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Validity of Biology Practicum Guidebook based on Science Literature for High School Class XI Students

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Abstract. The importance of practicum in reaching learning goals, particularly in the subject of science, is crucial, given that practicum is an inherent component of teaching and learning activities. In order for students to comprehend things more thoroughly, practicum serves as a technique of concretizing previously abstract materials and equipment. The development of scientific literacy-based practicum guidebooks is expected to propel the significance of practicum. This study will examine how the degree of validity of biology practicum guidelines based on scientific literacy for eleventh-grade students. This research approach use the Borg and Gall (1989) model to conduct development research. The presentation ratings were 91.5% (very good), 86.48% (very good), and 89% (very good) based on the validation of material experts, scientific literacy experts, and media design experts, respectively. This biology practicum guidebook based on science literature for high school class XI students is therefore suitable for use, according to the results of validation by experts.

Keywords: Practicum guidebook, Science literature, High school, Biology practicum

INTRODUCTION

The importance of practicum in reaching learning goals, particularly in the area of science, is crucial, given that practicum is an inherent component of teaching and learning activities. In order for students to comprehend things more thoroughly, practicum serves as a technique of concretizing previously abstract materials and equipment. This demonstrates the importance of practicum in accomplishing educational goals. Learning that incorporates activities and projects can enhance students' diverse abilities (Nasution et al., 2017), practicum is an instructional method that combines the two.

The application of theory to real-world situations (cognitive), the ability to autonomously organize actions (affective), and the use of specific instruments (psychomotor) may all be achieved concurrently via the use of practicum (Rahayuningsih, 2005). One of the reasons for the low level of scientific literacy among Indonesian youngsters is that they get less relevant instruction. Holbrook, 2005 claim that learning will have positive outcomes if it is relevant to the pupils.

Meaningful learning empowers students interest to apply scientific knowledge to real-world challenges. This is consistent with Holbrook's (2005) belief that learning becomes relevant for students when they are involved in the process of addressing scientific issues and making socioscientific judgments. In general, field circumstances suggest that education is a process of transmitting knowledge from instructors to pupils (Harahap et al., 2020a).

Rakhmawan (2015) found that inquiry-based science literacy instruction in the form of laboratory activities may increase high school students' scientific literacy in terms of content, context, process, and students' scientific attitudes. Gormally et al. (2009), who used laboratory inquiry learning to demonstrate that students' scientific inquiry skills and scientific literacy improved more than with traditional learning, reached the same conclusion. Basori (2010) conducted study on problem-solving laboratory exercises designed to enhance students' scientific process abilities. This is consistent with the findings of Iswari (2010), who employs laboratory activities centered on problem-solving to increase students' scientific literacy. Cognitive outcomes refer to the acquisition of knowledge and professional abilities, which can be generated through a sequence of organized learning activities (Harahap et al., 2019), including practicum.

Developing scientific literacy through well-structured learning activities. A study guide is required for the construction to be guided in line with the goals. The effectiveness of book-shaped study aids exceeds that of conventional study aides. Students will find it simpler to develop knowledge with the help of the techniques and explanations included in this book. Books serve as a conduit for other learning materials (Hedge, 2008) and are practical so that they may be utilized for education in and out of the classroom (Osborne, 2010). Previous research has shown that books play an essential

role in fostering student literacy (Harahap, 2014). It is evident that books offer several advantages when utilized as instructional resources.

In terms of scientific literacy, the use of textbooks and practical guidebooks in schools in Indonesia has not been balanced. This scenario emphasizes the necessity to progressively and continually enhance scientific education in schools by adding more hands-on activities. Efforts to enhance the quality of education in schools must be bolstered by data on the degree to which students' scientific literacy accomplishments are seen in their entirety.

In order to promote the scientific literacy of Indonesian students, practical guidebooks based on scientific literacy are provided as part of an attempt to do so. According to Chiapetta et al. (1991), there are four types of scientific literacy: (a) science as a body of information, (b) science as a method of investigation, (c) science as a mode of thought, and (d) the interaction between science, technology, and society (STS). Thus, the construction of a practical guidebook based on scientific literacy should include the four literacy components mentioned by Chiapetta.

Based on literature findings on the presence of a scientific literacy component in the design of biology practicum activities derived from practicum sheets in the textbooks used by instructors in the classroom, it does not include the four scientific literacy components. On the praxis sheet, the presence of four components of scientific literacy, science as a body of knowledge including theories, facts, principles, models, hypotheses, and laws, has not been listed individually.

On the activity sheet, science is presented as a method of investigation that engages pupils in experiments. In the design of practicum activities that currently exist in textbooks, scientific evidence in problem-solving relating to practical content has not been seen. The interplay of science, technology, and society, as well as self-reflection on the usefulness of the material performed with the community and the future advantages of science, are also not evident. Therefore, a book containing a compilation of one-semester biology practicums based on scientific literacy is required.

According to the preceding explanation, it is required to make adjustments to actual actions. Previous study has shown that the application of learning with practicum may enhance students' conceptual comprehension of the studied content. The practicum's effectiveness relies on various factors, including the provision of a high-quality practicum guidebook.

Experts have encouraged improved learning. The development of learning can take the shape of models, methodologies, learning media, and instructional materials. The development of a practical guidebook is one of the ways (Harahap et al., 2020b). The development of scientific literacy-based practicum guidebooks is expected to propel the significance of practicum. This research will examine how the degree of validity of biology practicum guidelines based on scientific literacy for eleventh-grade students.

METHOD

Research Design

The applied development model was adapted from the Borg and Gall approach (1989).

Research development, often known as R&D, refers to the research utilized to manufacture and evaluate the efficacy of certain goods (Sugyono, 2011). This study's only objective is to determine the validity of the generated product.

This study produced a biology practicum guidebook for SMA class XI IPA odd semester, based on scientific literacy, including the upcoming chapters: (1) Digestive System; (2) Respiratory System; (3) Excretion System; (4) Regulatory System; (5) Reproductive System; and (6) Immune System.

The following are the stages in this study procedure:

Phase I: assess, identify, and gather data on the practical guidebooks used by students for practical exercises.

Phase II: Analyze the challenges students and instructors experience in carrying out actual school activities.

Phase III: Conduct a requirements analysis with the intent of modifying the content to be included in the prepared practicum guide.

Phase IV: Determine the planning and design of the first output of scientific literacy-based practical guide books by gathering sources from relevant books, journals, and internet-sourced images of supporting materials.

Phase V: Determine the general structure of the book, which includes: (1) the practicum guide's cover, (2) the introduction, and (3) the table of contents. (4) list of images, (5) list of tables, (6) practice guidelines, (7) directions for using scientific literacy-based biology practical guidebooks, and (8) key competencies and concept maps for even semester biology materials. (9) practical tasks, (10) practice questions, (11) glossary and (12) bibliography

Phase VI: Determine the structure of each component in the scientific literacy-based practicum guide, which systematically includes scientific literacy components. (1) material titles; (2) fundamental competencies; (3) concept maps; (4) science as a body of knowledge; (5) biology links; (6) science as a way of investigating; (7) information biology; (8) science as a way of thinking; and (9) the interaction of science, technology, and society.

Phase VII: Instruments for material experts, design experts, teacher replies, and student responses are compiled at the seventh stage to be utilized in evaluating the produced goods. Two material expert lecturers, namely Mr. Prof. Dr. rer. nat. Binari Manurung M.Sc. and Mrs. Dra. Adriana Yulinda Lumban Gaol, M.Kes., and two media expert lecturers, namely Mr. Dr. Rachmat Mulyana, M.Sc. and Drs. Gamal Kartono, M.Sc.,

validated the design validation of material experts and media experts. This phase seeks to test the viability of the product generated for the scientific lab handbook for class XI biology during the even semester of senior year.

Phase VIII: The created practicum guide is validated and improved by the supervisor I and supervisor II before being validated by the subject matter experts. The created practical guidebook was verified and amended I (initially) using the advice and ideas of material expert validators and design experts.

Data Collection Technique

Quantitative data collected using a Likert scale questionnaire with a rating scale of 1 to 4 (1= not good/disagree, 2= not good/disagree, 3= good/agree, 4= very good/strongly agree). Qualitative data in the form of a description of suggestions and written input from the validator. The utilized analysis is descriptive analysis.

Dra. Adriana Yulinda Lumban Gaol, M.Kes, a lecturer at Medan State University with expertise in Human Anatomy and Physiology, and Prof. Dr. rer. nat. Binari Manurung, M.Si, a postgraduate professor at Medan State University with expertise in Ecology and Science Literacy, validated the materials. Content feasibility, presentation feasibility, and scientific literacy components are evaluated. The tool used is a questionnaire that serves as a validation sheet for the practicum guidebook.

Table 1. Practicum guide validation instrument grid by material expert.

No.	Component	Indicator	Number of items
1.	Content eligibility	Material suitability	3
2.		Material depth	3
3.		Material accuracy	8
4.	Serving Eligibility	Learning support materials	5
5.		Presentation technique	6
6.		Presentation of learning	3
7.		Serving equipment	11

Table 2. Practicum guide validation instrument grid by science literacy expert.

No.	Component	Indicator	Number of items
1.	Science Literacy Component	A body of knowledge	7
2.		Way of investigating	7
3.		Way of thinking	8
4.		Interaction of science, tecnology and society	4
5.		Self Evaluation	4

(Adisendjaja, 2009)

Drs. Rachmat Mulyana, M.Si, a postgraduate lecturer at UNIMED with expertise in Educational Informatics Engineering, and Drs. Gamal Kartono, M.Si, a lecturer at the Faculty of Arts, UNIMED, specializing in graphic design, carried out the validation by a team of design experts in order to provide criticism or suggestions on the design of a biology practical guide book based on learning science literacy. The dimensions of the

practical guide book, the design of the practicum guide book's cover, and the layout of the practical guide book's contents are evaluated. The tool used is a questionnaire that serves as a validation sheet for the produced practicum guide.

Table 3. Practicum guide validation instrument grid by design expert.

No.	Indicator	Number of items
1.	Skin Design	5
2.	Skin typography	4
3.	Content Design	11
4.	Content Illustration	5

FINDINGS AND DISCUSSION

Based on the initial investigation of the practical guide book, there is no standard form of the practical guide book. In doing practicum activities, students utilize merely photocopied papers from their biology textbooks as a practicum guide, so its look does not draw students' attention to study.

In addition, the diversity of the practicum guide activities included in the textbooks makes it difficult for instructors to implement consistent methods in practicum activities. The present practicum activities have not elevated the importance of the four scientific literacy components. According to the facts in the area, class XI science students must have a standard, fascinating, and approved guidebook for biology practicum.

Based on a study of difficulties at SMA Negeri 1 Tebing Tinggi, pupils had difficulty learning biology and comprehending current concepts. They are better able to comprehend the current content when supported by practical exercises. This is shown by the poor average score of the pupils, which is still below the Minimum Completeness Criteria of 75 established by the Biology Subject Teacher Consultation Team of SMA Negeri 1 Tebing Tinggi.

Practical activities are a method for enhancing student learning results. However, there is currently no biology practicum guide accessible in the field. As a consequence of failing to achieve the minimal mastery score, the value of pupils' scientific literacy is also diminished.

On the basis of the aforementioned issues and the first student survey of sixty class XII students, it is known that 91.66 percent of respondents indicated that the presently used practical guide book needs to be revised. Biology practical guidebooks based on scientific literacy are required by one hundred percent of respondents in order to increase students' biology learning outcomes and scientific literacy scores.

This book was developed by seeking information from various sources, both books, journals and internet sites that are relevant to the making of a practical guide book. The questions in the practice questions contained in each material were developed

independently referring to the four components of scientific literacy contained in each material in the guidebook.

Material Expert Validation

Dra. Adriana Yulinda Lumban Gaol, M.Kes lecturer, and Prof. Dr. rer. nat. Binari Manurung, M.Sc. validated the material in the practical guidebook. Validation is accomplished by delivering a practicum guidebook that has been prepared with the intention of receiving information on the content's viability and the presentation's viability in order to acquire ideas for enhancing the output of a better practicum guidebook.

This textbook was verified by a team of material specialists based on two components and seven subcomponents: material appropriateness, material depth, material correctness, learning support material, presentation method, learning presentation, and presentation completeness. The final findings of the evaluation of the two validators are shown graphically in Figure 1.

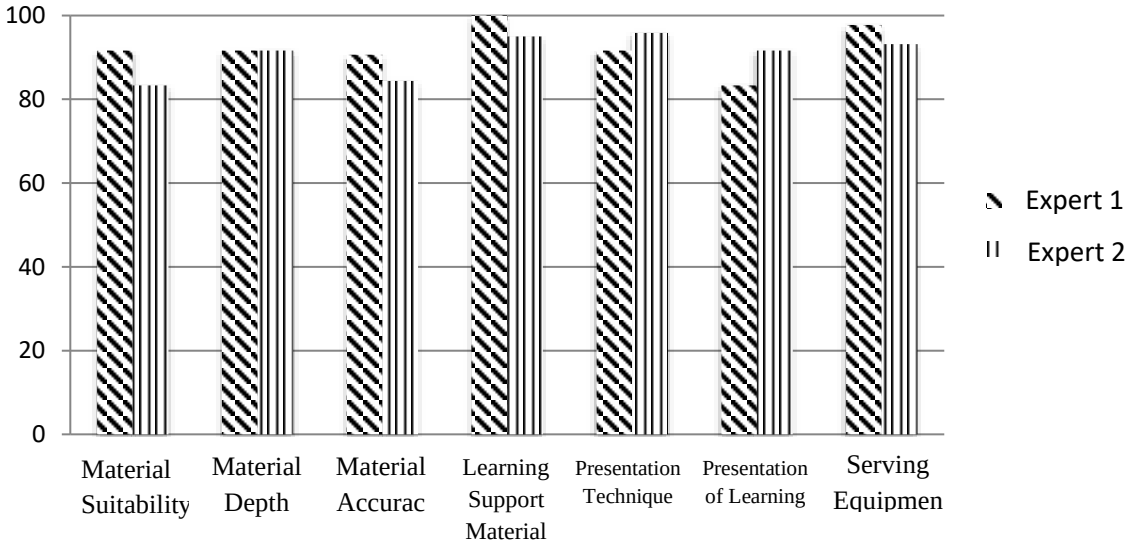


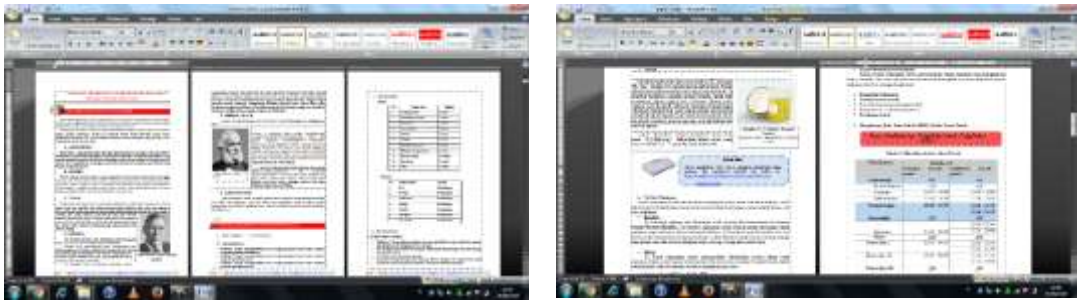
Figure 1. The outcomes of the practical guidebook's validation by a team of material specialists. The percentage is the average response to the questionnaire using the likert scale of 1 to 4. The average rating of the two experts for the material's suitability is 87.5 percent (very good), for depth it is 91.67 percent (very good), for accuracy it is 87.5 percent (very good), for learning support material it is 97.5 percent (very good), for presentation technique it is 93.75 percent (very good), for learning presentation it is 87.5 percent (very good), and for completeness it is 95.45 percent (very good).

The average rating of the two experts on the material's appropriateness is 87.5% (very good). The findings of the evaluation indicated that, from the standpoint of material compatibility, the expert team deemed the practical handbook to be of high quality and usability. The practicum guidebook has been revised in response to material expert advice on this aspect, namely that the use of language for practicum purposes must be aligned with the objectives of basic competencies; revisions are made by aligning the learning objectives of practicum activities with the objectives of basic competencies. Revision is seen in Figure 2.

A B

Figure 2. Display of modifications to the material's appropriateness in the practical guidebook. A: The display before the learning goals are established; B: The display after the learning objectives are specified and adjusted to the fundamental capabilities.

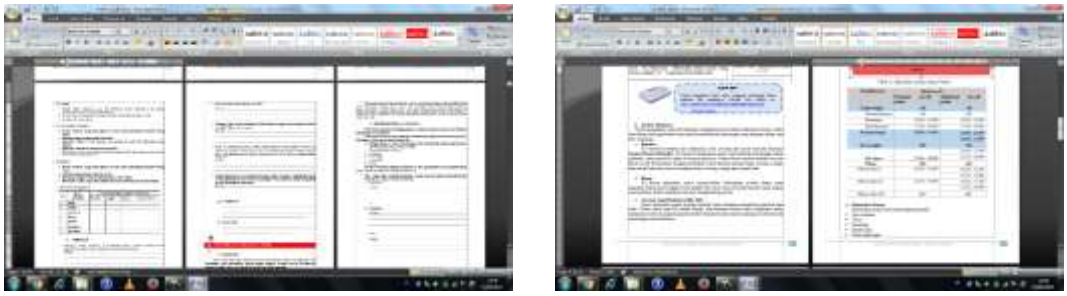
In terms of depth of information, the average rating from the two experts was 91.67 percent (excellent). According to the study's findings, the expert team deemed the practical guide book to be of high quality and usability. With the addition of ideas, principles, and materials to the scientific component as the body of knowledge, the practical guidebook has been changed. Revision is shown in Figure 3.



A B

Figure 3. Display of changes in the depth aspect of the material in the practical guide book. A: Display before concept, principle, material added; B: Display after concept, principle, material added.

The average aspect of the accuracy of the material is 87.5% (very good), the results of this study indicate that in terms of the accuracy of the material, the expert team assessed that the practical guide book was good and feasible to use. The practical guide book has been revised, namely reducing too long explanations and adding more points, diagrams, or tables. The revision can be seen in Figure 4.



A B

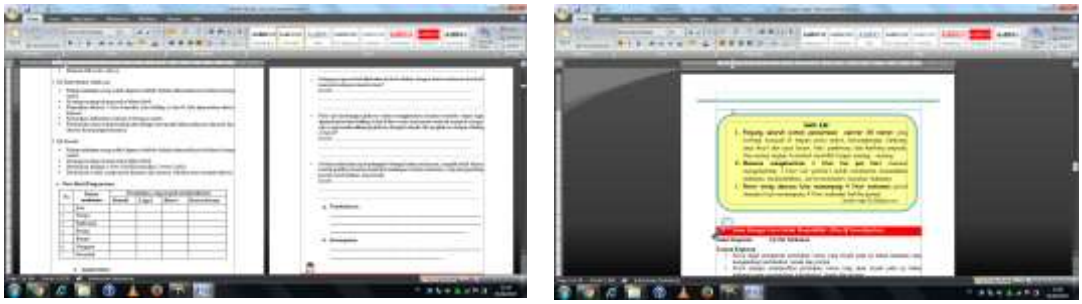
Figure 4. Display of changes in aspects of the accuracy of the material in the practical guide book. A: The display before the body mass index calculation table is added; B: The display after the body mass index calculation table is added.

The average aspect of learning support material aspects is 97.5% (very good). The results of this study indicate that in terms of aspects of learning support materials, the expert team assessed that the practical guide book was good and feasible to use. The practical guide book has been revised, namely reducing too long explanations and adding more points, diagrams, or tables. The revision can be seen in Figure 5.

A B

Figure 5. Display of changes in aspects of learning support material in the practical guide book. A: The display before the learning support material in the form of a bio info column and a bio link is added. B: The display after the learning support material in the form of a bio info column and bio link is added.

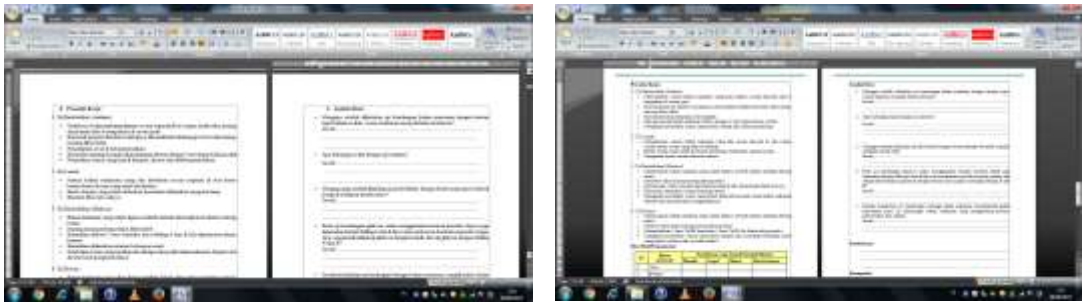
The average presentation technique aspect is 93.75% (very good). The results of this study indicate that from the technical aspect of learning presentation, the expert team assessed that the practical guide book was good and feasible to use. The practical guide book has been revised, namely by providing work procedures that are in accordance with KI and KD as well as containing a bio info column that can motivate students in learning. The revision can be seen in Figure 6.



A B

Figure 6. Display of changes in the presentation technique aspect in the practical guide book. A: The display before providing work procedures that are in accordance with KI and KD also contains a bio info column that can motivate students in learning added; B: The display after providing work procedures that are in accordance with KI and KD also contains a bio info column that can motivate students in learning added.

The average aspect of learning presentation is 87.5% (very good). The results of this study indicate that from the aspect of learning presentation, the expert team assessed that the practical guide book was good and feasible to use. The practicum guide book has been revised, namely by improving the language in the practicum guide book into a communicative language to students. The revision can be seen in Figure 7.



A B

Figure 7. Display of changes in the presentation of learning aspects in the practical guide book. A: The display before the language in the practicum guide was improved into a communicative language to students; B: The display after

the language in the practicum guide is improved into a communicative language to students.

Scientific Literacy Expert Validation

The validation of media design experts was carried out by Prof. Dr. rer. nat. Binary Manurung, M.Sc. is a lecturer and expert in scientific literacy at Medan State University. The purpose of this evaluation was to enhance the quality of scientific literacy-based textbooks.

This textbook was approved by a committee of scientific literacy specialists based on five criteria: features of a body of knowledge, method of investigation, mode of thought, connection between science, technology, and society, and aspects of self-reflection. Figure 8 is a visual representation of the ultimate outcome of the validator's evaluation.

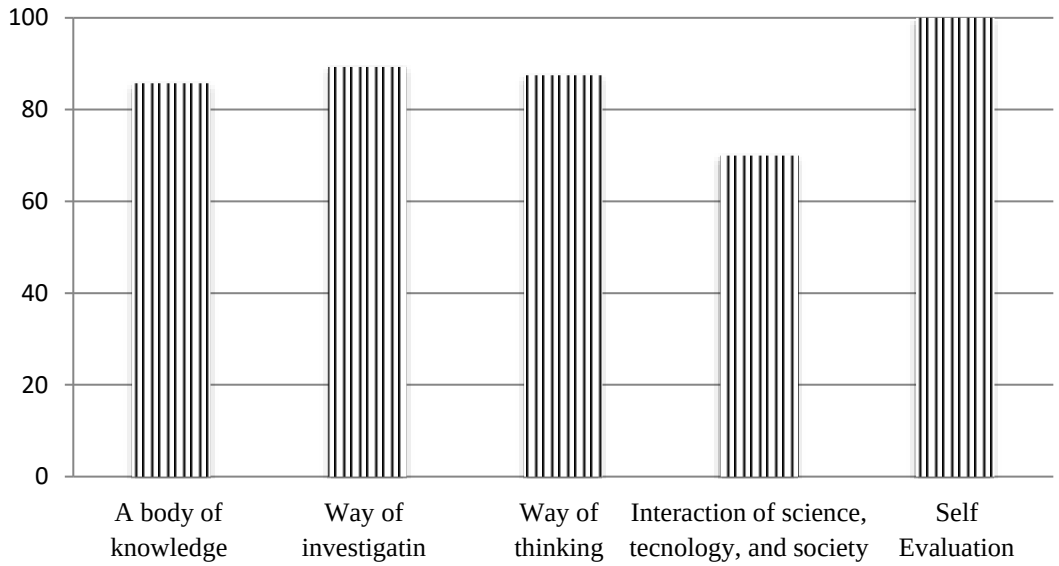
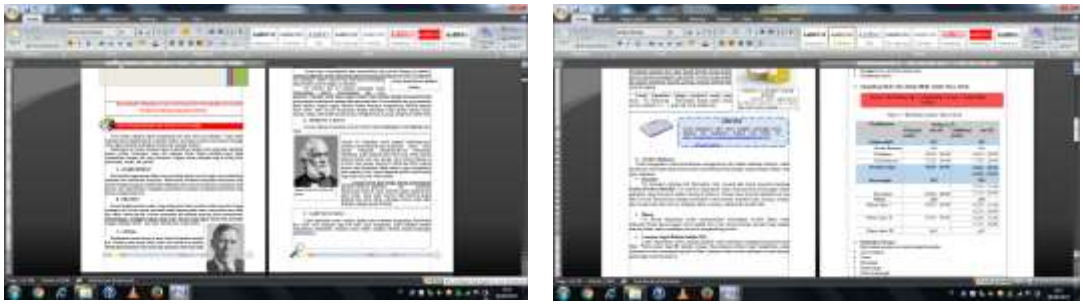


Figure 8. The results of the validation of the practical guide book by scientific literacy experts. Percentage is the average result of the assessment based on a questionnaire using a Likert scale of 1-4. The average assessment from the expert on the aspect of science as a body of knowledge is 85.71% (very good), Science as a way of investigating 89.28% (very good), Science as a way of thinking 87.5% (very good), Aspects of interaction of science and technology and society 70% (very good), and Aspects of self-reflection 100% (very good).

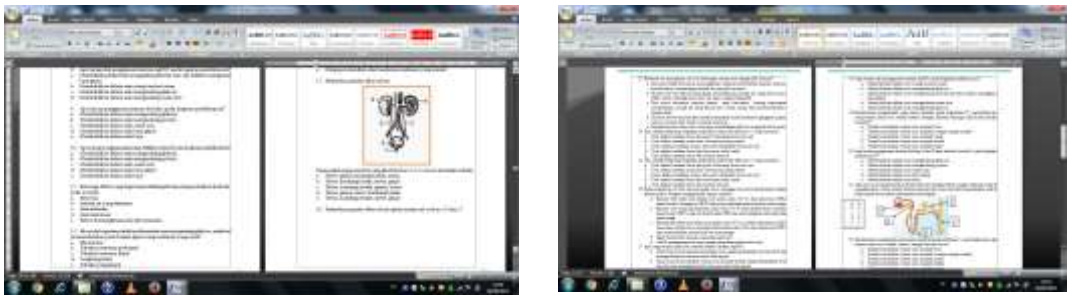
The average assessment from experts on aspects of a body of knowledge is 85.71% (very good), revisions to the practical guide book have been carried out by deepening and sharpening the material, practice questions on each material are also improved on the science component as the body of knowledge. The revision can be seen in Figure 9.



A B

Figure 9. Display of changes in the science component as the body in the practicum guide. A: The view before the science component as the body of knowledge is sharpened; B: The view after the science component as the body of knowledge is sharpened.

The average assessment of experts on the science element as a method of investigation was 89.28%. (very good). Revisions have been made to the practical guidebook, particularly to the practice questions. Prior to the revisions, the practice questions did not offer enough information on investigation.

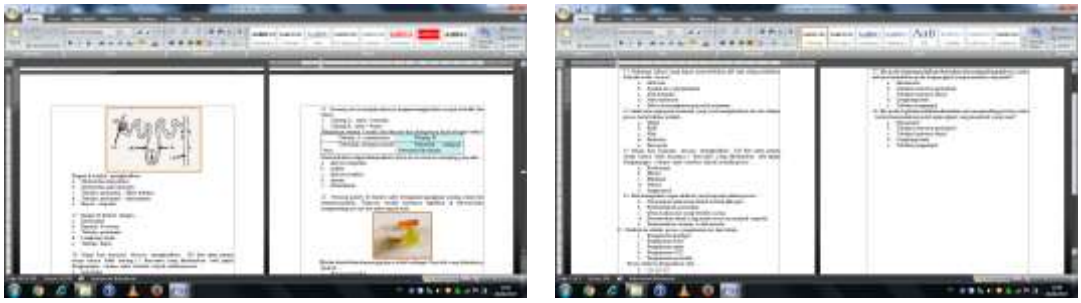


A B

Figure 10. Display of changes in the science component as a way to investigate the practice questions in the practical manual. A: The view before the science component as a way to investigate is sharpened; B: The aftermath of the science component as a way of investigating is sharpened.

The average rating from experts on the aspect of science as a mode of thought is 87.5% (very good). Adjustments have been made to the practical guidebook, with the majority of revisions focusing on practice questions. Some questions that were initially science

questions as a body of knowledge are now, according to experts, science questions as a method of investigation.



A B

Figure 11. View of changing components of science as a way of investigating. A: The appearance before the question of the science component as a way of thinking was changed; B: The display after the question of the components of science as a way of thinking is changed.

The average rating of experts for the aspect of science, technology, and societal interaction is 70%. (good). Self-reflection constitute 100% (very good). Revisions have been made to the practicum manual's sections on the intersection of science, technology, and society, specifically by lowering the amount of text in case studies.

A B

Figure 12. Display of changing components of the interaction of science, technology, and society. A: Before modification; B: After modification.

In general, the improvements and recommendations made by specialists in scientific literacy for practical guide books are as follows: (1) scientific literacy is not prominent in every component of scientific literacy; (2) questions in each material must reflect the components of scientific literacy. On the basis of the opinions of specialists in scientific literacy, it can be stated that the prepared practicum guidebook is of high quality and usable.

Design Expert Validation

The assessment by the two design experts was carried out to improve the quality of the textbook designs developed. This textbook was validated by a team of design experts based on 4 aspects, namely: Leather design aspects, leather typography, content design, and visual communication aspects.The final results of the assessment of the two validators are visualized using the graph in Figure 13.

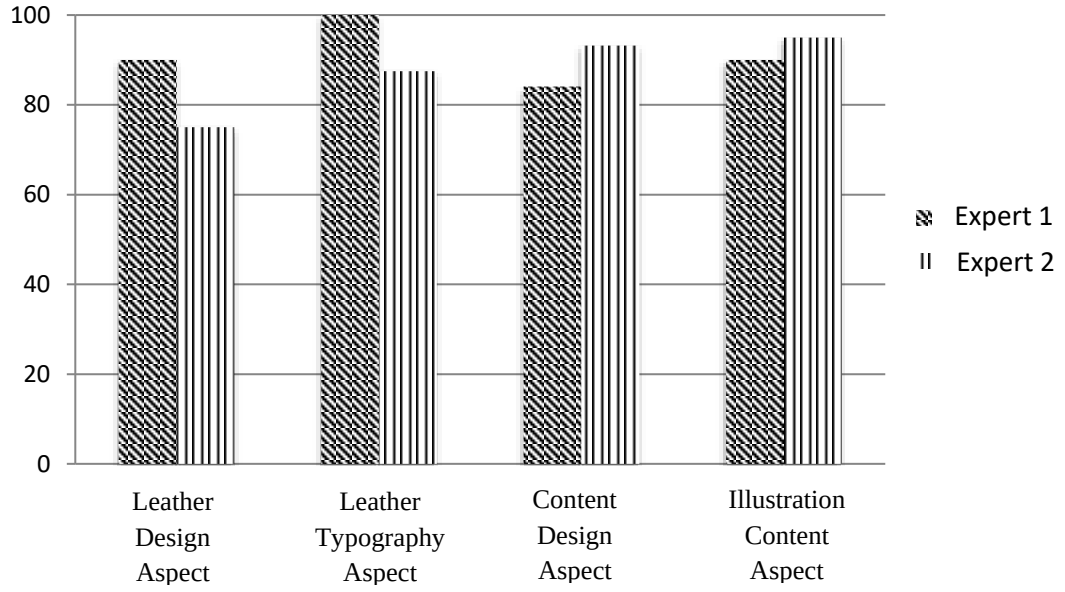


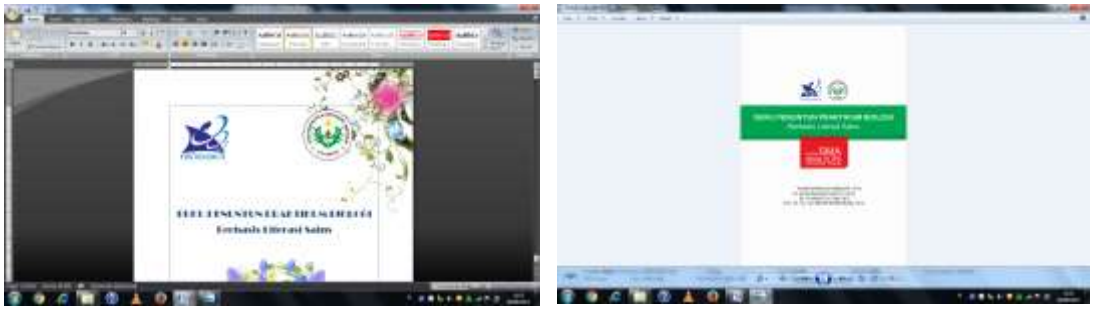
Figure 13. The results of the validation of the practical guidebook by a team of design experts. Percentage is the average result of the assessment based on a questionnaire using a Likert scale of 1-4. The Average Rating from the Two Experts on the Leather Design Aspect was 82.5% (Very Good), the Leather Typography Aspect was 93.75% (Very Good), the Content Design Aspect was 88.63% (Very Good) and the Illustration Content Aspect was 92.5% (Very Good).

The average assessment of the two experts on the skin design aspect is 82.5 percent (very good). Revisions to the leather design include altering the order on the cover, adding the title and author to the back of the book, and including the author's biography on the back page.

A B

Figure 14. Display changes to the skin design. A: Front cover before modification; B: Front cover after modification.

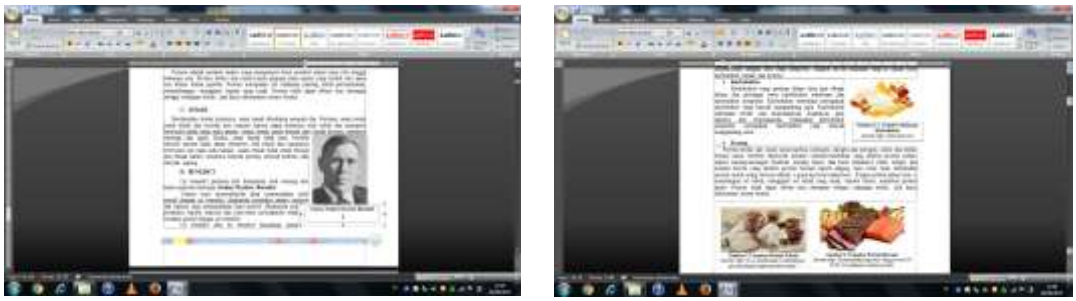
The average grade of the two experts on the typographic element of the skin is 93.75 percent (very good). Revisions to the leather typography include making the color of the book's title more contrasting and harmonizing the typeface and proportions of the display. The second iteration of the Ristekdikti and UNIMED logos were scaled down and positioned in the centre, and the basic competence of typographic color contrast was eliminated.



A B

Figure 15. Skin typography changes appearance. A: The Ristekdikti and UNIMED logos are still too big and not in the middle; B: The Ristek Dikti and UNIMED logos have been reduced and are in the middle.

The average rating of the two experts on the design element of the content is 88.63 percent (very good). Revisions from the design expert team include the addition of guidance on how to use books, the assignment of table numbers, the numbering of images and descriptions of photos as well as image sources, and the resolution enhancement of photographs.



A B

Figure 16. Views on the design aspect of the content. A: The image quality is still low resolution and there is no image numbering; B: The image has been increased in resolution, and the numbering and captioning of the image.

The average assessment of the two experts on the content illustration element is 92.5 percent (very good). Revisions made to this aspect include the addition of images to practice questions, determining whether or not the number one should be placed in the middle, and ensuring consistency in the wording of questions for each material. For example, if all answer choices are a, b, c, d, and e in descending order, then all questions must follow this format.

A B

Figure 17. Display changes to the illustration aspect of the contents. A: The placement of the image in the middle and the consistency of writing the answer choices before being corrected; B: The placement of the image in the middle and the consistency of writing the answer choices after being corrected.

So based on the outcomes of the improvement of components examined by the design expert team on the practicum guide that has been established, it can be stated that the developed practicum guidebook is considered good and practicable to use based on design experts.

CONCLUSION

The scientific literacy-based biology practicum guidebook designed as a whole meets the "very good" criterion for practicability. Where the average evaluation of two subject matter specialists is 91.5% (very good). The average scientific literacy component feasibility level of practical guide books is 86.48 percent, according to scientific literacy specialists (very good). In order for the practical guidebook to be approved and appropriate for use in teaching and learning activities, particularly practicum. The level of practicality for the design of the scientific literacy-based biology lab manual designed as a whole meets the "very good" criterion, as determined by the average rating of two experts on the design element (very good).

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