Development and Validation of a Medicinal Plant Inventory Booklet as an Effective Biodiversity Teaching Material

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Abstract: This research and development study aimed to produce a booklet on medicinal plant inventory as an alternative teaching material for biodiversity topics, and to evaluate its validity, practicality, and effectiveness. The development process employed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Product testing was conducted on a limited scale involving 19 tenth-grade science students and one biology teacher at SMAN 3 Kalukku. Validity data were obtained from assessments by material and media experts, practicality data were derived from teacher and student questionnaire responses, and effectiveness data were measured through students' cognitive learning outcomes and skill assessments. The results showed that the booklet achieved a validity score of 4.42 (valid) and practicality scores of 98% for teachers and 88.3% for students. Effectiveness was indicated by cognitive mastery and skill performance scores of 68.4% and 67.36%, *respectively (both at the moderate level*). This study implies that the developed booklet can help integrate local biodiversity knowledge into learning, thereby supporting more contextually and meaningfully grounded science education.

Abstrak: Penelitian dan pengembangan ini bertujuan menghasilkan booklet hasil inventarisasi tumbuhan obat sebagai bahan ajar alternatif pada materi keanekaragaman hayati serta mengevaluasi validitas, kepraktisan, dan efektivitasnya. Proses pengembangan dilakukan dengan menggunakan model ADDIE (Analysis, Design, Development, Implementation, and Evaluation). Uji coba produk dilaksanakan dalam skala terbatas dengan melibatkan 19 siswa kelas X IPA dan seorang guru biologi di SMA Negeri 3 Kalukku. Data validitas diperoleh melalui penilaian ahli materi dan ahli media, data kepraktisan diperoleh dari angket respon guru dan siswa, sedangkan data efektivitas diukur melalui hasil belajar kognitif dan penilaian keterampilan siswa. Hasil penelitian menunjukkan bahwa booklet memperoleh skor validitas sebesar 4,42 (kategori valid). Analisis kepraktisan menunjukkan kategori sangat praktis dengan persentase respon guru sebesar 98% dan siswa 88,3%. Efektivitas ditunjukkan oleh ketuntasan belajar sebesar 68,4% dan keterampilan sebesar 67,36% (kategori sedang). Implikasi penelitian ini adalah booklet yang dikembangkan dapat membantu mengintegrasikan pengetahuan keanekaragaman hayati lokal ke dalam pembelajaran sehingga mendukung pendidikan sains yang lebih kontekstual dan bermakna.

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A. Introduction

Biology education at the secondary school level aims to equip students with an understanding of fundamental concepts that serve as the foundation for a comprehensive mastery of biological sciences. One essential topic is biodiversity, which encompasses not only classification, distribution, and utilisation but also the conservation of natural resources. This topic requires a contextual learning approach, as it is closely related to real-life phenomena. However, in reality, students' achievement in this area remains relatively low. This is reflected in their learning outcomes, which often fall short of mastery standards, mainly due to limited access to varied, innovative, and relevant teaching materials (Magdalena et al., 2020; Paramita et al., 2018).

In many schools, teachers still rely heavily on conventional textbooks as the leading learning resource. However, in their role as facilitators, teachers are expected to provide creative media and learning strategies to enhance students' motivation, conceptual understanding, and critical thinking skills (Riyanto, 2015). Field data show that students often struggle to grasp the benefits of biodiversity, particularly medicinal plants. For instance, preliminary observations at SMA Negeri 3 Kalukku revealed that 10 out of 28 tenth-grade science students scored below the minimum mastery criterion in the biodiversity topic. This situation highlights the urgency of developing alternative learning resources that can present the material in a more concrete, engaging, and contextual manner (Julianti et al., 2021).

The availability of alternative learning resources enriched with contextual aspects and local wisdom can improve the quality of learning processes and outcomes (Ratumanan & Rosmiati, 2019). Teaching materials as learning resources are systematically and comprehensively designed to support learning activities, creating a learning environment that allows students to learn well and achieve the expected learning objectives (Cahyadi, 2019).

Teaching materials are part of teachers' efforts to improve the quality of learning. The availability of representative, high-quality teaching materials can enhance students' learning motivation and increase interactions among students, with the materials, and with teachers. The availability of teaching materials allows students to learn independently, deepen their knowledge, and even construct knowledge. The development of teaching materials can also be seen as an effort by teachers and educational units to provide broader services to students to support their development (Ratumanan & Rosmiati, 2019). Based on this, it is known that teachers, students, and learning resources are interrelated and interact in learning. In line with the opinion of Sukatin et al (2019), who state that learning is a process of interaction among learning resources, teachers, and students in a learning environment. According to Arifannisa et al (2023), learning resources can be designed (learning resources by design) to achieve learning objectives effectively and efficiently. Tolentino et al (2023) also argue that teaching materials must be carefully planned and carefully checked for suitability and validity, considering several factors, such as the learning content, examples, and sources used.

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One potential learning material to be developed is a booklet based on the medicinal plant inventory. As a concise, systematic, and easy-to-understand print medium, a booklet offers advantages over other teaching materials by presenting compact information supported with appealing visual illustrations (Fitriasih et al., 2019; Plarisaputri et al., 2016). In line with the opinion of Azizah et al (2022), which states that booklets that are simply designed, colourful, and contain illustrations can attract students' interest and attention. Furthermore, using medicinal plants as booklet content not only provides contextual learning but also introduces local wisdom related to the utilization of biodiversity. Indonesia, as one of the world's megadiverse countries, harbours more than 30,000 species of medicinal plants, yet only a small fraction has been optimally utilised and well documented (Sarno, 2019). Medicinal plant inventories conducted across various regions demonstrate the high potential of local knowledge for integration into biology learning (Hastuti et al., 2022; Herni, 2021). Therefore, developing a booklet from the inventory of medicinal plants is not only an innovative alternative teaching material for biodiversity but also a contribution to preserving ethnobotanical knowledge that is increasingly eroded by modernization.

The integration of biodiversity with local wisdom represents a relatively innovative approach in the development of biology teaching materials at the secondary school level. However, despite the abundance of traditional knowledge related to medicinal plants, most previous studies have predominantly focused on ethnobotanical or pharmacological aspects, while their systematic development and empirical evaluation as teaching resources in formal school learning remain limited. In particular, studies that transform medicinal plant inventories into instructional materials and rigorously examine their validity, practicality, and effectiveness in classroom contexts are still scarce. This condition indicates a clear gap between the richness of local biodiversity knowledge and its pedagogical application in biology learning. Therefore, by introducing a booklet based on medicinal plant inventories, this study addresses the existing gap by integrating local wisdom into formal education, not only to enhance students' cognitive understanding but also to foster environmental awareness, appreciation of local traditions, and a stronger sense of the importance of biodiversity conservation.

The novelty of this study lies in the systematic development of a biology teaching booklet derived from a local medicinal plant inventory that explicitly integrates biodiversity concepts with local wisdom and empirically examines its pedagogical feasibility in formal secondary education. Unlike previous studies that primarily emphasized ethnobotanical documentation or limited their scope to product validation, this study advances the field by implementing the ADDIE development model through the stages of validity, practicality, and effectiveness testing. Furthermore, the booklet incorporates 40 species of locally identified medicinal plants and evaluates not only students' cognitive learning outcomes but also their skill development, thereby providing a more comprehensive contribution to context-based biology learning and biodiversity education.

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Several features differentiate the booklet developed in this study from those in other studies, including a more complete description of biodiversity material accompanied by 40 types of medicinal plants from the inventory, and the booklet's implementation stage. In contrast to the booklet developed by Setyaningsih et al (2019), which only contains sub-material about diversity at the gene, type, and ecosystem levels, and the booklet developed by Paramita et al (2018), which only reached the booklet product validation stage, the level of effectiveness and practicality of the booklet is unknown. The level of validity of the booklet developed is also higher than that of the booklet by Paramita et al (2018), which is 3.46 (moderately valid), with a difference of 0.96.

Accordingly, this study is guided by the following research questions: (1) to what extent is the medicinal plant inventory booklet valid in terms of content and media quality; (2) how practical is the booklet for use by teachers and students in biology learning; and (3) how effective is the booklet in improving students' cognitive learning outcomes and skills in biodiversity topics. Based on these questions, the purpose of this study is to develop and evaluate a context-based biology teaching booklet derived from a local medicinal plant inventory using the ADDIE model, with a focus on its validity, practicality, and effectiveness. The successful implementation of this study is expected to contribute theoretically to the advancement of context-based biology teaching material development and practically to assist teachers in providing alternative learning resources that are more engaging, contextual, and relevant to students' daily lives, while simultaneously supporting the preservation of ethnobotanical knowledge that holds strategic value for both education and environmental sustainability.

B. Method

This study employed a Research and Development (R&D) approach to develop a booklet based on the inventory of medicinal plants and to test its validity, practicality, and effectiveness as a biology learning material. The development model used was ADDIE (Analysis, Design, Development, Implementation, Evaluation), as this model is systematic and emphasizes evaluation at each stage, thereby minimizing errors in the product development process (Sugiyono, 2019). The study was conducted from April to July 2022 during the odd semester of the 2022/2023 academic year. Product development was carried out at the Faculty of Teacher Training and Education, Universitas Sulawesi Barat, Majene Regency. The product trial was conducted at SMA Negeri 3 Kalukku, Mamuju Regency, West Sulawesi. The research subjects consisted of one biology teacher from SMA Negeri 3 Kalukku, serving as the respondent for the practicality test, and 19 tenth-grade science students (Class X IPA) from the same school, serving as participants in the product trial.

Data collection techniques in this study included questionnaires, cognitive learning outcome tests, and alternative assessment sheets. The questionnaires were used to obtain expert-assessed data on material and media validation, as well as to measure teachers' and students' practicality responses to the use of the booklet. The cognitive learning outcome test was administered as a written test comprising 10 multiple-choice and 10 essay

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questions, designed to evaluate the booklet's effectiveness in improving students' understanding. Meanwhile, the alternative assessment sheets were used to assess students' skills through poster-making activities related to biodiversity materials.

Data analysis techniques were carried out in stages, aligned with the assessment's focus. The validity of the booklet was analyzed based on expert validators' questionnaire scores, which were categorized as highly valid to invalid. The expert validators in this study comprised two groups: material experts and media experts. The two expert validators are lecturers in the Biology Education Study Program at Universitas Sulawesi Barat. Material experts are science education lecturers with experience in the field of science and a track record of scientific publications in plant biology. Media experts are expert educators with a track record in learning media. The qualifications of the two validators involved in this study are important to ensure that the booklet developed meets scientific feasibility standards. The validator assessment indicators for assessing the validity of the booklet being developed consist of 26 indicators, including the depth of the material and the novelty of the material according to the student's level of education, suitability of the material to contextual matter, correctness of the concept of the material, use of language, booklet design and clarity of images, accuracy of writing latin names, classification of medicinal plants contained clearly, accuracy of presentation of references, and each image has a reference.

The total score obtained from the validators is then analyzed to obtain the average validity score using the following Wirawan (2016) formula.

$$\chi = \frac{\Sigma x}{n}$$

Description:

χ = Average validation score

Σx = Total score of validators

n = Number of validators

The average validity score obtained refers to the qualifications for achieving booklet validity, as presented in Table 1 below, based on Sugiyono (2019).

Table 1. Guidelines for the Conversion of Average Validity Scores

Rating Scale	Qualification
4,5 ≤ M ≤ 5,0	Highly Valid
3,5 ≤ M ≤ 4,5	Valid
2,5 ≤ M ≤ 3,5	Moderately Valid
1,5 ≤ M ≤ 2,5	Less Valid
M ≤ 1,5	Invalid

Practicality was analyzed using the percentage of questionnaire scores from teachers and students, grouped into categories ranging from very practical to very impractical. The practicality value was obtained from the analysis of teacher and student assessment

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questionnaire data. The practicality questionnaire score was determined using a Likert scale, with the questionnaire assessment criteria listed in Table 2 below.

Table 2. Criteria for Assessing the Practicality Questionnaire

Rating	Description
5	Strongly Agree
4	Agree
3	Somewhat Agree
2	Disagree
1	Strongly Disagree

The questionnaire assessment scores are then converted to percentages and correspond to the practicality level qualification in Table 3 below.

Table 3. Practicality Level Conversion Guide

Rating Score	Qualification
80% - 100%	Highly Practical
66% - 79%	Practical
56% - 65%	Less Practical
40% - 55%	Impractical
30% - 39%	Highly Impractical

Effectiveness was analyzed based on students' cognitive learning achievement using a Minimum Mastery Criterion (KKM) of 67, as well as through the assessment of students' poster-making skills, which were categorized from high to low. The research flow is shown in Figure 1 below.

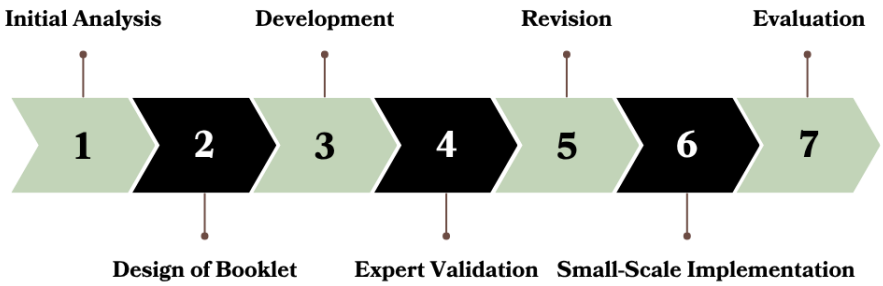

Figure 1. Research Flow Diagram

Figure 1. Research Flow Diagram presents the stages of the research and development process using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation. The analysis stage identifies learning needs, curriculum demands, and the potential of local medicinal plants as contextual learning resources. The design stage focuses on planning the booklet structure, content, and assessment instruments. The development stage involves producing the booklet prototype and conducting expert validation followed by revisions. The implementation stage includes

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limited-scale classroom trials to collect data on practicality and effectiveness. Finally, the evaluation stage analyzes the results of validity, practicality, and effectiveness to determine the feasibility of the booklet as a context-based biology teaching material.

C. Result

This study produced a final product in the form of a teaching booklet based on the inventory of medicinal plants, developed through the stages of the ADDIE model, which include analysis, design, development, implementation, and evaluation. The developed booklet meets the criteria of validity, practicality, and effectiveness, making it feasible to be used as an alternative teaching material in biology learning, particularly in the topic of biodiversity. The research findings are presented based on the results of validity, practicality, and effectiveness tests, as follows.

Booklet Validity and Test Instruments

Two expert validators conducted the booklet's validation to assess its content and design—the validation results are shown in Table 4 below. In addition, the test instruments, which consisted of multiple-choice and essay questions, were validated by two validators and confirmed to be appropriate for measuring the effectiveness of the booklet, with only minor adjustments required to the wording and cognitive level of the questions.

Table 4. Validation Results of the Booklet and Test Instruments

No	Item	Validator	Validation Level	Description
1	Validation of the booklet	Expert validator 1	4,69	Highly valid
2	Validation of the booklet	Expert validator 2	4,15	Valid
3	Validation of the test instrument	Expert validator 1	4,65	Highly valid
4	Validation of the test instrument	Expert validator 2	4,2	Valid

Table 4 above shows the level of validity of the booklet obtained from expert validator 1 of 4,69 (highly valid) and expert validator 2 of 4,15 (valid), with an average validation score of 4,42 (valid), indicating that the booklet can be used in teaching with some minor revisions according to the validators' suggestions. After these revisions were made, the booklet was printed and utilized in the trial phase. Meanwhile, the validity level of test questions from validator 1 was 4,65 (highly valid), and that from validator two was 4,2 (valid).

Practicality of the Booklet

The practicality level of the booklet was obtained through teacher and student response questionnaires after its use in the learning process. The analysis results are presented in Table 5 below.

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Table 5. Practicality Level of the Booklet

No	Questionnaire	Practically Level	Description
1	Teachers responses	98%	Highly practical
2	Students responses	88,3%	Highly practical

Table 5 above shows the level of practicality of the booklet, based on teacher responses (98%; highly practical) and student responses (88,3%; highly practical). These findings indicate that the booklet is easy to use, aligns with learning needs, and attracts students' interest in studying biodiversity material.

Effectiveness of the Booklet

The effectiveness of the booklet was analyzed based on students' cognitive learning outcomes and skills. The results of the cognitive test showed that 68.4% of students (as shown in Figure 2) met the Minimum Mastery Criteria (KKM 67), indicating that the booklet is efficacious in improving understanding of biodiversity concepts.

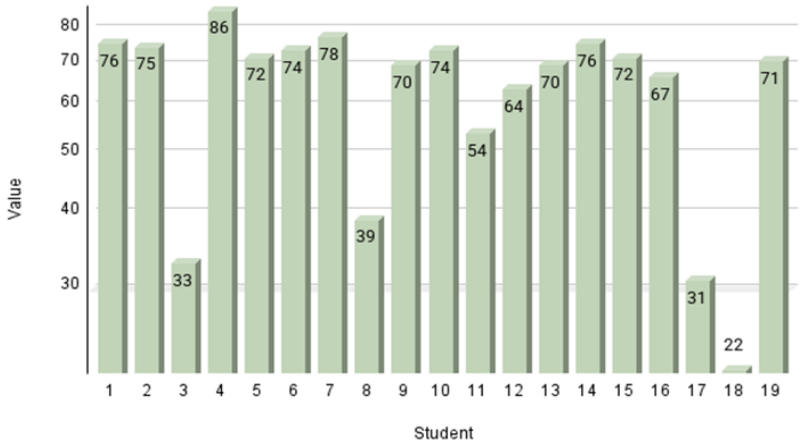

Figure 2. Bar Chart: Students' Cognitive Learning Outcomes

The students' cognitive learning results, shown in the bar chart in Figure 2, indicate that 13 students achieved scores above the KKM, with a range of 67-86. Meanwhile, six other students still obtained scores below the KKM. Several factors contribute to the six students' incompleteness, including varying abilities in receiving lesson material, students not paying attention to the teacher during the learning process, and students not being accustomed to answering questions at higher cognitive levels (C3–C5).

In addition, the assessment of students' skills through poster-making yielded an average score of 67.36% (as shown in Figure 3), placing it in the moderate category. This indicates that the booklet not only contributes to cognitive development but also promotes students' skill development through project-based activities.

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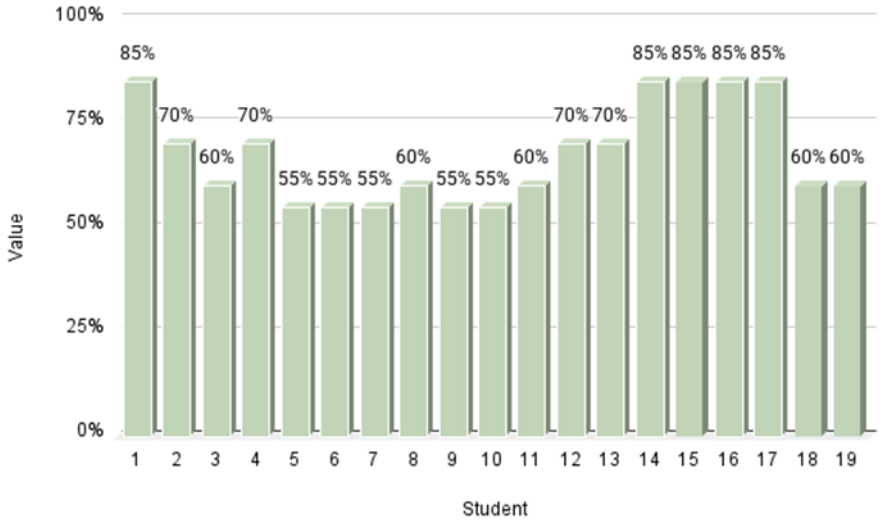

Figure 3. Bar Chart Students' Skill Scores

The student skill scores, shown in Figure 3 above, indicate that five students have a high skill level. Meanwhile, 14 other people are at a medium skill level. This indicates that the average student's skills after using booklets as teaching materials are in the moderate category.

D. Discussion

The results of this study indicate that the booklet developed from the medicinal plant inventory meets the criteria of validity, practicality, and effectiveness, making it feasible to use as an alternative learning resource for biodiversity material. These findings align with the fundamental concept of learning material development, which emphasizes presenting information in a concise, clear, and engaging manner to increase students' interest and comprehension (Magdalena et al., 2020). In terms of validity, expert validators' assessments produced an average score of 4.42 (valid). This high validity value is consistent with the findings of Paramita et al (2018), Fitriasih et al (2019), and Panjaitan et al (2021), who developed booklets on fern identification and obtained very high validity. This similarity indicates that booklets, as print-based media, have great potential as biology teaching materials because they can visualize abstract concepts in more concrete terms. Variations in design, content, and assessment indicators employed may Influence differences in validity levels across studies. This suggests that the success of booklet development is determined not only by its content but also by its visual aspects, structural presentation, and alignment with students' needs.

The booklet implementation involved both students and teachers as trial subjects, who served as users during biology lessons on biodiversity. To assess practicality, data were collected through teacher and student response questionnaires. According to Purwanti et al (2014), a booklet is considered practical and feasible if it receives responses within the 66%–100% range. The questionnaire analysis showed that the practicality level based on teacher responses reached 98% (efficient), while student responses also scored 88.3% (efficient).

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These findings suggest that the developed booklet is convenient for use as a teaching material. This is consistent with the view of Fitria et al (2017), who argued that booklets are considered practical if both teacher and student responses fall at least in the good category and can enhance student learning motivation.

Unlike the study by Paramita et al (2018), which was limited to the product validation stage and did not report practicality data, the present study provides a more comprehensive picture of user acceptance. The findings are also consistent with Setyaningsih et al (2019), who developed a booklet based on local potential for biodiversity topics, with teacher responses reaching 90.4% and student responses 90.0%, both categorized as very practical. The high positive responses in both studies are likely due to the booklet's appealing design, illustrations, and easy-to-understand presentation, making it more effective than conventional teaching materials. The main distinction between the booklet developed in this study and that of Setyaningsih et al (2019) lies in the scope of the material: their booklet focused only on the subtopics of genetic, species, and ecosystem diversity, whereas the booklet in this study presents a more comprehensive discussion of biodiversity, supplemented by an inventory of 40 species of medicinal plants.

Indonesia has around 30,000 plant species, of which 940 are medicinal plants. As many as 250 types of medicinal plants are used as local herbal medicine. The use of medicinal plants in West Sulawesi has been practiced for generations for treatment, rooted in belief in their properties, thereby forming habits. This habit has prompted some people, especially the elderly in West Sulawesi, to plant various medicinal plants around their home gardens (Kumontoy et al., 2023). One of them is black ginger (*Curcuma aeruginosa* Roxb.), also called 'Kunik Malotong' in the Mamasa language, which is believed to treat stomach aches, asthma, and coughs, and to increase appetite. Therefore, an inventory of 40 medicinal plant types is needed to serve as a source of information for the community, especially the younger generation, as an effort to preserve the ethnobotanical knowledge of medicinal plants in West Sulawesi.

The effectiveness of the medicinal plant inventory booklet as an alternative teaching material for biodiversity was measured through students' cognitive learning outcomes and skills. Further analysis indicated that the booklet's effectiveness rate was 68.4%, which was categorized as effective as a teaching material. The effectiveness of the booklet's teaching materials can be influenced by its attractive design, which uses Canva's element feature. Canva includes images, as well as a contextual learning approach. According to Widiastuti (2020), context-based teaching materials can enhance students' understanding of the material and help them connect their knowledge to real-world contexts.

Differences may have contributed to some students' lack of mastery in understanding the material and to low levels of concentration during lessons. This aligns with Aprilia et al (2013), who stated that students possess varying levels of intelligence that affect cognitive outcomes. Moreover, based on teacher interviews, students were not accustomed to answering questions at higher cognitive levels (C3–C5), as they were more frequently exposed to lower-level questions (C1–C2 or *Low Order Thinking Skills*). Subject

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teacher refers to the diversity of students' cognitive abilities, which are at a low-medium level, so teachersthe tends to provide only low-medium-level learning materials and questions. This results in students not yet mastering the HOTS questions (C3-C5). This situation influenced their learning achievement, even though overall, the booklet was effective. This corresponds with Fatmawati (2016), who asserted that teaching materials are considered adequate if they help achieve learning objectives, as indicated by students' attainment of the KKM.

The results of this study are also consistent with those of Muswita et al (2021), who reported that booklets were highly effective in improving learning outcomes on fern material, with an effectiveness level of 69.79%. Similarly, Melati et al (2020) found that booklets based on local wisdom in the Plantae material were effective in improving student learning outcomes. Their effectiveness was supported by an attractive design, illustrations, and a concise presentation of material, making the content easier to understand. This is reinforced by Christie & Lestari (2019), who argued that booklets designed with appealing visuals and concise, clear information can increase reader interest and comprehension. Likewise, Hanifah et al (2020) found that booklets improve learning outcomes because of their appealing format and simplified presentation. Nonetheless, this study acknowledges limitations, particularly that students were not yet accustomed to evaluation questions at the C3–C5 levels.

In addition to cognitive scores, the booklet's effectiveness was demonstrated through student skill assessments. Using an alternative evaluation instrument in the form of poster creation, the average effectiveness score was 67.36 (moderate skill). This shows that the booklet not only supports the cognitive aspect but also fosters students' skills. Rahmawati & Trimulyo (2022) emphasize that learning should balance knowledge and skill competencies, and the booklet thus serves a dual function in supporting both areas.

The effectiveness of the booklet was also influenced by the contextual learning approach applied during its implementation. Widiastuti (2020) asserted that context-based teaching materials can enhance understanding of concepts and help students connect the material to real-life situations. This aligns with Hardiyanto et al (2013), who found that contextual learning approaches improved students' cognitive outcomes. Therefore, it can be concluded that the medicinal plant inventory booklet is not only effective in improving cognitive learning outcomes but also supports students' skill development through contextual learning approaches.

E. Implication

Theoretically, this study reinforces the concept of instructional material development, emphasizing the importance of presenting content in a concise, clear, and engaging manner to enhance students' understanding, and it also demonstrates that simple printed media such as booklets remain relevant in biology learning. Context-based learning also increases students' understanding of concepts. From a practical perspective, the booklet on medicinal plant inventory can be used by teachers as an alternative learning resource,

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integrated into the learning implementation plan to enrich biodiversity instruction, support cognitive learning outcomes, and foster students' skills through contextual activities such as poster creation. Meanwhile, the social implication lies in the booklet's contribution to introducing local potential in the form of medicinal plant diversity, thereby fostering awareness of the importance of conserving biological resources, increasing local biodiversity literacy, and cultivating appreciation for local wisdom.

F. Limitation and Suggestion for Further Research

This study presents several limitations that warrant attention. First, the research design was confined to a specific context with a relatively small sample size based on a single school, which limits the generalizability of the findings to a broader population. Second, the measurement of students' learning outcomes focused primarily on basic to intermediate cognitive levels, meaning Higher-Order Thinking Skills (HOTS) were not optimally assessed. Furthermore, the limitations of the HOTS instrument used, combined with the short intervention duration of only two meetings, likely hindered students from developing optimal conceptual mastery. Third, the booklet was limited to a printed format, thereby constraining accessibility and restricting its use in the digital era. Collectively, these factors may impact the external validity and practical utility of the findings within diverse biology learning contexts.

In light of these limitations, future research should employ designs with broader coverage, including larger sample sizes and greater school variation, to ensure findings are more representative and applicable. Moreover, evaluation instruments should specifically target the assessment of Higher-Order Thinking Skills to provide a comprehensive view of the instructional material's effectiveness. Future studies should also consider adapting the booklet into interactive digital formats, such as e-books or multimedia applications, to enhance accessibility and student engagement. Consequently, continued development will strengthen validity, broaden generalizability, and better address the challenges of biology education in the modern digital landscape.

G. Conclusion

This study successfully developed a biology teaching booklet based on a local medicinal plant inventory using the ADDIE model. The findings indicate that the booklet meets the criteria of validity, practicality, and effectiveness as an alternative learning resource for biodiversity topics at the senior high school level. Expert validation results show that the booklet has a high level of content and media validity, while responses from teachers and students demonstrate that the booklet is highly practical and easy to use in classroom learning.

Furthermore, the implementation of the booklet contributes positively to students' cognitive learning outcomes and skill development, as reflected in the achievement of learning mastery and moderate skill performance. Although some students have not yet reached optimal learning outcomes, the overall results indicate that the booklet supports a

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more contextual and engaging learning process. By integrating local wisdom and biodiversity concepts, the booklet not only enhances students' understanding of biological content but also fosters awareness of the importance of conserving local biological resources.

Overall, this study provides empirical evidence that teaching materials based on local potential can be effectively integrated into formal biology education. The developed booklet can be utilized by teachers as a context-based learning resource and serves as a reference for further development of instructional materials that incorporate local wisdom to support meaningful and sustainable learning.

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