



Unnes.J.Biol.Educ. 9 (3) (2020)

Journal of Biology Education

<http://journal.unnes.ac.id/sju/index.php/ujbe>



Development of Dragonfly Species Diversity Booklet in Tinjomoyo Tourism Forest as a Supplement Material on Biodiversity Topic

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Article Info

Article History:

Received: August 2020

Accepted: September 2020

Published: December 2020

Keywords:

Booklet Supplement Material,
Tinjomoyo Tourism Forest,
Dragonfly Species Diversity

Abstract

Tinjomoyo Tourism Forest Area is located in Sukorejo, Gunungpati sub-district, Semarang has 57.5 hectares with natural potentials, one of them is dragonflies. Dragonflies have an important role because they are a bioindicator for monitoring water quality. The objectives of the study are to analyze dragonflies diversity and describe the feasibility of dragonflies species diversity booklet in Tinjomoyo Tourism Forest used as a supplement of biodiversity material. This study was designed by a modified Research and Development (R&D) research method. The Dragonfly Diversity Booklet that has been developed get very decent criteria to use as supplement material of biodiversity topic for tenth science grade students. The results of the acquisition of 81.82% of material experts and 95.83% of media experts. Teacher responses get a percentage score of 94.44%, responses of students get a percentage of 92% and readability test get a percentage of 92%.

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p-ISSN 2252-6579

e-ISSN 2540-833X

INTRODUCTION

Indonesia is one of the countries that has a high level of biodiversity, including insects species diversity. This is supported by Indonesia's geographical location, with the distribution of islands which group of flora and fauna into three types, namely the asiatic, transitional and australist types. The distribution of this island is evidence that the types of habitats and ecosystems in each geographical location are different, so that organisms including the types of insects that live there are also different (Herlambang *et al.*, 2016).

Biology is a field of science that studies everything about living things. Biology has a collection of processes and values that can be applied in real life, so it takes more than just a collection of facts and concepts. Many students are not able to develop their understanding of biological concepts because the acquisition of knowledge and processes are not well integrated. If biology is only taught by rote learning, students who have prior knowledge about a variety of biological phenomena cannot use their knowledge during the learning process (Saptono, 2011). Biodiversity material is in the 2013 Curriculum is taught in tenth grade at odd semester and found in Basic Competencies 3.2 and 4.2.

Based on observations of the school environment and interviews with biology teachers at SMA 12 Semarang, biology learning process at school still used learning media that are limited to student worksheets, textbooks from certain publishers and power point media. The results of the analysis of the tenth grade high school students' textbooks have not applied contextual examples to biodiversity material. The general examples, not from the immediate surrounding environment.

Learning by utilizing the environment around schools is still minimal, especially for biology subjects on biodiversity. This is because the surrounding environment has potential as a source of contextual and actual biology learning. One of the locations with biodiversity potential in Semarang is Tinjomoyo Tourism Forest. Tinjomoyo Tourism Forest Area which is located in Sukorejo Village, Gunungpati Subdistrict, Semarang City, including into the Great Forest Park which functions as the largest tourism forest which has an area of 57.5 hectares with high natural potential with a variety of flora and fauna diversity in it. This area is an Ex-Situ Conservation Area in Semarang.

Dragonflies have an important role for humans since it is one of the bioindicators to monitor water quality. Dragonfly nymphs cannot live in polluted or non-vegetated water (Susanti, 1998). Dragonflies are flying insects with their distinctive shape so they can be recognized easily with attractive variations in body color and wings. (Baskoro, 2018). Appears since the carbon age or between 360 - 290 million years ago. Dragonflies are aquatic insects. Their life depends on the water quality (Rahadi *et al.*, 2013).

Implementing the direct learning in nature will provide opportunities to students to interact with authentic learning resources directly and foster an interesting learning experience. Booklet development can be used as a source of learning because it is simple and provides accurate data that can help students to understand the concept of the material (Imtihana *et al.*, 2014). Students prefer fun learning and during learning students can understand easily the concept by using pictures medias, module books or textbooks those are not too thick (Puspita *et al.*, 2017).

Based on the description above, then realized in the form of supplementary teaching materials is the best solution. Research on the dragonflies diversity and carried out the development of the dragonfly diversity booklet. This booklet will be integrated directly with biodiversity material, so that it can help students to more explore the relationship between the concept of matter and the actual natural conditions through applied learning resources. The concept of developing this booklet is to bring biodiversity in this case, preferring the dragonflies diversity into the class. The development of the booklet considers the aspects of efficiency in factual and contextual learning, so learning can be done more efficiently since students do not need to go to the field which takes lot of time.

RESEARCH METHOD

This research used research and development methods, which are research methods used to produce certain products and test the effectiveness of these products. The research and development (R&D) procedure according to Sugiyono (2015) has been modified. The first stage of research was carried out by observation and interviews at SMA Negeri 12 Semarang. The data was collected in the Tinjomoyo Tourism Forest Area, Semarang.

The data collection point was carried out by determining 3 observation lanes using a transect line, namely the Sungai Besar (Kaligarang River) 1st route, Sungai Kecil 2nd route and Tinjomoyo Tourism Forest lane as the 3rd route. The time of this study was divided into two times, namely preliminary study time and observational data collection time. The preliminary study was conducted in March 2019 and the data collection time was conducted in April-May 2019.

All types of dragonflies that have been obtained are then carried out the identification process. Then the data were analyzed using the Species Diversity Index, the Evenness Index and the Type Dominance Index. After making observations and obtaining observational data, then the booklet design is done to contrive the appearance of the research product and then it is validated and tested.

Booklet validation was carried out by media expert validators and material experts at the Department of Biology, Faculty of Mathematics and Natural Sciences, Semarang State University, then revisions were made according to suggestions and input from media experts and material experts. The teacher's response was carried out by the biology teacher at SMA Negeri 12 Semarang.

Small-scale trials were carried out on 10 students of class XI MIPA 1 SMA Negeri 12 Semarang who had received material on KD 3.2 and KD 4.2. The small-scale trial aimed to assess the legibility of the Dragonfly Species Diversity Booklet. Students are asked to read and understand the contents of the booklet, then fill out a questionnaire for students' responses and fill out the gap test questionnaire on the instrument sheet provided.

RESULTS AND DISCUSSION

The Eligibility of Dragonfly Diversity Booklet in Tinjomoyo Tourism Forest Area

The Dragonfly Diversity Booklet in Tinjomoyo Tourism Forest Area that was developed has been validated by material experts, media experts, and biology teachers. The results of the material expert validation on the diversity of dragonflies material booklet consisting of four components of eligibility obtained the percentage results, namely the knowledge dimension 87.5%, linguistic 81.3%, 75% presentation technique and 83.3% presentation completeness. Overall, the results of the validation of the material obtained an average percentage of 81.8% with a very decent category and do not need to be revised.

The results of the media expert's validation of the dragonfly diversity material booklet consisting of six components of eligibility obtained a percentage of results, namely booklet size 75%, booklet cover layout 100%, typography booklet cover 87.5%, layout of the booklet content 100%, and pictures on fill booklet 100%. Overall results of material validation obtained an average percentage of 95.8% with a very decent category and do not need to be revised.

The results of the teacher's response include three components of eligibility to get the percentage results, namely the aspect of graphic at 100%, the material aspect 91.7% and the aspect of language at 91.7%. Overall, the teacher's response to the dragonfly species diversity booklet in Tinjomoyo tourism forest area obtained an average percentage of 94.44% in the very feasible category and did not need to be revised.

Table 2. Results of Validation of Dragonfly Diversity Booklet in Tinjomoyo Tourism Forest Area

No.	Validator	Percentage	Criteria
1	Theory	81,8%	Very feasible and not revised
2	Media	95,8%	Very feasible and not revised
3	Biology Teacher	94,44%	Very feasible and not revised
	Average percentage	90,68%	Very feasible and not revised

The interconnected test is conducted after the students have the entire contents of the booklet. The results of the overlap test to measure the readability level of the Dragonfly Diversity Booklet in Tinjomoyo Tourism Forest Area obtained an average percentage of 92% with high criteria.

Table 3. Interconnected Test Results for Measuring Readability

No.	Respondents / Students	Quantity	Percentage	Criteria
1	High level of ability	3	100%	High
2	Medium ability level	4	92%	High
3	Low ability level	3	84%	High
Average percentage		10	92%	High

Students felt excited and enthusiastic when reading the results of the Development of the Dragonfly Diversity Booklet in Tinjomoyo Tourism Forest Area. This is proved by the lowest percentage results of 83% and the highest percentage of 100%. The results of the questionnaire responses of students obtained an average score of 92% with very good criteria.

Table 4. Students' responses to the *Booklet*

No.	Statement	Score	Percentage	Criteria
1	The look of the booklet's cover is interesting	40	100%	Very good
2	The booklet makes me more excited in studying biology	36	90%	Very good
3	Pictures/photos can attract me to study the material	38	95%	Very good
4	The presentation of material in this booklet is systematically presented	33	83%	Very good
5	The material presented in this booklet deals with everyday life	36	90%	Very good
6	This booklet is equipped with photos / pictures supporting the material	40	100%	Very good
7	There is a table of contents containing the chapter and sub-chapter titles, and a list of dragonflies types	39	98%	Very good
8	The language used in this booklet makes it easier for me to understand its contents	34	85%	Very good
9	This booklet is not commonly found in typos or mistypes	33	83%	Very good
10	The font lettera used are clear and easy to read	37	93%	Very good
Average Percentage			92%	
Criteria			Very good	

The diversity of dragonflies as bioindicators of water quality describes the role of these animals in surrounding environment. The sensitivity of dragonfly nymphs to environmental changes makes them to be part of the most clearly visible bioindicator of environmental health. The reduced number of dragonflies in an area can be an indication of changes in the quality of water and environmental health. The results of this study, if applied in the learning process, students will gain experience, information, skills, and knowledge about how to analyze water quality based on the diversity of dragonflies, in addition students also have experience, knowledge directly about the morphology of invertebrate animals and abiotic factors that affect his life. The choice of learning resources is certainly inseparable from the learning objectives. Thus, the selection of media as learning resources must be in accordance with the learning objectives (Virgiawan *et al.*, 2015).

The eligibility assessment of the booklet by media experts, material experts and biology teachers was carried out before the booklet was tested on a small scale. The booklet eligibility data was also obtained through assessing student responses. Assessment of the feasibility of the booklet by students was carried out during small-scale trials. The booklet assessment sheet refers to the 2014 BSNP regulations on the Biology textbook assessment instrument that has been modified and adapted to this study.

The presentation of the booklet material begins with starting around biodiversity in general because this booklet functions as a material supplement. The next material is discussing the level of biodiversity starting from genes, types and ecosystems with examples adapted to environmental conditions in the Tinjomoyo Tourism Forest Area. Threats and efforts to conserve biodiversity are also presented in this booklet. This can stimulate readers to better understand the basic concepts of the material as a basis for

studying biodiversity material in accordance with KD 3.2 and 4.2.

The next material is a glimpse of the Tinjomoyo Semarang Tourism Forest, which contains an overview of the forest. Introduction to dragonflies begins later, beginning with discussing the body structure of dragonflies and a glimpse of dragonflies. There is also an introduction to the life cycle of dragonflies and dragonfly habitats in the Tinjomoyo Tourism Forest and continues by reading the dragonfly species page. The dragonfly species page or sheet contains a detailed explanation of the types of dragonflies found in the Tinjomoyo Tourism Forest during the research. This shows that this booklet is complete and makes it easier for readers to understand the content from start to finish. This indicates that the contents of the booklet are arranged in a coherent, systematic and complete manner.

The role of dragonflies added to the booklet is that many waters have been contaminated. Providing knowledge about keeping the waters and its surroundings clean can lead readers to carry out dragonfly conservation because dragonflies can only live in waters that have not been contaminated.

In accordance with the opinion Pralisaputri *et al.*, (2016) that the development of the SETS-based booklet as a learning medium has the advantage of an attractive colorful display and the illustrations of images, material and photos are clearer, shorter and denser than the books that have been used by the teacher. This is also supported by opinions Irwan *et al.*, (2017), that booklet media is an alternative media that can be used to overcome the limitations of the lack of textbooks. Media booklet is one of the visual media that is able to display interesting pictures and writing, will help in the delivery of material during the learning process and increase students' understanding so that learning takes place effectively and learning outcomes are in line with expectations.

The use of photographs from the results of photography can increase students' interest in dragonflies. One of the ways to develop interest in dragonflies by showing interesting pictures so that students are amazed by the various images of dragonflies and their differences. This is supported by opinion Mahendrani & Sudarmin (2015), that the ethnographic science booklet in its use of learning and recognizing the natural environment in several areas through pictures in the form of photographs as a fresh and relaxed presentation. The ethnographic science booklet is an alternative teaching material in the form of a booklet in natural science learning that contains material about ecosystems, especially with the ethnographic approach that dominates environmental images related to ecosystems, illustrated through photographs contained therein. The goal is to make learning process more interesting with a variety of images and colors that support. This is also supported by research results Imtihana *et al.*, (2014) that research-based booklets are effectively used as learning resources. Research results According to Wahyuningsih *et al.*, (2019) also showed the results of research that *Biomagz*. Based on Local Wisdom has fulfilled the eligibility criteria as a complement to learning according to the material validator and the media obtained a percentage of 92.21% with very decent criteria.

CONCLUSION

Based on the results of research in three observation lanes in Tinjomoyo Tourism Forest Area, 27 species were found, out of 7 families from 2 sub-orders, 2 of which are endemic to Java island. The overall index value on the Shannon-Wiener species diversity index scored 2.68, the Evenness index obtained 0.81 and the species dominance index obtained a value of 0.09. The Dragonfly Diversity Booklet that has been developed has very suitable criteria for supplementing biodiversity material for tenth Mathematics grade students. The results of the acquisition of an average of 81.82% of the material experts and 95.83% of media experts. The teacher's responses obtained a percentage score of 94.44% and students' responses obtained an average percentage of 92% and readability test obtained an average percentage of 92%.

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