
Development of a Research-Based Module on the Variation of *Nepenthes mirabilis* (L) Druce in Various Habitats for the Lesson of Plant Taxonomy

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Abstract

Modules are teaching materials that provide independent learning experiences and increase student competence effectively. The purpose of this research is to develop a research-based module on the variation of *Nepenthes mirabilis* (L) Druce in various habitats for plant taxonomy courses. The research design used is research and development. The development results consist of 1) potential analysis consisting of a high diversity of *Nepenthes mirabilis* (L) Druce and no research-based modules have been applied; 2) module design consisting of cover, learning activities and assessments; 3) the validation test shows that the module assessment obtained from material experts is 98.4% very valid and field trials can be carried out. The results of the assessment of the Plant Taxonomy module based on the media aspect amounted to 96.87% with a very valid category and worthy of field trials.

Keywords: Development of a Research-Based Module, the Variation of *Nepenthes mirabilis* (L) Druce

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PENDAHULUAN

One of the subjects in the Biology Education Study Program at the University of Bengkulu, namely Plant Taxonomy II. The results of interviews with supporting lecturers on September 24 2017 can be seen that the Plant Taxonomy II course appears in an even semester and has a weight of 3 credits with practicum activities. The Competency Standard for the Plant Taxonomy II course is that students are able to correctly and accurately describe, identify, and document plant herbariums of the Pinophyta-Magnoliophyta Division in nature and apply them in life.

A needs analysis conducted on 25 to 26 September 2017 using a questionnaire on 34 active Biology Education students at the University of Bengkulu who had passed the Plant Taxonomy II course showed that science process skills and metacognitive skills were still relatively low. The results of the analysis show that students' science process skills, namely the aspect of observing 55% (low), measuring 30% (very low), managing data 38% (very low), concluding 22% (very low), planning practicals/experiments 53% (low) and do practicum 20% (very low). Students' metacognitive skills obtained from the questionnaire were planning aspects 76% (enough), monitoring 76% (enough), evaluating 69% (enough), and revising 80% (good). Information from the lecturer in the Plant Taxonomy II course that they do not fully understand and know how to develop students' science process skills and metacognitive skills through learning.

Further assessment of the learning process of Plant Taxonomy II can be seen about the learning activities and teaching materials used. Learning activities are dominated by presentations and discussions. The teaching materials used are taxonomy books and practical guide modules. This learning situation caused some difficulties for students, namely: 1) it was difficult to get teaching materials related to plant identification, 2) applying the termination key from the results of plant identification 3) carrying out plant identification activities in the field.

Based on the description of the problems in learning Plant Taxonomy II, one solution that can be done is to develop teaching materials that are able to facilitate the development of science process skills and metacognitive skills. Law Number 12 of 2012 confirms that a tertiary institution is obliged to provide and facilitate

learning resources and teaching materials for students. Teaching materials have an important role in helping carry out the learning process of a course. According to Ngalimun (2014) the determination of teaching materials is important to achieve certain educational goals. Prastowo (2011) said that the forms of teaching materials are very diverse and can be classified into 4 types, namely: 1) printed teaching materials, 2) listening teaching materials, 3) viewing teaching materials, 4) interactive teaching materials. The results of the needs questionnaire revealed that students and lecturers needed modules or handbooks that could increase student independence, thinking skills and scientific processes.

Module teaching materials can guide students in carrying out plant description, identification and classification activities. According to Nasution (2003) the advantage of using modules is being able to motivate students through enrichment material that emphasizes the value of togetherness. The characteristics of the module consist of self-instructional, self-contained, stand-alone, adaptive, user-friendly, consistency that is arranged systematically and attractively to achieve certain competencies (Depdiknas, 2003).

The developed module teaching materials can support the development of students' thinking skills. The results of the study reveal that the use of modules in learning has a positive impact. The developed learning module is able to improve science process skills (Puti, 2015., Rosa, 2015). Based on research by Wicaksono, et al (2015) research-based modules have a significant effect on students' metacognition skills. Modules can be integrated into outdoor learning-based learning to help students gain learning experience. According to Saptono (2009) that learning activities that utilize the surrounding environment make learning more meaningful. The results of the study revealed that module integration with outdoor learning had a significant effect on learning outcomes (Satiningtias et al. 2012) and science process skills (Wahyuni, 2017).

The local potential owned by the City of Bengkulu is the type of pitcher plant (*Nepenthes*). The existence of *Nepenthes* in Bengkulu City is evidenced by the existence of several results which found *Nepenthes mirabilis* in the Lake Dendam Tak Already conservation area (Priyanti, 2009) and *N. mirabilis*, *N. gracilis*, *N. in Selebar* sub-district (Astuti, et al, 2012). According to Handayani and Syamsudin (1998)

Nepenthes plants belong to a group of carnivorous plants that have pockets at the ends of the leaves. Nepenthes habitat consists of swamps, coral cliffs and soil that has high humidity. Abiotic factors affect the morphological characteristics of Nepenthes mirabilis such as soil chemical characteristics (Mardhiana et al. 2012) and soil pH (Mansur, 2008). According to Handyani, T (2011) that Nepenthes mirabilis L has morphological variations.

The morphological diversity of Nepenthes mirabilis (L) Druce can be studied ecotypically as a learning resource for Plant Taxonomy II to train students to describe, identify and classify. Research on morphological diversity within a species is an ecotype study. The research report on the level of variation is Tobing, et al (2013) showed results in the form of morphological characters used to compile kinship descriptions and dendograms. Students can practice relating the kinship of Nepenthes mirabilis (L) Druce through learning activities using the developed modules. Based on the location, conditions and potential morphological diversity of Nepenthes mirabilis (L) Druce can be used as a learning resource in the course of Higher Plant Taxonomy in the Biology Education Study Program, University of Bengkulu.

The development of a module based on research results on the local potential of the Nepenthes mirabilis (L) Druce plant is a conservation effort. The types and numbers of Nepenthes have decreased due to the activity of building houses for residents and land conversion (Puspaningtyas, D.M and Wawangningrum, H 2007). Nepenthes' research is useful for educating the public that Bengkulu City has a unique flora that lives only in a few areas in Indonesia.

The implementation of the development of teaching materials requires development models that are adapted to the characteristics of the education system. The model used to develop modules based on Nepenthes mirabilis research is ADDIE (Branch, 2009). The stages of the ADDIE model consist of analyze, design, develop, implement and evaluate. The advantage of the ADDIE model is that there is a framework that can respond to the complexity of the learning environment and respond to various situations and contexts. According to Clark (2015) that the ADDIE model can produce the right product. The results of the study revealed that teaching materials developed using the ADDIE model were valid (Nurrohman, et al., 2017) and were

able to build students' metacognition skills (Triani & Rusdi, 2017)

The development of Plant Taxonomy II learning must be carried out. Based on the explanation that has been described, the development of teaching materials for the Nepenthes mirabilis (L) Druce variation module in various habitats in Bengkulu City is a solution to provide a variety of teaching materials and improve science process skills and metacognitive skills of Biology Education students at Bengkulu University.

METODE

Research and development is a type of research that is oriented towards studying new things and becoming information and then compiling this information to become a new product or system. This type of research is very popular recently because it is able to produce products that have guaranteed suitability for users because they have passed various stages of testing. Another term for research and development is R&D (Research and Development). Sugiyono (2013) simply defines R&D as a research method that is intentional, systematic, aims to find, formulate, improve, develop, produce, test the effectiveness of products, models, methods/strategies/means, certain procedures that are superior, effective, efficient, productive, and meaningful.

The research and development model that will be used to develop learning of Higher Plant Taxonomy based on Outdoor Learning is assisted by teaching materials from research on the variation of Nepenthes mirabilis (L) Druce, namely ADDIE. According to Branch (2009), the ADDIE model has five concepts as follows: 1) analyze (analysis); 2) design (design); 3) development (development); 4) implementation (implementation); 5) evaluation (evaluation).

RESULTS AND DISCUSSION

The research and development that has been carried out produces teaching materials for the Higher Plant Taxonomy module. This module is used by students of the Biology Education study program. Module development uses the ADDIE model (Branch, 2009) which includes analyze, design, develop stages.

Stages of Analyze

The analyze stage has the goal of gathering information in the form of facts, problems and needs in learning Taxonomy courses.

Based on interviews conducted with lecturers on September 24 2017, learning activities on Higher Plant Taxonomy have not linked material with existing local potential.

The types of pitcher plants in Bengkulu City that have been identified are *Nepenthes gracillis*, *Nepenthes reinwardtiana* and *Nepenthes mirabilis*. *Nepenthes gracillis* and *Nepenthes reinwardtiana* pitcher plants experienced a very significant decrease in the number of pitcher plants.

Design Stages

The result of the Design stage is a product design as a solution to the gaps or problems that have been identified. Components are divided into two, namely construct components and content components. The module being developed has construct components including: 1) A4 module size (29.7 cm x 21 cm), 2) 80 g glossy paper, and 3) 2 cm thick module. While the components of the contents of the module are separated into the beginning, core and closing.

The initial part of the module consists of the front page (cover), module identity, preface, table of contents, list of tables, and list of figures as well as an introduction. The core part consists of an introduction and learning activities. The introductory section of the module explains the module, module instructions, competencies and concept maps.

At the core there are learning activities consisting of competencies that must be mastered, content framework, material summaries, student worksheets, evaluation, and self-regulation. The closing section consists of an evaluation, glossary, answer key and bibliography. At the end of each material discussion there is self-reflection to facilitate students to develop their metacognitive abilities. In addition, in the student worksheets, activities are arranged that develop science process skills (observing, identifying, communicating, predicting and constructing arguments).

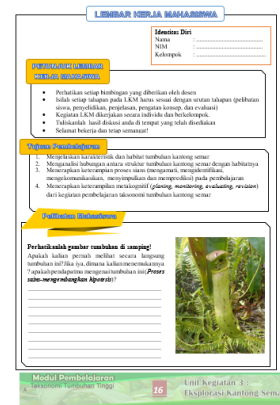
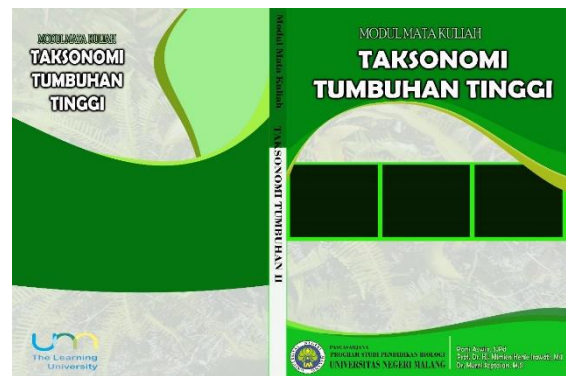
Development Stage

The develop stage describes the Higher Plant Taxonomy module products which are arranged according to the design. Modules are developed by testing validity, formative revision and readability tests.

The results of material validation are assessments, comments and suggestions for the Higher Plant Taxonomy module. The module assessment obtained from material experts was 98.4% very valid and field trials could be carried out. The percentage figure that has not reached

100% is not caused by an error in the concept or material in the module being developed. The lack of modut is the number of questions that are less varied and have not invited students to directly conserve the pitcher plant.

Suggestions and comments from material experts are useful for the feasibility of the developed Taxonomy module. The module parts that received comments from material experts were 1) the front cover (cover) writing "Higher Plants Taskonomy Module" was replaced with "Semar Bag Plant Taxonomy Module", 2) the module usage instructions section is better not to use a box, 3) the competency section simplified by covering the realm of attitudes, skills and knowledge, 4) the evaluation question section is adjusted to the objectives



The results of the assessment of the Plant Taxonomy module based on the media aspect amounted to 96.87% with a very valid category and worthy of field trials. The value of the media aspect of the module has not reached 100% because there are weaknesses in the module in terms of image quality and the type of font used. However, these shortcomings do not affect the overall attractiveness of the module.

Advice and comments from media experts regarding cover, content design and writing. The cover section is recommended to include the module synopsis and author biographical information. The module content design section has margin lines that are too close to the text. The writing section has word writing errors in several parts

Suggestions and comments from educational practitioners in the Plant Taxonomy module developed include concept, design and content. Comments given included 1) the images were too small and not professional, 2) the image contrast was not sharp, 3) there were writing errors in several parts, 4) it was necessary to add the concept of variation to the pitcher plant. Improvements based on suggestions and comments from educational practitioners to produce good modules

The product resulting from this research and development is the Plant Taxonomy course module. Module teaching materials can train individual abilities through regular independent activities (Depdiknas, 2008; Prastowo, 2013; Daryanto, 2013) and can be developed based on needs. The developed Plant Taxonomy course module consists of 3 learning activities, namely 1) the characteristics of the pitcher plant, 2) sources of evidence for the taxonomy of the pitcher plant, and 3) the taxonomy hierarchy of the pitcher plant.

The development of module materials is carried out by studying literature that is relevant to learning outcomes (Prastowo, 2011) and local potential research results. *Nepenthes* as potential natural resources in Bengkulu City are used as information for module development. The use of kantong semar aims to present a more contextual learning and build a caring attitude towards local plants.

Based on assessments by material experts, media, and educational practitioners, the results are very feasible. The validation results obtained by material experts were 98.4% with the category very feasible to be implemented in the field after revision. The results of validation by media experts were 96.87% with a very feasible category and the module design consisting of cover design and content design was acceptable. While the results of the validation by educational practitioners show a percentage of 96.2% with a very feasible category and the module can be implemented in class after making revisions.

CONCLUSION

Based on the assessment of material experts, media, and educational practitioners, the results are very feasible. The validation results obtained by material experts were 98.4% with a very feasible category to be applied in the field after revision. The results of validation by media experts were 96.87% with a very feasible category and the module design consisting of cover design and content design was acceptable. While the results of validation by educational practitioners show a percentage of 96.2% with a very feasible category and the module can be implemented in class after revision. This module is feasible for distribution in class to be tested through learning activities

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