Journal of Education and Learning Research
Journal homepage: https://jelr.greadc.org/index.php/jelr

E-ISSN
3024-9589

Development of a Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students

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ARTICLE INFO

Article history:

Received: 02 June 2026
Accepted: 15 July 2026
Published online: 10 Aug 2026

Keywords:

Pocketbook;
Laboratory Equipment;
Organ and Organ System

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Article Doi

Doi: https://doi.org/10.62208/jelr.4.1.p.39-48

A B S T R A C T

Biology learning in senior high school is important for understanding life concepts and biological processes. However, organ and organ system materials are often considered difficult because they involve broad concepts, scientific terminology, and laboratory practical activities. This study aimed to develop a laboratory equipment pocketbook for Grade XI senior high school students on organ and organ system materials, integrating laboratory equipment identification with QR codes linked to learning videos. The novelty of the pocketbook lies in integrating laboratory equipment identification with organ and organ system materials and QR codes linked to learning videos, providing a resource for learning support. The research employed the Research and Development (R&D) method using the ADDIE model, limited to the development stage. The study was conducted from December 2025 to February 2026 involving expert validators, Biology Education students, and Grade XI students. Data were collected through observations, interviews, validation sheets, and response questionnaires using a four-point Likert scale. Validation results showed an average score of 3.70, categorized as "very valid." Limited trial stages I and II obtained average scores of 3.83 and 3.92, respectively, both categorized as "very good." The findings indicate that the pocketbook is feasible and well-received as a supporting resource for introducing laboratory equipment in biology learning.

1. Introduction

Biology learning at the senior high school level plays an important role in helping students understand life concepts and biological processes occurring in the surrounding environment. However, biology is still considered one of the difficult subjects because it covers broad material, contains many scientific terms, and requires deep conceptual understanding (Jayawardana & Gita, 2020). One of the important topics in biology learning is organs and organ systems, which discuss the structure and functions of the organs that compose the body of organisms.

Organ and organ system material includes discussions about the relationships among organs that work together to form a system in maintaining the life of organisms. According to (Irmawati et al., 2021) an organ system is a collection of organs that interact and work coordinately so that organisms can perform life

functions stably. This material is complex and abstract, thus requiring learning media and methods that support students' understanding. One effort that can be implemented is through practicum activities in the biology laboratory.

Practicum activities are an important part of biology learning because they provide direct experiences for students in understanding scientific concepts. (Senisum, 2021) stated that practicum activities make students more active in the learning process and help them understand how a concept is obtained. In addition, practicum activities also train scientific skills such as observing, measuring, collecting data, analyzing results, and drawing conclusions. In order for practicum activities to run effectively, students need to have basic knowledge regarding laboratory equipment and materials.

Knowledge of the names, functions, and proper use of laboratory equipment is an important foundation for successful and safe practicum activities. Pramesti et al. (2018) stated that an initial understanding of laboratory equipment can support more effective and safer practicum implementation. Recent empirical studies further indicate that students may still experience difficulties in applying laboratory knowledge and safety practices. Caymaz (2021), for example, found that secondary school students had deficiencies in laboratory safety knowledge, including limited awareness of appropriate and inappropriate laboratory behaviors and safety symbols. Similarly, Permana (2022) reported misconceptions among Indonesian junior high school students regarding hazardous materials and laboratory safety signs. These findings suggest that familiarity with laboratory equipment and safety procedures should be developed before students engage in practical activities. Therefore, accessible learning resources that help students recognize laboratory equipment and understand its functions are important for preparing students for laboratory-based biology learning.

At the national level, this challenge is also reflected in Indonesia's science performance in the Programme for International Student Assessment (PISA) 2022. Indonesia recorded an average science score of 383 points, compared with the OECD average of 485 points, while only 34% of Indonesian students achieved Level 2 or higher in science, compared with 76% across OECD countries (OECD, 2023). Although PISA does not directly measure laboratory literacy, these findings point to broader challenges in students' ability to apply scientific knowledge and reasoning in real-world contexts. This situation highlights the need to strengthen science learning through contextual and practical learning experiences that provide students with opportunities to engage with scientific concepts and processes.

The issue of laboratory preparedness and safety is not limited to a particular school or region. Evidence from other educational contexts also demonstrates the importance of students' laboratory knowledge and learning environments. Mendez (2023), in a study involving 201 education students, reported a significant relationship between the science laboratory learning environment and students' laboratory safety practices, particularly in work procedures, emergency response, and experiment handling. More recently, Shaafi et al. (2025) reported moderate awareness of laboratory regulations among 131 secondary school students in Malaysia and highlighted the need for accessible educational media to strengthen laboratory safety awareness. These findings demonstrate that laboratory preparedness, safety awareness, and access to appropriate learning resources remain relevant concerns across different educational contexts.

In the local context, observations and interviews with biology teachers at six senior high schools, namely SMAN 2 Dumai, SMAN 8 Pekanbaru, SMAN 9 Pekanbaru, SMAN 15 Pekanbaru, SMAN 19 Pekanbaru, and SMA Muhammadiyah 1 Pekanbaru, revealed that students were still unfamiliar with the names and functions of several biology laboratory equipment. This condition was observed in schools with relatively complete laboratory facilities as well as in schools with more limited facilities. Teachers therefore needed to re-explain laboratory equipment before practicum activities, which could reduce the time available for practical learning. Although these observations were qualitative and did not quantify the proportion of students experiencing the difficulty, they provide contextual evidence that laboratory equipment familiarity remains a practical concern in the local biology learning context.

The observed difficulties were also associated with the limited availability of learning resources specifically designed to introduce laboratory equipment. The media commonly used in the observed schools included textbooks, student worksheets (LKPD), and PowerPoint presentations, but these resources did not consistently provide systematic visual information about laboratory equipment, including their names, functions, and appropriate uses. Consequently, students had limited opportunities to independently review laboratory equipment before practical activities. Providing a concise and accessible resource that combines clear visual representations with

functional explanations may therefore help students prepare for laboratory-based learning.

Previous studies have demonstrated the potential of pocketbooks and e-pocketbooks as practical learning resources that can support biology learning. Malisa et al. (2024) stated that a pocketbook is a practical learning medium, easy to carry, and can be studied anytime. Recent development studies have also explored pocketbooks with different content and technological features. For example, Qairunisa et al. (2024) developed an electronic pocketbook for plant-like protists that integrated real-world phytoplankton research, while Lesmanawati et al. (2024) developed an e-pocketbook on environmental pollution based on environmental issues in the Cirebon region. These studies demonstrate that pocketbook-based media can be adapted to provide contextual and accessible learning resources for biology students.

The integration of digital features has also been explored in pocketbook development. Bahari et al. (2024) developed a QR Code-based pocket book on solar system materials and reported high validity and practicality, demonstrating the potential of QR codes to enrich pocketbook-based learning with digital resources. However, their product focused on science learning at the primary school level and addressed solar system content rather than laboratory equipment and practical preparation in senior high school biology. Thus, the use of QR codes in pocketbook media has been demonstrated, but its application to laboratory equipment identification within organ and organ system materials remains insufficiently explored.

However, the existing studies identified above have generally focused on presenting subject-matter content, contextual information, or digital access features, rather than specifically integrating laboratory equipment identification with organ and organ system materials for senior high school biology learning. In particular, a pocketbook that systematically presents the names, functions, visual representations, and uses of laboratory equipment while connecting selected content to learning videos through QR codes has received limited attention. To address this gap, the present study develops a laboratory equipment pocketbook specifically designed for Grade XI senior high school biology learning on organ and organ system materials. The pocketbook combines concise explanations, visual representations of laboratory equipment, information on equipment functions and uses, human organ system torso illustrations, and QR codes linked to learning videos. This design is intended to provide students with an accessible resource for reviewing laboratory equipment before practical activities while connecting equipment identification with the biological concepts being studied.

Based on the identified needs and research gap, this study aimed to develop and determine the validity and students' responses to a laboratory equipment pocketbook on organ and organ system materials for Grade XI senior high school students.

2. Methodology

This study employed a Research and Development (R&D) approach using the ADDIE model. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation. In this study, the development process was limited to the development stage because the primary objective was to produce and assess the initial quality, validity, and user responses to the laboratory equipment pocketbook. The implementation and evaluation stages, which require broader application and systematic assessment of learning outcomes, were beyond the scope of the present study and are recommended for subsequent research.

The product developed was a laboratory equipment pocketbook on organ and organ system materials for Grade XI senior high school students. The research was conducted at the Biology Education Study Program, Faculty of Teacher Training and Education, University of Riau during the development and expert validation stages, with validation carried out at SMA Muhammadiyah 1 Pekanbaru and SMAN 8 Pekanbaru. The first limited trial was conducted on Biology Education students, while the second stage involved Grade XI students of SMA Muhammadiyah 1 Pekanbaru. The study was conducted from December 2025 to February 2026.

The development procedure began with the analysis stage through observations and interviews to identify learning needs, student characteristics, media usage, and problems related to understanding laboratory equipment. Curriculum analysis was conducted based on Learning Outcomes (CP) and Learning Objectives (TP) of organ and organ system materials in Phase F of the National Curriculum. The design stage included the preparation of the Learning Objective Flow (ATP), teaching modules, and pocketbook design using Canva containing laboratory equipment materials, functions, images, and visual instructions for use. The development stage was carried out through expert validation by Biology Education lecturers and senior

high school biology teachers who assessed presentation, appearance, readability and language, content feasibility, and usefulness aspects. After revisions, formative limited trial stage I was conducted with 10 seventh-semester Biology Education students, followed by formative limited trial stage II with 20 Grade XI students of SMA Muhammadiyah 1 Pekanbaru. These limited trials were conducted as part of the development stage to obtain user responses and identify aspects requiring product improvement, rather than to evaluate the effectiveness of the pocketbook on students' learning outcomes.

The research participants consisted of two Biology Education lecturers from the Faculty of Teacher Training and Education, University of Riau and two senior high school biology teachers who served as expert validators. The formative limited trials involved seventh-semester Biology Education students in trial stage I and Grade XI students of SMA Muhammadiyah 1 Pekanbaru in trial stage II. The article records the use of random sampling for participant selection; however, the population size and specific randomization procedure were not documented in the available research data. Therefore, the limited trials were treated as preliminary formative testing rather than as a basis for statistical generalization.

The research instruments consisted of learning tools in the form of the Learning Objective Flow (ATP) and teaching modules, as well as data collection instruments in the form of validation sheets and student response questionnaires. The validation sheet consisted of 27 assessment items covering presentation, appearance, readability, content feasibility, and usefulness aspects, while the response questionnaire consisted of 20 statement items covering attractiveness, content, readability, and usefulness aspects. Data were collected through observations, interviews, expert validation, and response questionnaires after the use of the pocketbook media in limited trial stages I and II. The data were analyzed descriptively using a four-point Likert scale. The average score for each assessment aspect was calculated by dividing the total score obtained by the number of assessment items and respondents. The resulting scores were then interpreted according to the criteria proposed by Sugiyono (2019), namely very valid, valid, less valid, and invalid for the validation data. Response data from the limited trials were categorized as very good, good, less good, and not good based on the predetermined score interpretation criteria. The product was considered feasible when the validation results reached the valid or very valid category.

Because the study was limited to the development stage, the analysis focused on product validity and user responses rather than learning effectiveness. No pre-test, post-test, control group, or inferential statistical analysis was conducted to determine whether the pocketbook improved students' learning outcomes. Therefore, the findings should be interpreted as evidence of the product's preliminary quality and acceptability, rather than evidence of its effectiveness in improving learning outcomes.

3. Results and Discussion

Development Results of the Laboratory Equipment Pocketbook on Organ and Organ System Materials

Analyze Stage

The analysis of the national curriculum showed that organ and organ system materials, particularly the skeletal system and food substance testing, are included in Phase F of the 2024 National Curriculum. In this phase, students are expected to understand the relationship between organ structures and organ system functions in responding to internal and external stimuli. Based on the analysis of Learning Outcomes (CP), Learning Objective Flow (ATP), and Learning Objectives (TP), it was determined that students need to master skills such as identifying bones in the human skeletal system, analyzing laboratory equipment, and conducting food substance testing practicums.

The results of the ATP analysis showed that the curriculum format still had shortcomings because it did not completely include learning activities, assessments, and learning resources. The analysis of learning media revealed that teachers in Pekanbaru generally used PowerPoint presentations, images, and videos in learning activities, but the use of laboratory equipment pocketbooks had not yet been implemented. This media was considered to have the potential to support student engagement and facilitate access to learning materials through concise explanations, visual representations, and digital learning resources. Furthermore, the material analysis showed that organ and organ system materials could be developed into seven main subtopics, namely the skeletal system, circulatory system, digestive system, respiratory system, excretory system, nervous system, and endocrine system. The analysis of student needs indicated that students required visual and accessible learning resources, particularly images, videos, and illustrations, to support their understanding of the material.

Design Stage

The design stage was the initial planning stage of the media and learning tools adjusted to the 2024 National Curriculum. At this stage, the Learning Objective Flow (ATP), teaching modules, assessment instruments, student worksheets (LKPD), and the initial design of the laboratory equipment pocketbook were developed.

The teaching module was developed based on the ATP using the Problem Based Learning (PBL) approach. The module included identity, learning objectives, assessments, learning activities, and appendices containing instruments and teaching materials arranged in detail to clearly describe the learning process. The designed assessment instruments consisted of diagnostic assessments, written assessments, Pancasila Student Profile attitude assessments, and performance or discussion assessments. Student worksheets (LKPD) were also designed based on the ATP for two meetings with structures including objectives, discourse, work procedures, problem-based activities, and conclusions. In addition, the initial design of the pocketbook was created using the Canva application containing information about biology laboratory equipment and human organ system torsos. This design aimed to serve as the basis for developing a more interactive final product.

The pocketbook design process began with a storyboard as an initial illustration of each page. Furthermore, the pocketbook was developed using Canva and ME-QR applications, resulting in a pocketbook accessible through QR codes connected to learning videos. The developed pocketbook consisted of a cover section, introductory section (preface, table of contents, instructions for use, and Learning Outcomes), content section (laboratory equipment, torso, QR codes, and fun facts), closing section (references), and author profile page.

The research instruments were also designed in the form of validation sheets and response questionnaires. The validation sheets were used to assess aspects of presentation, appearance, readability, language, content, and usefulness, while the response questionnaires were used to determine the attractiveness, content, readability, and usefulness of the product.

Development Stage

The development stage was the realization of the previously designed product into a final product ready for testing. The results of the module development can be seen in Figure 1.

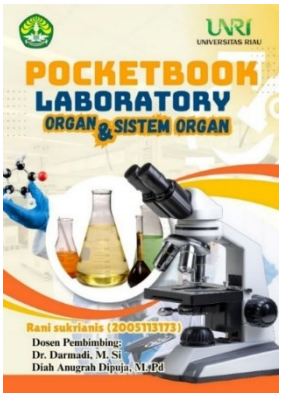

Figure 1. *Pocketbook Cover*

The developed laboratory equipment pocketbook contained materials on laboratory equipment and human organ system torsos adjusted to the learning objectives. This pocketbook was designed to facilitate students in understanding the material through visualizations, QR-code learning videos, and additional information such as fun facts. The QR-code learning videos can be seen in Figure 2.

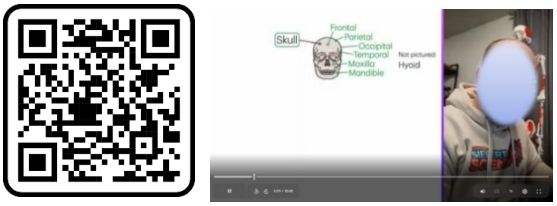

Figure 2. QR-Code Learning Videos

Validation Results of the Development of the Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students

Based on the obtained data, the validation results of the development of the Laboratory Equipment Pocketbook in terms of presentation, appearance, readability and language, content feasibility, and usefulness aspects are presented in Table 1.

Table 1. Validation Result

No	Assessment Aspect	Score	Average	Category
1	Presentation Aspect	15.00	3.75	Very Valid
2	Appearance Aspect	15.00	3.75	Very Valid
3	Readability and Language Aspect	14.80	3.70	Very Valid

4	Content Feasibility Aspect	14.00	3.50	Very Valid
5	Usefulness Aspect	15.00	3.75	Very Valid
	Validity Score	73.80	3.70	Very Valid

The validation results of the Laboratory Equipment Pocketbook development were obtained through five assessment aspects, namely presentation, appearance, readability and language, content feasibility, and usefulness. It was found that the highest average scores were obtained in the presentation, appearance, and usefulness aspects with an average score of 3.75 categorized as "very valid."

The presentation aspect obtained a score of 3.75 and was categorized as "very valid." The high score can be attributed to the systematic organization of the pocketbook, in which the content is arranged through introductory information, instructions for use, learning outcomes, laboratory equipment content, supporting illustrations, QR codes, and references. This sequence provides a clear learning pathway and allows students to locate information about laboratory equipment without having to navigate through extensive explanations. In developing a feasible and high-quality pocketbook, attention to presentation is important because the organization of information influences how easily learners can access and follow the learning material. Fegiarti et al. (2023) stated that the presentation aspect affects the quality and feasibility of a pocketbook; therefore, presentation methods need to fulfill established validity criteria. In the present study, the systematic structure and concise presentation likely contributed to the high validation score.

The appearance aspect obtained a score of 3.75 and was categorized as "very valid." The high score may be related to the use of illustrations, organized page layouts, laboratory equipment images, organ system torso visualizations, and QR-code elements that were integrated into the pocketbook design. These visual components are particularly relevant because laboratory equipment is an object-based topic that requires students to associate names and functions with concrete visual forms. A visually organized presentation can therefore reduce the difficulty of identifying equipment and make the information easier to access. This finding is in line with Azkiya et al. (2023), who explained that visual appearance is an important factor in attracting students' attention and supporting their understanding of presented material. However, the appearance score should be interpreted as evidence of perceived visual quality rather than evidence that the design improves learning outcomes.

The usefulness aspect, which obtained the same score of 3.75 categorized as "very valid," showed that the Laboratory Equipment Pocketbook was highly beneficial for both students and teachers as teaching material in learning activities. For students, the pocketbook was perceived as useful because it provided concise explanations, visual representations, interactive learning videos accessible through QR codes, and practice exercises. Meanwhile, for teachers, the pocketbook could be used as a guide in delivering material systematically and attractively and facilitating active communication with students. The usefulness aspect became one of the focuses in validation as a feasibility criterion because the pocketbook provided positive contributions to the learning process.

The readability and language aspect obtained an average score of 3.70 and was categorized as "very valid." This result suggests that the language, sentence structure, terminology, and overall textual presentation were considered appropriate for Grade XI students. The score may be associated with the use of concise explanations and relatively familiar biological terminology, which reduces unnecessary textual complexity in a compact learning resource. Hasanah (2020) stated that readability and language are important aspects of pocketbook development because effective sentences, clear paragraph structures, and communicative language facilitate students' understanding. In this product, the combination of concise text and visual representations also helped balance the amount of written information with the need to explain laboratory equipment accurately.

The content feasibility aspect obtained the lowest average score, at 3.50, although it remained within the "very valid" category. The relatively lower score may be related to the greater complexity of ensuring that laboratory equipment information is accurate, sufficiently comprehensive, and appropriately aligned with the organ and organ system materials. Unlike presentation or appearance, content feasibility requires careful consideration of conceptual accuracy, material coverage, terminology, and the relevance of each laboratory equipment item to the learning objectives. The pocketbook also needs to balance completeness with its compact format; including too much information could reduce its practicality as a pocketbook, whereas providing insufficient information could limit its usefulness for students' preparation before practical activities. Aprillia and Mahanani (2021) explained that content feasibility is an important criterion in learning material validation because the content needs to correspond to students' learning needs and the intended learning objectives.

Therefore, the 3.50 score can be interpreted as indicating that the content was considered appropriate but still had greater room for refinement than the other assessed aspects.

Results of Limited Trials of the Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students

The results of limited trial stages I and II are presented in Tables 2 and 3.

Table 2. Limited Trial Stage I Results

No	Assessment Aspect	Score	Average	Category
1	Attractiveness	15.10	3.77	Very Good
2	Content Feasibility	23.10	3.85	Very Good
3	Readability	19.20	3.84	Very Good
4	Usefulness	19.30	3.86	Very Good
	Trial Stage I Score		3.83	Very Good

Table 3. Limited Trial Stage II Results

No	Assessment Aspect	Score	Average	Category
1	Attractiveness	15.30	3.82	Very Good
2	Content Feasibility	23.50	3.91	Very Good
3	Readability	19.85	3.97	Very Good
4	Usefulness	19.95	3.99	Very Good
	Trial Stage II Score		3.92	Very Good

In limited trial stage I, the pocketbook obtained an average score of 3.83 and was categorized as "very good." Usefulness received the highest score (3.86), while attractiveness received the lowest score (3.77), although both remained within the "very good" category. The higher usefulness rating suggests that respondents perceived the pocketbook as functionally valuable for accessing laboratory equipment information and supporting preparation for biology learning. This perception may have been supported by the concise organization of the material, visual representations, and QR-code access to supplementary learning videos. Waruwu (2024) explained that development research should assess products systematically to determine their quality and usefulness. The result therefore indicates positive initial user acceptance of the product, rather than evidence of its effectiveness in improving learning outcomes.

Although the attractiveness score remained in the "very good" category, its position as the lowest-rated aspect suggests that visual appeal was relatively more demanding than content, readability, and usefulness. This may be because attractiveness depends on subjective preferences regarding layout, color combinations, image composition, typography, and visual balance. In a pocketbook containing many laboratory equipment images and biological illustrations, maintaining visual consistency while presenting sufficient information in a small format can be challenging. Solihin et al. (2024) stated that attractive and interactive teaching materials can influence students' interest and understanding. Therefore, the lower relative attractiveness score does not indicate poor visual quality, but rather suggests an opportunity to refine visual elements to accommodate different student preferences.

At this stage, technical problems were also found in the form of writing errors and inaccessible QR codes. Therefore, improvements were made by replacing the QR-code system using the ME-QR application to ensure optimal access to learning videos. This finding is in accordance with (Kandiri et al., 2025), who emphasized the importance of easy access to digital features in learning media. The results of limited trial stage II showed an increase in the overall response score from 3.83 in trial stage I to 3.92 in trial stage II, with both results categorized as "very good." Usefulness again received the highest score (3.99), whereas attractiveness remained the lowest-rated aspect (3.82). The consistency of this pattern across both trials suggests that respondents perceived the pocketbook primarily in terms of its practical value, while visual attractiveness remained the aspect with greater potential for refinement. The increase in the overall response score may be associated with revisions made after trial stage I, particularly corrections to writing and improvements to the accessibility of the QR-code feature. However, this increase should be interpreted as an improvement in user response to the revised product, not as evidence of increased learning achievement.

The higher usefulness score in trial stage II coincided with improvements to the QR-code feature, suggesting that improved access to supplementary videos may have contributed to respondents' more positive perceptions of the product's usability. However, this relationship was not tested statistically and should therefore be interpreted as an indication from the user-response data rather than a causal effect. In addition, the usefulness aspect is an important indicator in limited trials of learning media. The readability aspect obtained a score of 3.97, indicating that the language and presentation were perceived as appropriate for the comprehension level of senior high school students.

This finding is consistent with Malisa et al. (2024), who emphasized the practical and accessible nature of pocketbook-based learning resources. In the present study, the concise presentation of information and combination of text and visual elements may have supported the high readability rating.

Attractiveness remained the lowest-rated aspect in trial stage II (3.82), although it was still categorized as "very good." The consistency of this result with trial stage I (3.77) suggests that visual attractiveness was relatively more difficult to optimize than usefulness and readability. Asrul (2021) emphasized that clear visuals play an important role in delivering information and increasing the attractiveness of learning media. In the present study, respondents' suggestions regarding the color contrast of numbering on the costa bone images indicate that some visual elements still required refinement. This finding demonstrates that visual design needs to balance aesthetic appeal with functional readability, particularly when multiple anatomical images and equipment labels are presented in a compact format.

Quality Results of the Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students

The results of the average quality scores of the Laboratory Equipment Pocketbook are presented in Table 4.

Table 4. Quality Results of the Pocketbook

Quality Aspect	Average	Category
Validation Test	3.70	Very Valid
Limited Trial Stage I	3.83	Very Good
Limited Trial Stage II	3.92	Very Good
Average	3.81	Very Good

The overall quality of the laboratory equipment pocketbook was reflected in the validation and limited trial results, with an overall average score of 3.81 categorized as "very good." Rather than indicating learning effectiveness, these results demonstrate that the product achieved favorable preliminary quality and user-response ratings during the development process. The progression from 3.70 in expert validation to 3.83 in limited trial stage I and 3.92 in stage II indicates that the product was increasingly well-received after revisions and user testing. This pattern is consistent with the formative nature of the development process, in which expert feedback and user responses are used to identify and refine aspects of the product before broader implementation. The consistently high usefulness ratings across the validation and two limited trials indicate that the strongest perceived contribution of the pocketbook was its practical function as a compact learning resource. The product combines concise laboratory equipment information, visual representations, organ system illustrations, and QR-code links to supplementary videos. This combination distinguishes the product from a conventional printed reference because students can use the physical pocketbook while accessing additional digital explanations when needed. Research on QR-code-based learning media has similarly demonstrated the potential of QR codes to connect printed learning resources with digital content. Bahari et al. (2024), for example, developed a QR Code-based pocket book and reported very high validity and practicality, supporting the feasibility of integrating QR codes into pocketbook-based learning media.

The findings also indicate that the product's strengths were more apparent in usefulness and readability than in visual attractiveness. This suggests that the pocketbook successfully addressed its primary functional purpose, namely providing accessible information about laboratory equipment, while some visual elements still require refinement. The finding is pedagogically relevant because a learning resource should not only be informative but also visually organized enough to support attention and information processing. Therefore, future refinement should focus on visual consistency, color contrast, image labeling, and layout balance without reducing the concise character that makes the pocketbook practical.

Overall, the results support the feasibility of the pocketbook as a preliminary learning resource for introducing laboratory equipment in Grade XI biology. The QR-code feature provides an additional pathway for students to access learning videos independently, while the compact format allows the resource to be used before or during practical preparation. However, these interpretations concern product quality, usability perceptions, and accessibility features. Because the present study did not include implementation with a broader sample, pre-test and post-test measurements, a comparison group, or inferential analysis, the results cannot establish that the pocketbook improves students' learning outcomes or laboratory skills.

The quality of the developed pocketbook can also be considered in relation to previous pocketbook development studies. Bahari et al. (2024) reported a validity score of 93.56% and practicality of 98.25% for a QR Code-based pocket book on solar system materials, demonstrating high feasibility and practicality of QR-integrated pocketbook media.

Meanwhile, Qairunisa et al. (2024) reported a Content Validity Index of 1.00 for an electronic pocketbook on plant-like protists, indicating that pocketbook-based media can achieve high content validity when supported by contextual learning resources. Compared with these studies, the present study obtained a validation average of 3.70 on a four-point scale, equivalent to 92.5% when expressed proportionally, and limited-trial response averages of 3.83 and 3.92. These results indicate a similarly high level of preliminary product quality, although direct numerical comparison should be made cautiously because the studies used different instruments, scoring systems, participants, and product characteristics. The present product contributes a different focus by integrating laboratory equipment identification with organ and organ system materials and QR-linked learning videos for Grade XI senior high school biology.

4. Conclusion

Based on the development process and formative testing, the Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students demonstrated very good preliminary quality. The product obtained an average validation score of 3.70, categorized as "very valid," while limited trial stages I and II obtained average scores of 3.83 and 3.92, respectively, both categorized as "very good." These findings indicate that the pocketbook is feasible as a supporting learning resource for introducing laboratory equipment in biology learning. Its practical value is supported by the concise presentation of laboratory equipment, visual representations, information on equipment functions and uses, organ system illustrations, and QR codes linked to supplementary learning videos. The pocketbook can therefore be used by teachers as an additional resource when introducing laboratory equipment and by students as a reference for reviewing equipment before practical activities.

However, this study was limited to the development stage of the ADDIE model and formative limited trials. The study did not proceed to broader implementation and evaluation and did not include pre-test and post-test measurements, a comparison group, or inferential analysis to determine the effectiveness of the pocketbook in improving students' learning outcomes or laboratory skills. In addition, the limited number of trial participants restricts the generalizability of the findings. Therefore, the results should be interpreted as evidence of preliminary product validity, quality, and user responses rather than evidence of learning effectiveness. Future research should proceed to the implementation and evaluation stages with a larger and more diverse sample and employ an appropriate experimental or quasi-experimental design to examine the pocketbook's effectiveness in improving students' laboratory knowledge, practical skills, and learning outcomes.

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How to cite this article:

Sukrianis, R., Darmadi., & Dipuja, D. A. (2026). Development of a Laboratory Equipment Pocketbook on Organ and Organ System Materials for Grade XI Senior High School Students. *Journal of Education and Learning Research*, *4(1)*, 39-48.