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DEVELOPMENT OF A NON-TEXTBOOK LEARNING MATERIAL BASED ON THE CHARACTERIZATION OF PITCHER PLANTS (NEPENTHES SP.) IN NORTH SUMATRA AS A SOURCE OF KNOWLEDGE ENRICHMENT

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ABSTRACT

This research aimed to develop a non-textbook on the characterization of pitcher plants (*Nepenthes* sp.) in North Sumatra as an alternative educational media and knowledge enrichment source for the general public. The research employed a Research and Development (R&D) approach using the 4D model (define, design, develop, disseminate) to systematically identify user needs, design content, validate the product, and evaluate its effectiveness. Field data were collected from six regencies in North Sumatra, involving morphological observations of 37 characters with 72 sub-characters across various species. The developed non-textbook, *Exploring the World of North Sumatran Pitcher Plants*, comprises 120 pages with carefully designed layout, typography, and illustrations. Expert validation across content, language, presentation, and graphic aspects indicated that the book met high-quality standards. A limited-scale trial with 20 general public participants further confirmed its feasibility, with an average assessment score of 85.11 (excellent). During dissemination, 60 participants from Medan, the research regencies, and North Sulawesi underwent a pretest–posttest evaluation, showing a substantial increase in knowledge, with an average N-gain of 1.37 (high). The research demonstrates the effectiveness of the developed non-textbook in enhancing public understanding of *Nepenthes* species while promoting biodiversity literacy and conservation awareness.

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INTRODUCTION

The learning ability is a fundamental human potential that enables individuals to improve themselves through various means, both independently and with the help of others such as educators, study groups, or discussions (Chairul, 2014). Education and knowledge play a crucial role in understanding new concepts and enhancing self quality. One factor supporting successful learning is the availability of learning resources. Most human knowledge is conveyed in written form, making books an important and primary media for learning activities (Mikk et al., 2022). However, textbooks have limitations because they are structured according to a specific curriculum. Therefore, supplementary books that are curriculum-free, known as non-textbooks that are needed accordance to Permendikbud No. 8 of 2016. Non-textbooks function as enrichment materials that broaden readers' insights into science, technology, and the arts (Wardana et al., 2015).

One important topic that needs to be included in non-textbooks is Indonesia's biodiversity, particularly rare flora such as the pitcher plant (Nepenthes sp.). Observations conducted in three locations in Medan City (Unimed Digital Library, Gramedia Gajah Mada, and the Medan City Library and Archives) showed that the absence of non-textbooks specifically discussing pitcher plants. The scarcity of reading materials has led to a low level of public knowledge about this plant. A survey involving 30 respondents from the general public with at least a bachelor's degree (S1) in Medan yielded an average knowledge score of 40.33 and an average score of 39.72 for ownership of reading materials, both categorized as low.

The pitcher plant is a unique carnivorous plant with high ecological and economic value. For example, the tips of its leaves form pitchers that attract and digest insects as a source of nitrogen (Bohn & Federle, 2004). The varied pitcher morphology and attractive colors make it an exotic ornamental plant with economic value. Furthermore, this plant has potential traditional uses, such as for treating stomach aches and eye pain, and its stems can be used as rope (Listiawati & Siregar, 2008). This plant thrives in nutrient-poor habitats with relatively high humidity (Mansur, 2006).

According to the International Union for Conservation of Nature (IUCN, 2025), approximately 10 species of the genus Nepenthes are categorized as Critically Endangered (CR), 15 species are Endangered (EN), and 20 species are Vulnerable (VU). Globally, around 45 Nepenthes species are listed as threatened. These figures indicate that the Nepenthes genus faces serious conservation threats, particularly on Sumatra Island, one of the centers of its diversity.

The decline in Nepenthes populations is mainly caused by various human activities such as forest fires, illegal logging, conversion of forest land to residential or plantation areas, and uncontrolled commercial exploitation (Azwar et al., 2006). Therefore, this plant is included in the protected species list under Undang-Undang No. 5 of 1990 concerning the Conservation of Biological Resources and Ecosystems and Peraturan Pemerintah No. 7 of 1999 concerning Protected Species of Plants and Animals. These protection efforts aim to ensure the sustainability of the species to prevent extinction in their natural habitat.

However, these conservation initiatives will not be effective without public awareness and participation. The lack of community understanding regarding the importance of pitcher plant conservation highlights the need for accessible and informative educational media. Preliminary observations indicate that the public supports the development of a non-textbook on pitcher plants, with an average support score of 85.83. This finding underlines the necessity of developing a non-textbook on Nepenthes species characterization as an alternative educational media and knowledge enrichment source for the general public.

The development of this alternative media, a non-textbook, was conducted using Research and Development (R&D) research, which refers to the 4D model (Define, Design, Develop, Disseminate) to systematically

identify user needs, design learning content, validate the product, and evaluate its effectiveness (Thiagarajan et al., 1974). This type of research was chosen because it has been proven to produce learning products that are not only theoretically sound but also effective in increasing user knowledge and engagement in educational and community literacy contexts (Gall et al., 2007).

Based on the background, this research was conducted to develop a non-textbook based on characterization of pitcher plant (Nepenthes sp.) in North Sumatra. The research results are expected to be a non-textbook of knowledge enrichment that can be used as an alternative media and source of supporting knowledge about pitcher plants in North Sumatra for the general public.

RESEARCH METHODOLOGY

This research was conducted from May to September 2019 to collect data for the development stage, while the dissemination stage was conducted twice in October 2019 and September 2025. Field research was conducted in six regencies in North Sumatra, South Tapanuli Regency (Sayurmatinggi District), Central Tapanuli Regency (Pandan District), Humbang Hasundutan Regency (Bakti Raja District), Toba Samosir Regency (Taman Eden 100), Dairi Regency (Sicike-cike Natural Tourism Park), and Samosir Regency (Harian and Onan Runggu Districts).

The type of this research was Research and Development (R&D). Research and Development (R&D) is a research approach used to develop non-textbook materials by testing their feasibility and effectiveness. The characterization of pitcher plants (*Nepenthes* sp.) in North Sumatra served as the foundation for developing non-textbook learning materials based on Thiagarajan's 4D development model.

The define stage aims to identify public needs for non-textbook learning materials and to gather relevant product information. This stage involved conducting a public knowledge survey in Medan using a questionnaire and observing the availability of non-textbook materials on pitcher plants in the Unimed Digital Library, Gramedia Gajah Mada, and the Medan City Library and Archives.

The design stage follows the definition stage, compiling an outline for the non-textbook, selecting media as additional sources of knowledge, and developing instruments for testing the book's suitability and usability. These include a product validation sheet, a questionnaire, and multiple-choice questions. The validation sheet consists of three types: material expert validation, language expert validation, and layout expert validation, which assess aspects of material, presentation, language, and graphics.

The develop stage consists of five steps, research preparation, observation, data processing, no textbook preparation, and product validity testing. The preparation stage includes conducting a site survey, selecting observation locations in six districts of North Sumatra, and preparing the necessary tools and materials. The research involved observing the presence of pitcher plants, collecting specimens, conducting morphological observations of 37 characters with 72 sub characters, and identifying plant species based on relevant literature. Morphological character data were converted into binary data and analyzed using the UPGMA clustering method to determine relationships among species.

The non-textbook was developed based on the observation results, validated by experts in subject matter, language, and layout design, revised according to feedback, and subsequently tested on a limited scale with 20 participants of the general public. The validation results were also used to develop a multiple-choice instrument for use during the dissemination stage.

The dissemination stage aimed to distribute the book and evaluate its effectiveness in enhancing public knowledge. The book was provided to 60 participants of the general public in Medan and the research sites, who were given a seven-day independent reading period. Effectiveness was assessed using a one-group pretest–posttest design with 25 multiple choice

questions developed from the book's content. The pretest was administered before reading the book, and the posttest was administered afterward. Product dissemination was carried out among the general public in Medan City, North Sulawesi, and all regencies where the research sites were located.

RESULTS AND DISCUSSION

Based on the data obtained from define, design, and develop stages, the characterization result of *Nepenthes* plants in North Sumatra were developed into a book. The non-textbook developed is titled *Exploring the World of North Sumatran Pitcher Plants*. The book measures 17.6 cm × 25 cm (B5 size), which is a standard and recommended size for educational non-textbooks because it provides an optimal balance between reading comfort and page space efficiency. It consists of 120 pages arranged with a proportional layout that adheres to readability principles.

Seven types of fonts are used in the book, Gill Sans MT, Harlow Solid Italic, Papyrus, Matura MT Script Capitals, Gill Sans MT Condensed, Chiller, and Comic Sans MS. Among these, Gill Sans MT is the most frequently used because of its simple, bold, and easily readable appearance, particularly for the main text and descriptive explanations. The selection of these fonts aligns with the principles of non-textbook design and typographic recommendations for educational materials, which emphasize readability and suitability for the target audience (Pusat Kurikulum dan Perbukuan, 2018).

The developed non-textbook consists of a cover, preface, table of contents, list of figures, and five main chapters covering the introduction, characteristics, distribution, phylogenetic relationships, and diversity of *Nepenthes* plants in North Sumatra. The final section of the book includes a bibliography, glossary, and author biography as closing components.

The feasibility of the non-textbook was assessed through a validation process conducted by three experts, a material expert for content and presentation aspects, a language expert for linguistic aspects, and a layout design expert for graphical aspects. This validation aimed to ensure that the non-textbook met quality standards in terms of content accuracy, language clarity, and visual design, making it suitable for use as an alternative learning resource for the general public. The assessment results from each expert are presented in Table 1.

The results of the material expert's assessment on the content aspect showed an average score of 85.71, receiving an excellent predicate and categorized as eligible. The evaluated sub-aspects included the relevance of content to the readers, accuracy of legal material, originality, currency, and sources of material. This finding aligns with the view of Gall, Gall, and Borg (2020) that content feasibility is determined by the accuracy, relevance, and currency of sources, and is consistent with the BSNP (2014) guidelines, which emphasize the importance of scientific accuracy and validity in content evaluation.

Table 1. Results of the Assessment on the Content, Presentation, Language, and Graphic Aspects of the Book

Assessment Aspect	Main Sub-Aspects	Average Score	Predicate	Category
Content	Relevance of material description to the readers, accuracy of legal content, originality and validity of material, material updates, and sources of information	85.71	Excellent	Eligible

Presentati-on	Presentation technique, material utilization, and presentation feasibility	90	Excellent	Eligible
Language	Language use, accuracy of writing and terminology, coherence and logical flow of ideas	96	Excellent	Eligible
Graphics	Book cover design, content layout design, typography design, and illustration design (images, tables, graphics)	83.47	Excellent	Eligible

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For the presentation aspect, the book obtained a score of 90, also categorized as excellent. The sub-aspects evaluated included presentation technique, material utilization, and presentation feasibility. This result indicates that the book was systematically organized and easy to understand, in accordance with the Depdiknas (2008) guidelines and the perspective of Sugiyono (2019), which emphasize that an effective presentation must be communicative, structured, and supportive of learning objectives.

In the language aspect, validation by the language expert resulted in an average score of 96, with an excellent predicate and eligible category. This indicates that the book employs communicative language that adheres to the conventions of popular scientific writing and is easily comprehensible to a wide range of readers. This is supported by the linguistic criteria for literacy material development proposed by Tarigan (2013), who highlights the importance of readability, clarity of terminology, and suitability of language style to the target audience. Furthermore, according to Depdiknas (2008), the use of communicative and standard language is a key indicator in assessing the feasibility of educational non-textbooks.

Meanwhile, in the graphic design aspect, the validation results showed an average score of 83.47, with an excellent predicate and eligible category. This score indicates that the book's visual design was attractive and proportional, enhancing material clarity and stimulating reading interest. This finding is consistent with the BSNP (2014) guidelines, which state that graphic aspects play a crucial role in increasing visual appeal and communication effectiveness in educational books. Similarly, research by Maier (2024) found that proportional and consistent graphic design can improve readers' motivation and comprehension of book content.

Results of the Pilot Study

This section presents the findings obtained from the limited-scale trial conducted with general readers. limited trial of the non-textbook was conducted involving 20 participants of the general public in Medan City, each with a minimum education level of a Bachelor's degree (S1). The purpose of this activity was to assess the quality and feasibility of the book from the perspective of the general public. The evaluation covered four aspects, content, presentation, language, and

graphics, accompanied by comments and suggestions regarding the developed book.

Table 2. Results of the Book Assessment by the General Public

No	Assessment Aspect	Score	Predicate	Category
1	Content	84.4	Excellent	Eligible
2	Language	84.25	Excellent	Eligible
3	Presentation	87	Excellent	Eligible
4	Graphics	86.33	Excellent	Eligible
	Average	85.11	Excellent	Eligible

The results of the public assessment showed an average score of 85.11, earning an excellent predicate and categorized as eligible. The scores for each evaluation aspect are presented in Table 2, while the visualization of the assessment results is shown in Figure 1. Although there were slight variations among aspects, the book overall received an excellent rating across all components, indicating that it is feasible for use by the general public.

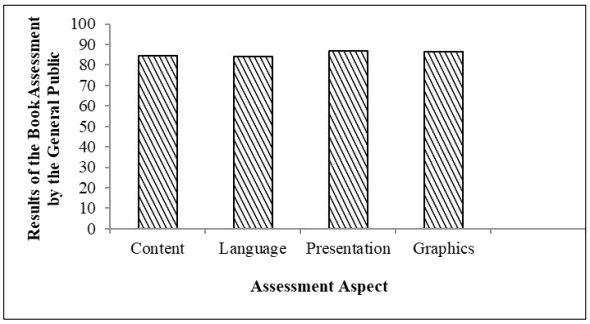

Figure 1. Graph of Book Assessment Results by the General Public

The developed non-textbook was validated by expert validators and declared feasible. After a limited trial with the general public, the next stage was the disseminate of the book. The non-textbook was disseminated to participants of the general public with a minimum education level of a Bachelor's degree (S1).

The dissemination involved administering pretests and posttests to 36 participants, consisting of 18 participants from Medan City, 18 participants from all regencies in the research area, and 24 participants from North Sulawesi. The pretest was conducted before reading the book, while the posttest was administered after completing the book. Both the pretest and posttest used the same set of 25 multiple-choice questions, which had been validated by experts and declared feasible. The results of the pretest and posttest assessments among the general public are presented in the table below.

Table 3. Pretest and Posttest Data of the General Public

Source of Data	Total Score	Overall Score
	Pretest	Posttest
General Public in Medan City	130	306
General Public in Research Regencies	142	334
General Public in North Sulawesi	160	410
Total	432	1050
Average Score	29.03	70.1

The implementation of the non-textbook among the general public demonstrated a significant improvement, as indicated by the average posttest score of 70.1, which exceeded the average pretest score of 29.03. Analysis showed that participants from Medan City, the research regencies, and North Sulawesi experienced an increase in knowledge about *Nepenthes* of 41.07 points on average.

This overall improvement was reflected across all sample locations. The highest score improvement was observed among participants in the research regencies, with an increase of 42.7 points, while participants in Medan City and North Sulawesi showed improvements of 39.1 and 41.6 points, respectively. The comparison of average pretest and posttest scores for the general public is illustrated in Figure 2 below.

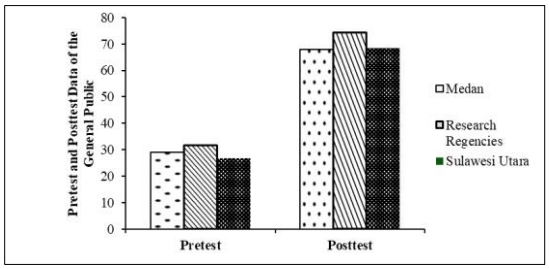

Figure 2. Graph of Pretest and Posttest Data of the General Public

These results indicate that the implementation of the non-textbook is effective in enhancing the general public's cognitive about *Nepenthes*. This finding aligns with Nieveen (2010), who stated that the effectiveness of a developmental product can be evaluated based on improvements in users' learning outcomes following an intervention. It is further supported by Plomp (2013), who emphasized that an increase in posttest scores compared to pretest scores is a key indicator of the success of a developmental product in improving users' knowledge and understanding.

CONCLUSION

Based on the results of the research and validation, it can be concluded that the non-textbook entitled *Exploring the World of Pitcher Plants in North Sumatra* is deemed feasible. This is supported by the average scores from subject matter experts at 87.86, language experts at 96, and layout design experts at 83.47, all categorized as feasible. A pilot study among the general public also showed an average score of 85.11, which is considered feasible.

This non-textbook has proven effective in enhancing the knowledge or cognitive understanding of the general public regarding pitcher plants, particularly in North Sumatra, with an average gain score of 1.37, which is categorized as high. Its effectiveness is further confirmed by the significant differences between the pretest and posttest scores of the pilot study participants.

Therefore, this non-textbook is suitable to be used as an alternative educational media and a scientific information source for the general public in learning about pitcher plants especially in North Sumatra.

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