Development of Field Guide Book to Insect Pollinator of Herbaceous Plants in City and Residential Area in Medan

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***Abstract*— This research was conducted to develop field guide of herbaceous plants insect pollinators in city and residential area in Medan for entomology course. This book was developed according to Thiagarajan 4D (define, design, development, dissemination) model, minus dissemination steps. This book was validated according to quality of its content / materials, learning design and layout design. Validation result of content aspects (material's suitability, material's accuracy and strength, systematics of learning, book efficiency in learning and language feasibility) assessed by content expert had an average score of 83.59% (very good). Learning design aspects (content feasibility and display feasibility) validation result by expert had an average score of 88.73% (very good). Result of layout design aspects (book size, cover design, and content layout design) assessed by content expert had an average score of 79.72% (good). Several revisions were made until those final scores obtained and the book feasible to use.**

Keywords*— Entomology, City, Insect Pollinators, Development of Field Guide.

I. INTRODUCTION

Insect ecology has been a subject discussed in Entomology course. Entomology is one of elective courses that 4th semester students have to take in Universitas Negeri Medan (UNIMED). Basic competences that students have to achieve are ability to analyze insect role in ecosystem and human life, application of classification and insect identification. Entomology book that used by 4th semester students in Universitas Negeri Medan covers insect structures material, insect life cycles, insect identification and classification, insect ecology, insect role and collection method and insect propagation [1]. These topics were considered as general topics, therefore addition of ecology of insect pollinators in city were necessary.

Preliminary observation result on student needs in entomology course showed, out of 40 biology students observed, 63% were agree that field guide book are necessary to make learning more meaningful. Further, students fully realized the importance of insect pollinators in plant pollination.

Learning cities ecology, began became new subject interest of ecology researchers. This situation occurred because cities ecology has important role in balancing abundance and diversity of insect. [2] said that green area provide suitable habitat for insects, including food source and nesting behavior that barely known broadly. By providing habitat for insects, it will support cities diversity. Research on insect pollinators in cities change a view about city biological values and its ecological importance [3].

Learning diversity and identification have a wide range of material. This eventually caused learning process became quite hard to understand [4]. It also should be supported by learning tools such as identification tools to support learning. Qualified learning process can be pursued, one of them is by improving learning facilities. The quality of good learning facilities can influence learning activities carried out by educators and students [5]. This kind of learning is what is expected in universities [6]. This field book developed provided information that could be used as identification diversity of insect pollinators in herbaceous plants, especially in cities. Hopefully, this book could induce active learning in students and promote independence in finding concepts of Entomology.

Tremendous technology of this era, require lectures/teachers/students to used more than one handbook as source of information to teach and to learn. Undergraduate biology students used entomology handbook and supplementary books such as field guide to insect pollinators as learning books. Basically, books have an important role because they allow students to learn something in an organized manner to achieve certain competencies independently [7]. Some research-based book development [8-10], and research-based teaching materials [11,12] have been considered feasible and can help students in the learning process. This research-

based book is a way of implementing research results on learning to achieve contextual learning [13,14].

II. MATERIALS AND METHODS

A. Research Design

This research was conducted using Thiagarajan 4-D's (define, design, development, dissemination) development model minus dissemination steps. This book was made based on research held previously.

a. Defining Phase (Define)

This stage aimed to establish basic problems, analyze student characteristics, and analyze essential concepts of material and student skills that will be improved.

b. Planning Stage (Design)

The design of guidebook was done by choosing a format that was in accordance with the format of a good and correct textbook. At this stage an outline was made to be used starting from realizing the plan at the defining stage into the design stage, selecting the writing format then making the initial design.

c. Development Stage (Develop)

The guidebook that will be used by lecturers and students was first validated, including material validation, learning design and layout design. The feasibility of field manuals was assessed with a range of assessments on questionnaires score 1-5 which represented 5 criteria namely very good, good, moderate, not good and bad. The results of the analysis data were categorized as follows:

Table 1. Answer Criteria Instrument Validation Items

No	Indicator	Score
1.	Very Good	5
2.	Good	4
3.	Moderate	3
4.	Not good	2
5.	Bad	1

Table 2. Suitability Presentation Criteria of Product Component Indicators

No.	Score Range	Criteria
1	85 ≤ % score ≤ 100	Very Good
2	69 ≤ % score ≤ 84	Good
3	53 ≤ % score ≤ 68	Moderate
4	37 ≤ % score ≤ 52	Not good
5	20 ≤ % score ≤ 36	Bad

(Sugiyono, 2015)

Then the calculation results were accumulated in the formula for the feasibility percentage of each aspect of the assessment below

$$\frac{\text{Number of scores obtained}}{\text{Ideal total score}} \text{ X } 100\%$$

The collected data were analyzed by quantitative descriptive analysis techniques expressed in the distribution of scores and percentages of the predetermined rating scale categories. After presentation in percentage form, the next step was to describe and draw conclusions about each indicator. The research steps with the 4-D model were presented as follows:

a. *Defining Phase (Define)*

This stage aimed to define lesson needs by analyzing the goals and boundaries of the material, then set the basic problem, analyze the characteristics of students, and analyze the essential concepts of material and student skills that will be improved. Establishing basic problems was done by observing the field and collecting supporting articles and journals. Then analyze the characteristics of students as product target. Product development aimed for students in semester 4 or semester 6 who had Entomology courses.

b. *Planning Stage (Design)*

At this stage an outline of a research-based field guide on Insect Pollinator of Herbaceous Plants in City and Residential Area in Medan was made which will be used starting from realizing the plan at the defining stage into the design stage, selecting the writing format, then making the initial design. Media that were relevant to the characteristics of Insect Pollinator of Herbaceous Plants in City and Residential Area in Medan, namely media images, schemes, tables and graphs. The use of research-based field manuals was presented in print. Media used such as the format selection and the initial design of the field guidebook design. The elements contained in the field guidebook are: book cover; book title; acknowledgments, preface; preliminary; materials and methods; data analysis and results; insect images from field studies; bibliography; glossary and index.

c. Development Stage (Develop)

At the development stage, the product was assessed and revised by material experts, layout design experts and learning design experts. Then the product will be repaired by the researcher and validated again until it shows a good feasibility rate. The results of the assessment will be used as a reference to revise the product again.

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III. RESULTS AND DISCUSSION

A. Results

a. Define step

Result of requisites analysis showed 63% of biology graduate students said they need field guide to insect pollinator in entomology course to make the learning more meaningful. Students considered the importance of insect pollinator in plant pollination. After determining student needs, content material then analyzed. This field guide book was developed based on research held previously by author. This was step held on purpose to make students understand the topic and

understand that the topic discussed was one unity with research of insect pollinators.

b. Design step

Result of field study was embedded in field guide book developed. All field study processes which started from finding background, sampling method, identification, and data analysis would be used to design the initial draft of this field guide. Parts of the material in the field guide book were prepared based on the flow of field study. The initial draft was arranged by making frameworks for topic discussed and all field study processes would be put down in every chapter title. The next step was literature study to support the materials. Facts related to insect orders then embedded in the book. The book was written by considering the *lay-outing* of layout writing, pictures, font's type and size to make the book more appealing and easier to read. Book cover was designed to represent the content and could attract reader interest.

c. Development step

Development step was held after design step finished. Validation of all instruments by experts, such as content, learning design and layout design validations were held in this step.

- Validation by content experts result

The Field Guide Book content quality was assessed by two experts, Amelia Zuliyanti Siregar, M.Sc., Ph.D and Drs. Puji Prastowo, M.Si. The result displayed in table 3 below.

Table 3. Validation by content experts result

No	Assessment component	Mean score (%)	Criteria
1	Material's suitability	87,5	Very good
2	Material's accuracy and strength	76,78	good
3	Systematics of learning	89,58	Very good
4	Book efficiency in learning	82,5	Very good
5	Language feasibility	81,61	Very good
	Mean	**83,59**	**Very good**

Content validation was done by two experts to improve material content in the book. The aspects assessed by experts were material's suitability, material's accuracy and strength, systematics of learning, book efficiency in learning and language feasibility. Each component consists of several indicators, which it score later would be accumulated and counted to find the mean score. The mean score percentage of content validation obtained was 83.59% and classified in very good criteria.

- Validation by learning design experts result

The Field Guide Book learning design quality was assessed by two experts, Dr. Hasruddin, M.Pd and Dr. Anggi Tias Pratama M.Pd. The mean score percentage of learning design validation obtained was 88.73% and classified in very good criteria. The detailed result displayed in table 4 below.

Table 4. Validation by learning design experts result

No	Assessment component	Mean score (%)	Criteria
1	Content feasibility	89,28	Very good
2	Display feasibility	88,19	Very good
	Mean score	**88,73**	**Very good**

- Validation by layout design experts result

The Field Guide Book layout design quality was assessed by two experts, Dr. R Mursyid, M.Pd and Dr. Sriadhi, M.Pd, M. Kom, Ph.D. The mean score percentage of learning design validation obtained was 79.72% and classified in good criteria. The detailed result displayed in table 5 below.

Table 5. Validation by layout design expert result

No	Assessment component	Mean score (%)	Criteria
1	Book size	79,16	Good
2	Cover design	77,33	Good
3	Content design	82,67	Very good
	Mean score	**79,72**	**Good**

IV. DISCUSSION

Field Guide Book to Insects Pollinator was a learning support teaching material for Entomology courses. This book has been compiled based on the results of research conducted by researchers about the abundance, diversity, and composition of insect pollinators in urban areas. The title of the book that has been developed was "Field Guide to Insect Pollinators of Herbaceous Plants in Medan". In accordance with the guideline for learning tools and teaching materials for higher education in 2017, the directorate general of learning and student affairs provides the standard elements that should contained in the book include: (1) preface, (2) table of contents, (3) chapters or sections, (4) bibliography (5) glossary (6) index list. This field guide was also compiled based on the steps of the research, which was collecting data, seeking information, compiling hypotheses, analyzing the data, and drawing conclusions. Research-based learning aims to create a learning process that leads to activities of analysis, synthesis, and evaluation as well as improving the ability of students and lecturers in terms of assimilation and application of knowledge. This book was developed for lecturer use as a source of additional learning material for students.

The contents of the book as products developed will be briefly described as follows: (1) Introduction. This section

contains the introduction of green areas in the Medan, pollination of plants, plants visited by pollinating insects, understanding of pollinating insects, and morphology of pollinating insects. (2) Implementation and observation techniques. This section describes the location of the study, the time of observation, the procedure of activities in the field, the tools and materials used (displayed in table form and told in narrative form) and data analysis techniques. (3) Data Observation. In this section, the data analysis results were analyzed with the SYSTAT application (in graph and narrative form). (4) Sequence of pollinator types. In this section, the results of the insect sampling were detailed based on the order, family and species. In this section, the results of the research were presented in obtaining 3 orders, namely: (1) Order of Diptera. This section contains characteristics, body structure, time of observation, habitat, and species descriptions obtained from research result. (2) Order of Hymenoptera. This section contains characteristics, body structure, time of observation, habitat, and species descriptions obtained from research result. (3) Order of Lepidoptera. This section contains characteristics, body structure, time of observation, habitat, and species descriptions obtained from research result.

The book developed based on the steps of the Thiagarajan's model, which consist of four steps (four-D Models), namely define step, design step, develop step and disseminate step. However, this book development research was only held until the development step.

Based on all the validation results (content, learning design, layout design) this book was feasible to use. The results of this feasibility can be seen based on the material presented in the field guidebook which was 83.59%. This field guidebook was expected to help students understand the types of insect pollinator that can be found in everyday environments. According to Oktaviana (2015) research-based books have a very good impact on strengthening student's understanding of abstract concepts in textbooks, so students will have a more real understanding.

Book learning design validation was also carried out to assess the quality of language used and make them in accordance with the rules of the Indonesian language to make students understand the meaning and prevent misunderstanding of concept. The score obtained from learning design validation was 88,73% and classified book's learning design quality in very good category. The results indicate that this book has fulfilled the criteria that must be owned by a book.

Layout design carried out to assess the quality of physical form of the book. The aspects assessed were the book size, cover design, and content layout design. The score obtained from layout design validation was 79,72%, and classified book's layout design quality in good category. The results indicate that this book has fulfilled the criteria that must be owned by a book.

The book that has been declared good by the validators must be revised according to the advice of experts (Lepiyanto, 2015). The reviews by experts and student responses to the books developed were carried out in accordance with their respective perspectives (Lestari, 2013), and referring to the regulation of the Minister of National Education Number 2 in 2008 explained that books that were appropriate to be used as teaching materials must fulfilled criteria quality (standards) including, (1) content/material feasibility, (2) presentation feasibility, (3) language feasibility, (4) graphical feasibility. These criteria have been listed in the validation sheet component assessed by the validators. According to Rochmad (2012), a good teaching material was when it fulfilled the aspects of validity, which were valid and practical. The validity of the book developed can be determined by validity test, valid criteria can be determined if the value obtained from experts assessment was at a percentage interval of $81\% \leq X \leq 100\%$ and $61\% \leq X \leq 80\%$ or in very good and good criteria [16]. Valid books can be determined from the validity test to obtain suggestions and improvements from the content validator, learning design validator and layout design validator. A book that has been declared good by the validator, still have to be improved, if there was still present teaching materials suggestions from several experts [17].

V. CONCLUSION

According to data analysis and explanations it was concluded that the book content feasibility was 83,59%, learning design feasibility was 88,73% and layout design feasibility was 79,27%. Overall, these result showed that The Field Guide Book to Insect Pollinator of Herbaceous Plants in City And Residential Area in Medan was feasible to used by lecturers or students.

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