

DEVELOPMENT OF A FIELD GUIDEBOOK FOR POLLINATOR INSECTS ON PALAWIJA PLANTS IN DOLAT RAYAT DISTRICT

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ABSTRACT

This study was aimed to determine the feasibility of a field guide book for pollinating insects of crop plants in the Subdistrict of Dolat Rayat, Karo District, which is suitable for undergraduate students majoring in Biology. This research is development research with a 4D model (Thiagarajan) which consists of 4 stages, namely: define, design, develop, and disseminate, in research only up to the developing stage. The field guidebook developed was validated based on the content aspects and presentation, scored 94% or very feasible, while the learning design was scored 90% (very feasible) and the graphic 83% (very worthy). The Entomology lecturers' responses were 68% (feasible). The results of individual trials for the field guidebook were 92% (very feasible), 91% (very feasible), and 92% (very feasible) in the larger group. That the field guide book for pollinator insects in crop plants for the Subdistrict of Dolat Rayat is very feasible thus can be used by students as a guide book to learn to recognize pollinator insects of the crop plants in the Dolat Rayat District.

Introduction

Insect ecology is studied in the Entomology course ([Gullan & Cranston, 2014](#)). Entomology is an elective course that must be taken by 5th-semester students. The basic competence achieved by students in this course is the ability of students to analyze the role of insects in the ecosystem and for humans, classify and identify insects. In the Entomology book used by 5th-semester students at Medan State University, the insect material studied includes insect structure, insect life cycle, insect identification and classification, insect ecology, the role of insects and collection methods, and insect propagation ([Sudibyo, 2019](#)). The role of insects in an ecosystem is also an important matter discussed in the Entomology material.

The lack of references to research on pollinating insects such as field books for student use is evidenced by journals and research articles on pollinating insects in the form of several field books. The lack of research on pollinating insects in the forest causes students to only know a few types of pollinating insects, this is obtained from

previous research journals and because in urban areas there are not as many plants as in forests, to overcome this, students tend to choose forests as a place for insect research. pollinator for field books to be used.

It was found that there was a difference between the practical manual book and the actual situation, this was obtained when doing field observations and matching it with the practicum manual that the students had. The ineffectiveness of the research location in the practicum manual used by students, with the ineffective location of the research location in the practicum manual for students, the students tend to choose the forest as the location for pollinating insect research for field manuals. The low experience of students in calculating the diversity of pollinating insects is obtained from observations made on students, with the existence of this field guide book can help students in calculating the diversity of pollinating insects and identifying types of pollinating insects.

Given the important role of pollinating insects in the ecosystem, it would be very good if the course was enriched with an introduction to pollinator insects. Therefore, a field practicum guide is also needed to get to know these pollinating insects. The importance of developing field manuals helps in the learning process. Broadly speaking, it is filling the shortcomings or the absence of field manuals contained in the entomology course, especially for pollinating insects. With the help of field manuals, students will find it easier to understand insects, especially pollinator insects in Malawi plants. Therefore, it is very important to develop a field manual.

This broad enough material must be supported by the existence of learning tools such as means of identification that support learning. A quality learning process can be pursued, one of which is to improve learning facilities. The quality of good learning facilities can affect the learning activities carried out by educators and students ([Wahono, 2014](#)). This kind of learning process is expected in higher education ([SS & SE, 2013](#)). The material of pollinator insects in Malawi plants which are packaged into field books can be used as a means of enhancing students' insight and cognition, this field book can also be used as a supporting book during field lectures and practicum.

Research Methods

Research on pollinating insects was carried out in Dolat Rayat Village, Sugihen Village, and Ujung Sampun Village (Dolat Rayat District, Karo District) as the first location and as the second location for the Biology Department of FMIPA, the State University of Medan, which is located on Jalan William Iskandar Pasar V-Postal Code 20221 This research will be conducted in January-March 2021.

The subjects of this development research are Biology undergraduate students who have taken the Entomology course, lecturers of Entomology courses, and expert validators in their fields totaling 3 people consisting of material expert validators, learning design expert validators and layout design expert validators, postgraduate qualifications, and serving. minimum for 5 years.

This type of research is research and development which is used to produce certain products and to evaluate certain products. In this study, Thiagarajan used the Four-D development model which was modified to the development stage ([Mutia et al., 2020](#)).

The individual group assessment consisted of 6 students of Biology at the State University of Medan, 10 students of the Biology department at the State University of Medan and a limited group assessment of 1 class from the Biology students of the State University of Medan was limited to 28 students (to students majoring in semester Biology. 6).

In this research, Thiagarajan uses a 4-D model which consists of 4 stages, namely: Define, Design, Development, and Dissemination, but in this study only up to the Development stage. The development of this field guidebook is based on the research carried out. The research procedures carried out in product development research are as follows.

A. Define

The defining stage is useful for determining and defining needs in the learning process and gathering various information related to the product to be developed. The product developed is aimed at Biology students at the State University of Medan in the Entomology course.

This stage begins with a student needs analysis, RPS analysis, and field observations.

B. Design

After completing the defining stage, the design stage is then carried out. This design stage aims to help students understand more easily about insects, especially pollinator insects in Malawi a plant and the arrangement of their instruments. The media chosen as a source of additional knowledge for students is a research-based field guide book presented in printed form. After selecting the media, an initial draft of the field guidebook was developed. The initial design was in the form of an outline for the field guidebook that was developed.

C. Development

The product development stage begins with the collection of materials, management of materials, and finally the initial production or publishing stage. The collected materials are managed by the validation team in the form of design, content, and materials. After being validated by a team of experts, the researcher will improve the feasibility of the product again until it reaches the desired feasibility. The material planning in the field manual is following the facts in the field. The learning design is following the basic competencies, and a concept is made which contains the components that will be developed.

The data obtained were in the form of quantitative descriptive data from scale instruments and qualitative data that came from criticism, suggestions, and input from the product appraisers.

The technique of collecting data using a questionnaire. There are 3 types of questionnaires used to capture information and data needed in the development of a field guide book for pollinating insects in Malawi plants in the Dolat Rayat sub-district, which are arranged based on the needs and suitability of the information for students in Entomology courses, namely: material expert validation sheet, learning design, and layout design. The development of the three validation sheets is based on ([Perbukuan, 2014](#))

Results and Discussions

This field guide book for pollinating insects on Malawi a plant in the Dolat Rayat sub-district was developed based on the results of field research supported by data and literature books and journals related to information about pollinating insects on Malawi a plant in Dolat Rayat District. The book, entitled "Knowing Pollinating Insects in Palawija Plants" measures 18.2 cm x 25.71 and 102 pages thick. There are three types of fonts used in this non-textbook, namely: Snap ITC, caliber, and Georgia. The font size used is 12, 10 with the space size used, namely, 1.5 lines. Of the three types of writing used in this field manual, Georgia dominates the type of writing used in this book.

The parts of the field guide book for pollinator insects in Malawi plants in Dolat Rayat District that have been developed consist of book covers, foreword, table of contents, list of pictures, list of tables, book descriptions, and book contents, including CHAPTER 1. Introduction, Chapter 2.Palawija Plants, Chapter 3.Data Collection Methods, Chapter 4.Types of Pollinating Insects in Dolat Rayat District, Chapter 5.Diversity and Abundance of Pollinating Insects in Dolat Rayat District, Chapter 6. Pollinator Insect Behavior, followed by the closing section, namely: Bibliography Author's Glossary and Biographies.

One of the feasibility of developing a field guide book for pollinating insects on Malawi a plant in Dolat Rayat sub-district was obtained based on the evaluation of material expert validators. The role of material experts invalidating this developed book is to get criticism, input, and assessment of the suitability of book content based on an entomological point of view. In the book feasibility test process, the book is assessed by the validator by providing a score and suggestions on each of the indicators of the sub-aspects of the assessment from the material aspects and book presentation.

The sub-aspects of the assessment of the material aspect of the book consist of the suitability of the description and explanation of the material with the reader, legal certainty in the material, the authenticity and correctness of the material according to the field research carried out, the updating of the material, and the material sources. Meanwhile, the sub-aspects of assessment from the aspect of book presentation consist of presentation techniques, material utilization, and presentation feasibility.

Based on the results of the material assessment and material presentation from the material validator for the developed field manual, a percentage score of 94% was

obtained with the predicate very feasible, for data on the feasibility of material aspects and its presentation in Table 1

Table 1
Data on the Feasibility Value of Material Aspects and Their Presentation

No.	Sub-aspect of Assessment	Score	Category
1.	The suitability of the material description with the readers	100%	Very feasible
2.	Legal certainty in the material	100%	Very feasible
3.	The authenticity and correctness of the material	93%	Very feasible
4.	Material proficiency	80%	Worth it
5.	Material sources	100%	Very feasible
6.	Presentation technique	93%	Very feasible
7.	Utilization of the material	90%	Very feasible
8.	Serving eligibility	100%	Very feasible
	Average score percentage	94%	Very feasible

One of the feasibility of the field guide book for pollinating insects on Malawi a plant in the Dolat Rayat sub-district was obtained based on the assessment of the learning design expert validator. The role of instructional design experts invalidating this developed book is to get criticism, input, and assessment of the suitability of book content based on the learning design point of view. The book developed is tested for its feasibility or validated by an expert validator of learning design to improve the quality of learning design. In the book feasibility test process, the book is assessed by the validator by providing a score and suggestions for each indicator of the sub-aspects of the learning design.

Sub aspects of learning design consist of concept depth, material accuracy, presentation technique, clarity of sentences, completeness of presentation, language, and book efficiency in learning. The book that has been assessed is then revised according to the suggestions and comments of the learning design expert validator. The revised book is then given back to the learning design expert validator to be revised again until the validation results are declared in the proper category. Based on the results of the learning design assessment from the learning design validator for the field guidebook

developed, a percent score of 90% was obtained with the predicate very feasible, for the data on the feasibility value of the learning design aspect can be seen in Table 2.

Table 2
Data of Feasibility Value for Learning Design Aspects

No	Sub-Aspect of Assessment	of	score	Category
1.	Depth of Concept		95%	Very feasible
2.	Accuracy of Material		93%	Very feasible
3.	Presentation Technique		90%	Very feasible
4.	Clarity of Sentences		80%	worth it
5.	Completeness of Serving		100%	Very feasible
6.	Language		80%	Worth it
7.	Efficiency of Books in Learning		95%	Very feasible
Average score percentage			90%	Very feasible

One of the feasibility of developing a field guide book for pollinator insects on Malawi a plant in Dolat Rayat sub-district was obtained based on the evaluation of the layout design expert validator. The role of layout design experts in validating the book being developed is to get criticism, input, and assessment of the suitability of book content based on the quality of the layout design. In the book feasibility test process, the book is assessed by the validator by providing a score and suggestions for each indicator of the sub-aspect of the layout design.

The sub-aspects of layout design consist of book cover design, book layout, book content, typography, and image illustrations (tables and graphics). The book that has been assessed is then revised according to the suggestions and comments of the layout design expert validator. The revised book is then given back to the layout design expert validator to be revised again. Based on the results of the layout design assessment from the layout design validator for the developed field manual, a percentage score of 83% was obtained with the predicate very feasible, for the data on the feasibility value of the learning design aspects can be seen in Table 3.

Table 3
Feasibility Value Data for Layout Design Aspects

No	Sub-aspect of Assessment	Score	Category
1.	Book cover design	80%	Worth it
2.	Book layout	93%	Very feasible
3.	The contents of the book	85%	Very feasible
4.	Typography	82%	Very feasible
5.	Image Illustrations (Tables and Graphics)	73%	Worth it
Average score percentage		83%	Very feasible

The book product appraisal trial developed was carried out based on the Thiagarajan (4D) development model, with assessments including individual assessments, small group assessments, and limited group assessments. The individual assessment was carried out on 6 semesters 6 students of the Biology Department at Medan State University who had passed the Entomology course. The small group assessment was carried out on 10 semesters 6 students of the Biology Department at Medan State University who had passed the Entomology course. For the limited group assessment, 28 students of the 6th semester of the Biology Department at Medan State University had passed the Entomology course.

Based on the results of the assessment of the field guide book for pollinating insects on palawija plants in Dolat Rayat sub-district by 6 semesters 6 Biology Department students who have passed the Entomology course by 92% with a very decent category, a small group of 10 students of the 6th semester of Biology Department who have graduated Entomology course is 91% with a very feasible category and a limited group assessment, namely 28 students of the 6th semester of the Biology Department at Medan State University who have passed the Entomology course by 92% with a very decent category. The feasibility test data can be seen in Table 4.

Table 4
Feasibility Trial Data

No	Research subject	Aspects Of The Assessment	Score	Category
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1.	Individual (6 students of the 6 th semester of the Biology Department at Medan State University who have passed the Entomology course)	Theory	94%	Very feasible
		Languag e	91%	Very feasible
		Presentat ion	93%	Very feasible
		Graphics	91%	Very feasible
		Average	92%	Very feasible
2.	Small-Group (10 students of the 6 th semester of the Biology Department at Medan State University who have passed the Entomology course)	Theory	91%	Very feasible
		Languag e	91%	Very feasible
		Presentat ion	90%	Very feasible
		Graphics	91%	Very feasible
		Average	91%	Very feasible
3.	Limited Group (28 students of the 6 th semester of the Department of Biology at the State University of Medan who have passed the Entomology course)	Theory	92%	Very feasible
		Languag e	94%	Very feasible
		Presentat ion	93%	Very feasible
		Graphics	91%	Very feasible
		Average	92%	Very feasible

The results of the book product assessment trial that were developed were carried out based on the Thiagarajan (4D) development model, with assessments including individual assessments, small group assessments, and limited group assessments. The data obtained were not only product assessments but also from the responses of the lecturers who taught the Entomology course at the State University of Medan. Based on the response of the lecturer who teaches the subject, the feasibility test data is obtained, namely: 68% with proper criteria. The response data of the Entomology subject lecturer can be seen in table 5.

Table 5
Response data of Entomology lecturers

No	Research subject	Assesment Aspects	Score	Category
1.	Lecturer in Entomology Subjects	Theory	80%	Worth it
		Language	65%	Worth it
		Presentation	66%	Worth it
		Graphics	63%	Worth it
		Average	68%	Worth it

The field guidebook for pollinator insects in palawija plants in Dolat Rayat District is learning support for the entomology course. From the needs analysis, it was found that students needed a research-based book to provide motivation and information to conduct research. This field guide book for pollinator insects in palawija plants in Dolat Rayat District is designed to be as attractive as possible for students to do research and one of the supporting materials for students to do research, this book can also be a reference material for relevant material to find something new to apply. for students. The research presented in this book motivates students to develop insights.

In today's technological advances, it is not enough for teachers/lecturers/students to only use one handbook, but they are required to read from various types of reading sources that are relevant to be taught and studied ([Hanifah, 2014](#)). Students use the Entomology textbook and an additional book in the form of a pollinator insect field guidebook as a learning book. Books have an important role because they allow students to learn something in an organized manner to achieve certain competencies independently ([Octavia, 2020](#)).

The field guidebook developed is also equipped with research or research steps and is also supported by pictures of the research process and photos of research results. Of course, this can clarify the results of the research which are outlined in the research.

One of the functions of the images presented in teaching materials is to attract and also motivate students to generate interest in something new to be studied. According to (Suardi, 2018) a good book must be able to motivate learning by utilizing interesting things such as pictures, illustrations to support learning and can be used to support problem-solving activities. In line (Priyatni, 2012), teaching materials are good criteria if the teaching materials are written in good and easy-to-understand language, are presented in an attractive manner equipped with pictures and descriptions, the contents of the book also describe something based on the author's ideas.

This book was written according to learning needs. The material is arranged systematically following the research flow. This book has the title "The Handbook of Handling to Know Pollinating Insects in Palawija Plants". This book presents the whole process and results obtained during the research process of pollinating insects in Dolat Rayat District so that this book is applicative. The explanation of the scientific method, the elaboration of the order, and the analysis of the data are guidelines that can be used by students in the process of activities in the field. This topic can also be an optional selection of mini-research assignments so that users of this book can learn the overall research/research overview. Several research-based book developments (Priyatni, 2012), and research-based teaching materials (Afrida, 2014; Oktaviana, 2015) have been deemed appropriate and can help students in the learning process. This research-based book is a way of implementing research results in learning so that learning becomes contextual (Syarifuddin, 2011).

The chapters contained in the product being developed will be briefly described as follows: (1) Introduction. This section describes the morphology of pollinator insects, types of pollinator insects, pollination of plants, and the benefits of pollinator insects. (2) Palawija plants. This section describes the family and species of palawija plants in the Dolat Rayat sub-district, (3) Data collection methods. This section describes the location of the research, the tools and materials used in the study (displayed in tabular form and told in narrative form), procedures for field activities, and data analysis techniques. (4) Types of Pollinating Insects in Dolat Rayat District. This section describes the results of insects found, the results in the field are broken down by family and species. (5) Diversity and abundance of pollinating insects in Dolat Rayat District. This section describes the diversity, abundance, and relationship of pollinator insects. (6). Pollinating Insect Behavior. This section describes the process of pollination of plants, pollination by insects, effectiveness of pollination, environmental factors that affect pollination.

The field guidebook for pollinating insects on palawija plants in Dolat Rayat District was developed by following the steps of the Thiagarajan model consisting of four stages (four-D Models), namely the Define stage, the Design stage, the Development stage, and the Disseminate stage (deployment). However, this development is only limited to the development stage. Based on the results of the validation by a team of material experts, validation of learning experts, and validation by a team of layout design experts accompanied by field trials with individual group

trials with 6 students, small group testing with 10 students, and limited group testing with 28 students, and the response of eye supervisors entomology course shows that this book is very suitable to be used as a material for the continuity of the teaching and learning process in the entomology course. The results of this eligibility were assessed from the assessment and revision by the validation team. Books can be declared valid and fit for use after going through the validation and testing stages ([Su'udiah et al., 2016](#)).

Products that have been declared good by the validators still have to be corrected according to the suggestions of experts ([Lepiyanto & Pratiwi, 2015](#)). Reviews by experts and student responses to books developed are carried out according to the point of view of their respective expertise ([Fernandes, 2019](#)), and referring to the regulation of the Minister of National Education of the Republic of Indonesia Number 2 of 2004 explaining that books that are suitable for teaching materials must include criteria quality (standard) including, (1) feasibility of content/material, (2) feasibility of presentation, (3) feasibility of language, (4) feasibility of graphs. These criteria have been listed in the validation sheet component assessed by the validators. According to Rochmad (2012), a good teaching material if it meets validity aspects, namely valid and practical. The validity of the book developed can be determined by validity testing, valid criteria can be determined if the value obtained from the experts is at the percentage interval $81\% \leq X \leq 100\%$ and $61\% \leq X \leq 80\%$ with very good and good criteria ([Syarifuddin, 2011](#)).

The results of the validation by a team of experts in the field guide book material for palawija pollinator insects in Dolat Rayat District obtained a percentage of 94% in the very good or very feasible category. Feasibility content consists of 24 points of assessment that focus on material and concepts that are following the research achievements in the field. The appropriateness of the contents of a book shows that the contents of the book are developed in accordance ([Simon et al., 2021](#)) nice with the learning objectives. The field manual must be prepared based on the research flow and can be justified for its accuracy. According to ([Putro et al., 2016](#)) research-based books are indispensable for students not only to interact with lecturers, but students also interact using teaching materials. Teaching materials in the form of research-based books require students to solve problems that occur in everyday life that are solved using research.

Validation by a team of experts in learning the insect field guide book of palawija plant pollinators in Dolat Rayat District obtained a percentage of 90% in the very good or very feasible category. The feasibility of the book is also carried out to assess the accuracy of the material, the feasibility of presentation such as the title of the cover book, the table of contents, and the presentation of the learning validation image as well as to assess the language of course in the book, the language field manual used must be by good and correct Indonesian language principles. According to

([Lepiyanto & Pratiwi, 2015](#)) textbooks must be useful for students and teachers. The grammar used is designed according to the level of student development. If

students find it difficult to understand terms, a glossary is provided as a guide to understanding difficult terms.

Validation by a team of experts in the field guide book design for crop pollinator insects in Dolat Rayat District obtained a percentage of 83% in the very good or very feasible category. This book is validated by a team of design experts to know the book format, book layout, good and correct book typography including book ampoule image assessments, book size, book color, font, font size, appropriate illustrations, and consistent layout. . In addition, the pictures in field manuals can affect a person's reading interest because most of them see the pictures before reading ([Kasmaienezhadford et al., 2015](#)). Meanwhile, the type and font of writing affect the readability of the book. If a book has good readability, then this can affect the reader's interest, make it easier for the reader, and help the readers' memory, and help the reader speed up efficiency ([Yunita et al., 2019](#)).

Based on the individual test, the small group and the limited group were respectively 92%, 91%, 92% which indicated very good or very feasible criteria. This shows that students are interested in field guidelines for pollinating insects on palawija plants in Dolat Rayat District. This book is to supports student research learning activities because this book is the result of research conducted by researchers and everything is written in the book so that students can research what researchers do.

This field guidebook for pollinator insects on Malawi plants in Dolat Rayat District was developed to answer the needs of students in researching the field. This book is a supporting material for students to know more about applications in the field and this book can be used as a guide for students to conduct research. However, this book certainly has advantages and disadvantages for users. The strengths of this book are (1) this book is prepared based on the research process (2) the material presented uses simple and easy to understand language (3) this book contains the author's research (4) this book has an attractive design so that users of this book are interested and motivated (5) this book can be used in all circles (6) this book has been validated by 3 experts, namely material experts, learning design experts and layout design experts. The weakness of this book is that it is used mostly to support entomology courses and this book has not been tested for its effectiveness.

Conclusion

Based on the results and the previous discussion, it can be concluded that the "Handbook of Palawija Plant Pollinator Insect Fields in Dolat Rayat District" is very feasible from the material aspect, namely 94%, very feasible from the learning design aspect, namely 90%, very feasible from the book layout design aspect, namely 83%, feasible to be used for students based on the responses of lecturers in the Entomology course, very feasible based on the responses of students from the Department of Biology, FMIPA, UNIMED.

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