good answer is less than half of the total number of respondents, then the CVR value will be negative (-).
2) If the number of respondents who chose very good or good is exactly half of the total respondents, then the CVR value is 0.
3) If all respondents give a rating of very good or good, then the CVR value reaches 1. However, in practice, this value is adjusted to 0.99 based on the respondents involved. Since there are five respondents in this study, the critical CVR value is set at 0.99.

4) If the number of respondents who answered very good or good is more than half of the total respondents, then the CVR value is in the range of 0-0.99.

After calculating the CVR value for each criterion, the CVI (Content Validity Index) value is calculated, which is the average of all CVR values obtained.

RESEARCH RESULT

The laboratory manual is an implementation of teaching materials based on the results of physical, chemical, and organoleptic tests of cincalok from West Kalimantan in the sub-subject of conventional biotechnology. The manual was adapted and modified from Zakiah et al. (2022), and includes the laboratory title, theoretical basis, laboratory objectives, equipment and materials, procedures, results and discussion, conclusions, and references. Specifically, the manual provides detailed instructions and data for the pH, and organoleptic (color, odor, taste, and texture) tests of cincalok. The laboratory manual for the production, pH testing, and organoleptic testing of cincalok in the conventional biotechnology subtopic is presented in Figure 1.

(a) (b) (c)

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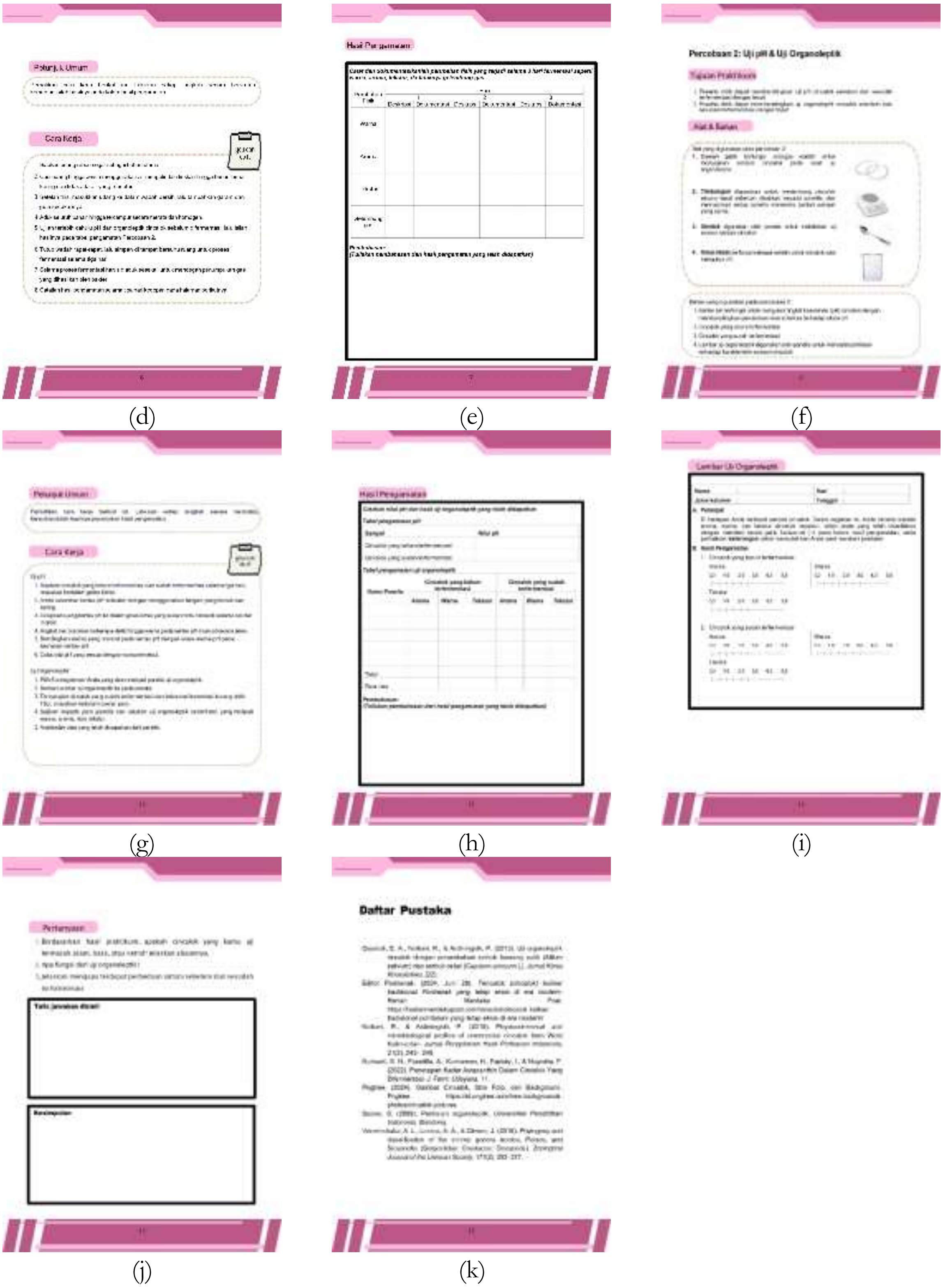


Figure 1 (a) Cover, (b) Theoretical basis, (c) Cincalok production, (d) Method of operation, (e) Results & discussion, (f) pH & organoleptic testing, (g) Methodology, (h) Results & Discussion, (i) Organoleptic Test Sheet, (j) Questions & Conclusions, (k) References

In this study, validation of the instruments and teaching materials was conducted. Instrument validation was carried out by two lecturers from the Biology Education Study Program at the Faculty of Teacher Training and Education, Tanjungpura University. The validation of teaching materials, specifically the laboratory guide, was conducted by five validators, consisting of two lecturers from the Biology Education Program at the Faculty of Education and Teacher Training, Tanjungpura University, one biology teacher from State High School 8 Pontianak, one biology teacher from State High School 1 Sungai Pinyuh, and one biology teacher from Muhammadiyah High School 1 Pontianak.

Based on the results of the instrument validation, both validators concluded that the instrument was suitable for use, as all assessed aspects met the established criteria. Subsequently, the feasibility of the teaching materials in the form of the compiled practical guides was evaluated by five validators. The assessment covered three aspects, namely format, language, and content, as shown in Table 1.

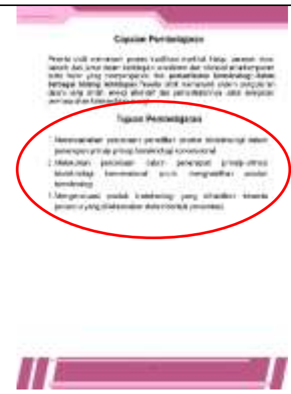
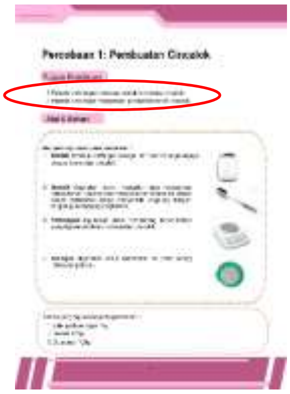
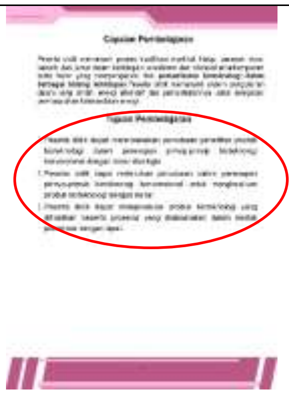
Table 1 Feasibility Analysis Data for Practical Guidance on Conventional Biotechnology Subtopics

Aspect	Criteria	Validator					CVR	Desc.
		1	2	3	4	5		
Format	Appropriateness of the size of the practical guidebook	4	4	4	4	4	0,99	Valid
	Clarity of the font used in the practical guidebook	4	4	4	4	4	0,99	Valid
	Clarity of the components of the practical guidebook	4	4	4	4	4	0,99	Valid
	The cover has a clear identity	4	4	4	4	4	0,99	Valid
Language	The language used complies with PUEBI standards	4	4	4	4	4		Valid
	Sentences used	4	4	4	4	4	0,99	Valid
Conten	Appropriateness of the content in the practical guide	4	3	4	4	4	0,99	Valid
	Appropriateness and completeness of the concepts of conventional biotechnology subtopics in the practical guide	3	4	4	4	4	0,99	Valid
	Content of the practical guide	4	4	4	4	4	0,99	Valid
	Presentation of text and images	4	4	4	4	4	0,99	Valid
CVI							0,99	Valid

Based on Table 1, all aspects of the assessment of the laboratory manual were found to be valid with a CVR value of 0.99. This value indicates that the laboratory manual has met the eligibility criteria in terms of format, language, and content. These results reinforce that the laboratory manual developed is suitable for use as instructional material, particularly in conveying conventional biotechnology content through laboratory activities, with the caveat that improvements should be made based on feedback from validators (Table 2).

Table 2. Suggestions and Improvements for Practical Guides

Advice and feedback from validators	Before revision	After revision
On the cover of the practical guide, the year is still listed as 2024, so it must be changed to 2025.	 Before it was fixed, the year on the cover was still 2024.	 After being corrected, it has been changed to 2025 in accordance with the year of publication of the practical guide.
In the theoretical section, add the principles of biotechnology related to the activities carried out.	 Before being revised, the theoretical basis did not include biotechnology principles related to the activities carried out.	 The principle of biotechnology has been added to the theoretical basis in the first paragraph. "Bioteknologi kenvensional merupakan bioteknologi yang memanfaatkan mikroorganisme untuk proses biokimia, contoh yang paling sering dijumpai dikehidupan

		sehari-hari adalah fermentasi dari tempe, tape, donat dan roti yang menggunakan bahan tambahan seperti ragi. Salah satu contoh produk fermentasi lain khas Kalimantan Barat adalah cincalok. Cincalok merupakan fermentasi udang rebon (*Acetes* sp.), gula, dan garam yang disimpan dalam jangka waktu 3-7 hari"
The writing of learning objectives and practical objectives does not yet comply with the ABCD rules (the learning objectives do not mention the audience and degree, while the practical objectives do not mention the degree).	   The learning objectives and practical objectives are not yet in accordance with the ABCD rules, so they must be adjusted to comply with these rules. Previously, the sentence in the learning	   The learning objectives and practical objectives have been adjusted in accordance with the ABCD rules. The learning objectives now include audience and degree, while the practical

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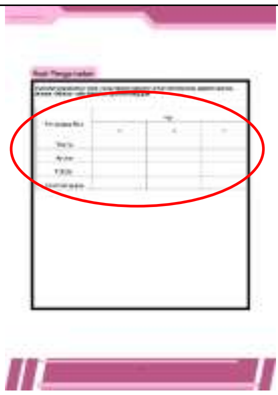
	objectives read: "Merencanakan percobaan penelitian produk bioteknologi dalam penerapan prinsip-prinsip bioteknologi konvensional". Meanwhile, the practical objective read: "Peserta didik dapat membuat produk fermentasi cincalok."	objectives now include degree. After revision, the learning objectives are as follows: "Peserta didik dapat merencanakan percobaan penelitian produk bioteknologi dalam penerapan prinsip-prinsip bioteknologi konvensional dengan benar dan logis." The objectives of the practicum are: "Peserta didik dapat membuat produk fermentasi cincalok dengan tepat."
The images in the practical guide are sourced.	 Before being corrected, the images in the practical guide did not include sources.	 After being corrected, the images in the practical guide now include the source from which they were taken.
In the results of the experiment, add a documentation column.	 Before being corrected, the results section of experiment one did not include a documentation column.	 After being revised, a documentation column has been added so that students can record their observations in the documentation column.

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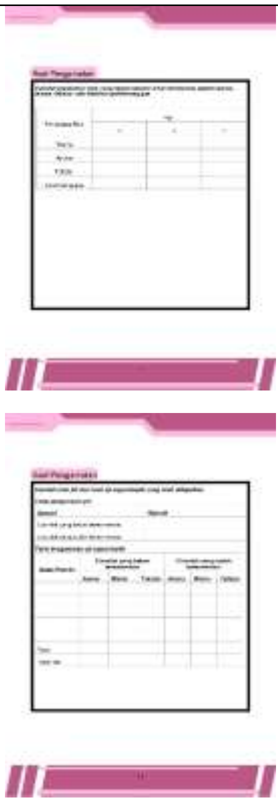
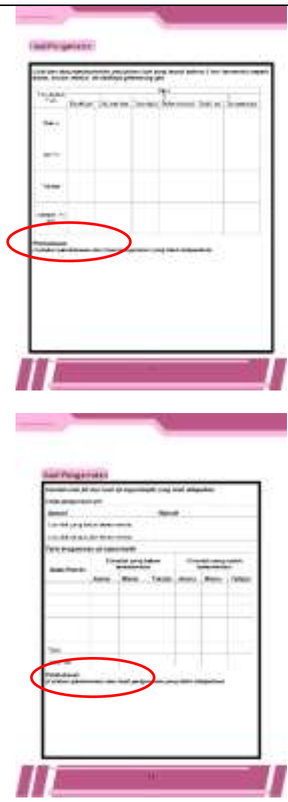
A discussion column was added to the observation results.	 Before being revised, the observation results did not include a discussion column.	 After being revised, a discussion column has been added, allowing students to discuss the results of their observations

DISCUSSION

The practical guide that has been compiled can be used as teaching material to support practical activities in schools. The main components of the practical guide are the theoretical basis of the practical objectives of the cincalok production experiment, pH and organoleptic tests, tools and materials, procedures, results and discussion, questions, conclusions, and references. The practical guide that has been designed contains two main activities. The first activity focuses on the production of a local fermented product, namely cincalok, while the second activity involves conducting pH tests and organoleptic tests on the cincalok that has been produced.

The first activity involves students directly making cincalok using fresh shrimp as the main ingredient, mixed with salt and sugar. Before the fermentation process begins, pH and organoleptic tests are conducted first to obtain initial data that will be used in the second activity. The mixed ingredients are then fermented for three days. Students are asked to observe changes during the fermentation process, including changes in color, odor, texture, and taste. After fermentation is complete, pH and organoleptic tests are conducted again to determine the changes that occurred post-fermentation. Students are then asked to analyze and compare the test results before and after fermentation to understand the impact of the fermentation process.

The laboratory manual that had been compiled was then validated by a validator to assess its suitability as teaching material. The validation process was divided into two stages: validation of the laboratory manual instrument and validation of the teaching material in the form of the laboratory manual. The validation of the instrument aimed to assess the suitability of the validation sheet used, and the results indicated that the instrument was deemed suitable for use. After validating the instrument, the next step was to validate the practical guide to determine the extent to which it met the suitability criteria. The validated practical guide was revised based on input from the validators. The validation results were analyzed using Lawshe (1975) CVR formula, with assessment aspects including format, language, and content suitability.

The results of this study show a CVR value of 0.99 and a CVI value of 0.99, indicating that the practicum guide meets the criteria for high content validity. All assessed aspects, which include format, language, and content, were classified as valid based on the validators' evaluations. These findings confirm that the developed practicum guide is suitable for supporting learning activities. The discussion then continues with an explanation of the strengths, limitations, and pedagogical implications of the developed product.

1. Aspects format

The format aspect consists of four criteria, all of which received a CVR score of 0.99, indicating that all important criteria have been met satisfactorily. The first criterion ensures that the size of the guidebook is in accordance with A4 paper size (21 x 29.7 cm). According to Hanum (2010), teaching materials are generally typed using A4 paper because this size is an international standard in education and office settings. A4 paper also facilitates document storage and duplication and is compatible with most printing devices. According to Achyani et al. (2020), A4 paper has become a common reference in the preparation of academic documents.

The second criterion is to ensure the clarity of the font size and type used. The selection of the appropriate font type and size is an important aspect in the preparation of laboratory manuals. Clear fonts such as Arial with a size of 11-12 pt are highly recommended because they have a high level of readability. Fonts that are too small or ornate can impair the readability of the laboratory manual.Hanum (2010) suggests using the Arial font in instructional materials due to its formal appearance. Pangesti, Yulianti, and Sugianto (2017) also indicate that fonts with a size of 12-14 pt and without decorative fonts are the physical standard for instructional materials.

The third criterion ensures that the important components of the laboratory manual are complete, such as the title, objectives, tools and materials, procedures, results, and conclusions. The completeness of these components is crucial in a laboratory manual. These components serve as the main structure guiding the systematic conduct of the laboratory session. According to Zakiah et al. (2022), a structured laboratory manual can enhance the effectiveness of laboratory experiments.

The fourth criterion ensures that there is a clear identity on the cover of the laboratory manual. The identity on the cover, such as the author's name, institution, target level, and year of compilation, indicates the credibility and ownership of the instructional materials created. According to Rozanatunnisa and Hardjanto (2022), identity is not merely a label but also signifies credibility and accountability. Identity establishes the authority of the source and prevents plagiarism. A complete identity provides the foundation for the laboratory manual as an academically accountable product.

2. **Aspects Language**

The language aspect consists of two criteria, both of which received a CVR score of 0.99, indicating that all important criteria have been met satisfactorily. The first criterion assesses the use of language in writing, specifically whether it complies with PUEBI guidelines, such as spelling, punctuation, use of letters, foreign language terms, and standard words. PUEBI guidelines are an important foundation for ensuring that writing has the correct structure and grammar, so that readers can understand the content. Practical guides that follow PUEBI will be easier to understand and have a systematic writing structure. According to Ernis and Wahyuni (2021), PUEBI is a set of rules that must be followed in writing, thereby reducing the potential for misunderstanding.

The second criterion evaluates whether the sentences used are unambiguous, logical, and concise. Effective and efficient sentences are a requirement in the development of instructional materials to ensure that the message is conveyed fully and accurately. Ambiguous or convoluted sentences can lead students to misunderstand the practical guide, potentially causing errors during the implementation process. According to Juraidah et al. (2023), the use of effective sentences has a significant effect on writing and systematic thinking skills, especially in the context of school learning.

3. Aspect Content

The content aspect consists of four criteria, all of which received a CVR score of 0.99, indicating that all important criteria have been well met. The first criterion ensures that the suitability of the practicum guide covers the Learning Outcomes (CP), Learning Objectives (TP), and practicum objectives. The alignment between CP, TP, and practical objectives is crucial for the practical guide to effectively guide students toward achieving the targeted competencies. CP provide the minimum competency framework that students must achieve, while PLO detail the concrete learning steps that support these outcomes. According to Bait et al. (2025), this integration of CP and TP enables learning to be relevant, meaningful, and inclusive. By formulating TP based on CP, the laboratory instructor can ensure that each step of the laboratory has a clear and structured purpose.

The second criterion ensures that conventional biotechnology concepts are presented accurately, comprehensively, and in accordance with current theory and practice, so that students have a strong knowledge foundation before conducting the laboratory. Conventional biotechnology material must be presented comprehensively, in accordance with theory and scientific procedures. Research bySaparas et al. (2022) shows that students' understanding of biotechnology concepts increases significantly when laboratory activities align with theory.

The third criterion ensures that the content of the laboratory guide is easy to understand, easy to perform, and engaging. The laboratory guide instructional materials are designed to facilitate understanding, laboratory operations, and motivate students. The fourth criterion ensures that the presentation of images and text is relevant to the material, complementary, and easy to understand. According to Hernan et al. (2021), clear, relevant, and engaging material presentation is crucial in developing instructional materials. The content of the laboratory manual must be easy to understand, able to guide students effectively, and engaging to motivate students to follow the laboratory steps. Images and illustrations must also be relevant and supportive of the content, as well as easy to understand, so that the visualizations can reinforce students' understanding and avoid confusion.

This conventional biotechnology sub-material laboratory guide has several advantages, including incorporating local elements of West Kalimantan through the introduction of cincalok fermentation products, training students' scientific skills in a logical and systematic manner, making learning more focused because the steps are well-organized, and facilitating teachers and students in conducting the laboratory experiment. However, there are drawbacks, such as the unsuitability of cincalok ingredients (fresh shrimp) outside West Kalimantan and the limited laboratory facilities in some schools. To address this, alternative ingredients that are easily found in the surrounding environment can be used, and household tools can be utilized as substitutes for laboratory equipment to ensure the practical session remains effective.

CONCLUSION

The feasibility assessment of the practicum guide was conducted to ensure that the teaching materials developed had been validated. Based on the results of the study, it can be concluded that the practicum guide has a CVR value of 0.99, which is classified as valid, and a CVI value of 0.99, which indicates that the practicum guide that has been developed meets the validity criteria. A CVR value of 0.99 indicates that the content and objectives of the practical guide are in line with the curriculum requirements and relevant to the material being taught. Meanwhile, a CVI value of 0.99 indicates that the design and presentation of the practical guide are considered valid. This practicum guide is suitable for use in high schools; however, its effectiveness in the learning process should be evaluated through further testing.

REFERENCE

Achyani, Dharmawan, R. Agustono, Y. Amran, Mafrudin, S. Arif, and P. Angkupi. 2020. *Pedoman Penulisan Karya Ilmiah Edisi Revisi Ke VI Tahun 2020*. Metro.

Agustina, Putri, Alanindra Saputra, Eva Khusnul Khotimah, Dwi Rohmahsari, and Nunuk Sulistyanti. 2019. "Evaluasi Pelaksanaan Praktikum Biologi Di SMA Negeri Di Klaten Pada Ditinjau Dari Kualitas Laboratorium, Pengelolaan, Dan Pelaksanaan Praktikum." *BIO-PEDAGOGI* 8(2):105. doi:10.20961/bio-pedagogi.v8i2.36148.

Alfatih, Andy. 2017. *Buku Pedoman Mudah Melaksanakan Penelitian Deskriptif Kualitatif*. Palembang: PT. Global Eksekutif Teknologi.

Asih, Dwi Aprilia Setia. 2017. "Pengaruh Penggunaan Fasilitas Belajar Di Lingkungan Alam Sekitar Terhadap Keterampilan Proses Sains." *Formatif: Jurnal Ilmiah Pendidikan MIPA* 7(1). doi:10.30998/formatif.v7i1.1331.

Azzahra, Uray Qiera Zelia, Maherawati Maherawati, and Dzul Fadly. 2024. "ANTIMICROBIAL ACTIVITY OF LACTIC ACID BACTERIA ISOLATE FROM TRADITIONAL

FERMENTED FOOD PEKASAM FROM SAMBAS REGENCY KALIMANTAN BARAT." *Journal of Nutrition College* 13(2):196–203.

Bait, E. H., E. Mulyasari, D. Hendriawan, Arwasih, and M. N. Ulwan. 2025. "Kurikulum Merdeka Dan Dinamika Tujuan Pendidikan: Integritas Capaian Pembelajaran (CP), Dan Tujuan Pembelajaran (TP), Dan Alur Tujuan Pembelajaran (ATP)." *Kalam Cendekia: Jurnal Ilmiah Kependidikan* 13(1):615–24.

Barcenilla, Coral, Avelino Álvarez-Ordóñez, Mercedes López, Ole Alvseike, and Miguel Prieto. 2022. "Microbiological Safety and Shelf-Life of Low-Salt Meat Products—A Review." *Foods* 11(15):2331. doi:10.3390/foods11152331.

Budiarti, Winda, and Anak Agung Oka. 2017. "Pengembangan Petunjuk Praktikum Biologi Berbasis Pendekatan Ilmiah (Scientific Approach) Untuk Siswa Sma Kelas Xi Semester Genap Tahun Pelajaran 2013/2014." *BIOEDUKASI: Jurnal Pendidikan Biologi* 5(2):123–30.

Ernis, Poni, and Neneng Wahyuni. 2021. "Penguasaan PUEBI Terhadap Keterampilan Menulis Teks Laporan Hasil Observasi." Jurnal *KIBASP* 5(1):71–82.

Guswita, Serly, Bambang Sri Anggoro, Nukhbatul Bidayati Haka, and Akbar Handoko. 2018. "Analisis Keterampilan Proses Sains Dan Sikap Ilmiah Peserta Didik Kelas XI Mata Pelajaran Biologi Di SMA Al-Azhar 3 Bandar Lampung." *Biosfer: Jurnal Tadris Biologi* 9(2):249–58. doi:10.24042/biosfer.v9i2.4025.

Hanum, Chairani. 2010. *Pedoman Penyusunan* Buku *Ajar*. Medan: Universitas Medan Area.

Juraidah, Juraidah, Muh Nasir, and Fahruddin Fahruddin. 2023. "Implementasi Pratikum Biologi Untuk Meningkatkan Keterampilan Proses Sains Siswa SMA Negeri 3 Kota Bima Tahun Pelajaran 2022/2023." *JUPEIS: Jurnal Pendidikan Dan Ilmu Sosial* 2(3):127–35.

Lawshe, C. H. 1975. "A Quantitative Aproach to Content Validity." *PersonnelPsychology* 28:563–75.

Mahmudah, Ifa Rifatul, Yanti Sofi Makiyah, and Dwi Sulistyaningsih. 2019. "Profil Keterampilan Proses Sains (KPS) Siswa SMA Di Kota Bandung." *Diffraction: Journal for Physics Education and Applied Physics* 1(1).

Ningsih, Chindy Sulastri, Entin Daningshih, and Reni Marlina. 2022. "Kelayakan Penuntun Praktikum Struktur Dan Fungsi Jaringan Tumbuhan Dengan Informasi Ketebalan Daun Dan Laju Transpirasi." EduNaturalia*: Jurnal Biologi Dan Kependidikan Biologi* 2(2):50–58. doi:10.26418/edunaturalia.v2i2.45420.

Nofiani, Risa, and Puji Ardiningsih. 2018. "Physicochemical and Microbiological Profiles of Commercial Cincalok from West Kalimantan." *Jurnal Pengolahan Hasil Perikanan Indonesia* 21(2):243–49.

Pangesti, K. I., D. Yulianti, and Sugianto. 2017. "Bahan Ajar Berbasis STEM (Science, Technology, Engineering, and Mathematics) Untuk Meningkatkan Penguasaan Konsep Siswa SMA." *Unnes Physics* Education *Journal* 6(3):53–58.

Pontoh, Febrianto, Zusje W. M. Warouw, and Anneke T. Rondonuwu. 2023. "Implementasi Pendekatan Keterampilan Proses Sains Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Pada Materi Ekosistem." *SCIENING : Science Learning Journal* 4(2):193–99. doi:10.53682/slj.v4i2.2062.

Rozanatunnisa, Luthfia, and Tofan Dwi Hardjanto. 2022. "A Corpus-Based Study of Writer Identities in Biology Research Articles: Clusivity and Authorial Self." *Lexicon* 9(2):72. doi:10.22146/lexicon.v9i2.65914.

Saparas, Nirwana Saparas, Irda Wulandini Wulandini, Rizki Putri Khoiriah Sipahutar Sipahutar, Sri Yanti Tarihoran Tarihoran, and Miftahul Kharani Kharani. 2022. "Analisis Pemahaman Konsep Bioteknologi Pada Siswa SMA Dengan Kegiatan Praktikum." *BEST Journal (Biology Education, Sains and Technology)* 5(2):175–80.

Simanjuntak, Nola Desti Pratiwi, Salastri Rohiat, and Elvinawati Elvinawati. 2017. "Hubungan Antara Sarana Laboratorium Terhadap Keterampilan Proses Sains Siswa Kelas XI MIPA 5 Di SMA Negeri 3 Kota Bengkulu." *Alotrop* 1(2).

Sugiyono. 2015. *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D* . Bandung: ALFABETA.

Suryaningsih, Yeni. 2017. "Pembelajaran Berbasis Praktikum Sebagai Sarana Siswa Untuk Berlatih Menerapkan Keterampilan Proses Sains Dalam Materi Biologi." *BIO EDUCATIO:(The Journal of Science and Biology Education)* 2(2).

Taluke, Dryon, Ricky S. M. Lakat, and Amanda Sembel. 2019. "Analisis Preferensi Masyarakat Dalam Pengelolaan Ekosistem Mangrove Di Pesisir Pantai Kecamatan Loloda Kabupaten Halmahera Barat." *Spasial* 6(2):531–40.

Zakiah, Zakiah, Maisura Maisura, and Makawiyah Makawiyah. 2022. "PENGEMBANGAN PENUNTUN PRAKTIKUM TIPE DISCOVERY PADA MATERI LARUTAN ASAM BASA DI SMA NEGERI UNGGUL SIGLI." *Jurnal Real Riset* 4(2):240–49. doi:10.47647/jrr.v4i2.670.