A Contextual Biodiversity Handbook to Identify Bintan Coastal Invertebrates

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Abstract. Contextual teaching and learning is quite important to be applied due to students weakness in connecting between what they learn and how the knowledge will be used. It is a learning system that matches the performance of the brain, to construct patterns that embody meaning, by linking the academic content with the context of learners’ everyday life. By applying contextual teaching and learning the information received is not only stored in short-term memory, which is easily forgotten, but can be stored in long-term memory. Contextual teaching and learning can be applied through various learning components. One of them is by applying appropriate learning resources/learning media to facilitate contextual learning. Through research and development applying Plomp model, a handbook has been developed to identify specific invertebrates exist on the coast of Bintan (the Province of Kepulauan Riau). This handbook was developed through processes namely; (1) collecting invertebrates of the coastal area of Bintan, (2) identifying invertebrates using research publications, (3) displaying content in the form of handbooks applying attractive designs, (4) suggestions for improvements by validators, and (5) test the feasibility through trials in learning. These processes drive the handbook different from most learning resources on this topic that do not specifically provide information about invertebrates exist in Bintan or Kepulauan Riau. The using of handbook encourages 100% completeness in learning mastering for 21 students. Furthermore, it increases learning motivation in a high increasing category.

1. Introduction

Biology as part of the natural sciences related to finding out and understanding nature systematically. Learning biology is not only to mastery of knowledge in the form of facts, concepts, principles, but also as a process of discovery [1]. Learning biology requires an interaction between the subjects studied. The process of learning should drive students to explore abilities, knowledge, understanding. Therefore the context learned in Biology emphasize understanding of concepts and process skills.

Nature provides various objects in form both biotic (plants and animals) and abiotic (water, air, and stone) so that learners are more familiar with the learning environment. One of the objects in biology is invertebrate animal. In secondary school, this topic was taught in grade X. The topic of invertebrates includes identification and classification of invertebrate animals based on phyla. Therefore, a lot of animals that must be recognized in order to be able to identifying and classifying. Mostly of invertebrate animal was unfamiliar to the students. This makes it difficult for students to understand the concept. Teachers describe that Invertebrate topic is difficult, it was showed by the low classical
learning mastery in this topic. In the test on Invertebrate topic there were only 50% of students who got score above learning completeness criteria.

One of the efforts to overcome the low level of students' mastery learning is by increasing the enjoyment of learning in the form of contextual learning. Most students learn best when they can connect new concepts to the real world through their own experiences or experiences teachers can provide them (CORD, 1999). Contextual learning is a learning concept that helps teachers link the concept to real situations. It will encourage students to make connections between knowledge and experience [2]. Contextual learning teaches life skills to help students see the connection between school and life. Learning will be meaningful if the teacher puts more emphasis on students understanding what they learn in school with real life situations where the content of the lesson will be used. Contextual teaching and learning helps students connect the content they are learning to the life contexts in which that content could be used [7].

According to Permendikbud No.103 of 2014, teacher is expected to be able in initiating contextual learning. Contextual learning can be drive based on local potential. Local potential is one of the options that can be used as the basis for the selection of themes because it is contextual, interesting, and related to real life [3]. Local potential is the potential for specific resources found in an area. Local potential should be utilized to support decentralization of education. The introduction of local potentials can increase learners' respect for local potential, recognize local wisdom values and internalize values that can lead participants educate to be a character person [4].

Teachers should integrate the local potential as learning resource. Local potential is essentially a resource that is belong to particular area. Local potential is the potential of natural, human, technology, and cultural resources [5]. Through integrated local potential in learning will encourage students to be motivated in learning, so learning is more meaningful. Learning integrated with local potential can improve student learning outcomes and students care for the environment [6].

Contextual learning on the topic of invertebrates can be carried out through field observations. Field observation activities allow students to carry out the direct discovery process as well as the identification and classification of the invertebrates found. However, to carry out the identification process of invertebrates, learning resources are needed that can provide information on the classification of invertebrates. Moreover, invertebrates that are found or which are abundant on the coast of Bintan. Based on other research, integrated learning of local potency is effective in increasing generic science skill. Therefor contextual learning resource which is integrate with the local potential of coastal area should be developed in order to drive the meaningful learning [8]. Internalization of local potential in biology learning can help educators present biology material according to everyday life.

2. Method
This study was conducted using the Research and Development method and implemented the Plomp development model. The Plomp development model is carried out through five phases, namely 1) the initial investigation phase, 2) the design phase, 3) the realization phase, 4) the test, evaluation, and revision phases, 5) the implementation phase. During the initial investigation phase, a survey was conducted to map and and identify the biodiversity of invertebrates in Bintan Island coastal region. Identification and documentation were carried out by using camera and referencing identification guides and reference websites. Result of the survey is developed in to a practical handbook for the student. The handbook is checked for validity and practicality by using validation and practicality questionnaire. The effectiveness of the product as a learning media is assessed using a test instrument. The data in this study were analyzed descriptively and using descriptive statistics.

3. Results
The research results in this paper are divided into several stages as follows.
3.1. Needs analysis
Based on interviews to the teachers of SMA Negeri 1 Teluk Bintan and MAN Bintan, there are obstacles or difficulties experienced by the teacher in the learning process on the topic of Invertebrates. It was because this topic involves a lot of classification of living things based on taxonomy and too much scientific names. Another difficulty that arises is that many invertebrate species are not directly observed by students, students can only find out examples of species through books. In the learning process of this topic, teacher utilized learning media such as power points slides and pictures of learning object. Teacher assigned students to look for more information by used internet. Even though they have used the media, the student learning outcomes are still under the learning completeness criteria. Regarding the characteristics of the lesson which have many groupings of animals and binomial nomenclature, the teacher argues they need learning media that is in accordance with the characteristics of Invertebrate lesson that can present the lesson interestingly, attractive, contextual and practical to be used.

3.2. Context Analysis
Context analysis was carried out by identifying the local potential of the Bintan coastal area which is relevant to the topic of invertebrates. The concept of the local potential of the coastal area is defined based on a literature review. Each regional landscape has specific local potential. Kepulauan Riau Province is an area with an archipelago landscape. The islands have coastal area.

According to Dahuri, the potentials of coastal resources are generally divided into four groups: (1) resources that can be recovered (renewable resources); (2) resources cannot be recovered (non-renewable resources); (3) marine energy; and (4) services to the marine environment (environmental services). Resources that can be recovered consist of various types of fish, shrimp, seaweed, seagrass beds, mangroves, coral reefs, including coastal aquaculture and mariculture (marine culture). Resources that cannot be recovered include minerals, minerals / quarrying, oil and gas. Energy resources consist of OTEC (Ocean Thermal Energy Conservation), tides, waves and so on. While those that are included as the services of the marine environment are tourism and marine transportation [9].

Budiharsono explained that the character of coastal areas and small islands is very unique with various potentials that they may have, one of this is potential for marine fauna [10]. Based on the definition of the local potential of the coastal area and conditions in the coastal area of Bintan, it is concluded that the biotic resources in the Bintan coastal area in the form of coastal fauna are very diverse and can be used as a learning context on the topic of invertebrates.

3.3. Identification of Bintan Coastal Invertebrates
The identification of Bintan coastal invertebrates was carried out for a month, in six (6) different locations, namely Loola Beach, Dugong Beach, Pengudang, Stres, Batu Licin and Malang Rapat Beach. This stage was conducted by applying survey method to collect the invertebrates. Each invertebrate found then identified by observing the characteristics and matching it with the relevant literature. The identification process refers to the World Register of Marine Species website at http://www.marinespecies.org. Based on the results of the survey and identification, 57 species of invertebrates from 7 phyla were found. The following is a breakdown of the number of these invertebrates.
Table 1: Invertebrates Found on the Bintan Coastal

| Phylum          | Number of species found | Examples of Species Found                  | Location found   |
|-----------------|-------------------------|--------------------------------------------|------------------|
| Porifera        | 4                       | *Dysidea avara*, Schmidt, 1862             | Loola beach      |
| Coelenterata    | 5                       | *Acropora* Oken, 1815                     | Loola beach      |
| Platyhelminthes | 1                       | *Thysanozoon ningropapillosum* (Hyman, 1959) | Loola beach      |
| Annelida        | 3                       | *Eumida longicornuta* (Moore, 1906)        | Loola beach      |
| Molluscs        | 20                      | *Conus sp.* (Linnaeus, 1758)              | Dugong beach     |
| Phylum       | Number of species found | Examples of Species Found         | Location found         |
|--------------|-------------------------|-----------------------------------|------------------------|
| Echinoderms  | 17                      | Protoreaster nodosus (Linnaeus, 1758) | Pengudang Beach        |
|              |                         | Pentaceraster mammilatus          | Stres beach            |
| Arthropods   | 9                       | Panulirus versicolor (Latreille, 1804) | Malang Rapat beach     |

Total 59
From the survey, it was found that Molluscs and Echinoderms were the group of invertebrates with the most species found in six locations in the coastal area of Bintan. The important result is that one of the endemic invertebrates on the coastal of Kepulauan Riau is also the object of study in the topic of invertebrates. These invertebrates are one of the mollusc phylum, namely Strombus sp which is Gonggong as its local name.

3.4. Handbook design
This handbook was made using the CorelDRAW Graphics Suite X7 program and was designed with a size of 10 cm x 12 cm. The handbook is designed in navy blue as the background. According to Arsyad [11] color is used to attract attention and distinguish the components of the book. Choosing a contrasting color helps students focus more on activities using hand book learning media.

On the content aspect, this handbook was designed by integrating the content of Invertebrate Animal topic and the context of invertebrates found at the survey location. In the handbook, the locations where these invertebrates were found is written. The aim is to make the content being closer to the student. By knowing the location where invertebrate found, the students were expected to be interested and attracted to know more and to investigate the object directly. The following are examples of handbook design.

Figure 1. Example of material pages in the handbook
The presentation of the material in the handbook is designed in a simple way, prioritizing conciseness and simplicity in order to be easy to understand and use. This design is in accordance with the main purpose of the book design, which is to identify invertebrate animals. The main content in this handbook is the classification, taxon level and scientific name of the invertebrate as well as the general characteristics of the invertebrate group. The explanation is accompanied by a photograph of the invertebrate animal and the location where it was found.

3.5. Expert and practitioner assessment

The assessment of the handbook design was carried out by lecturers with expertise in learning media and zoology. Expert judgment is needed to assess the product validity of the material substance and its feasibility as a learning medium. Practitioner assessments are carried out by teachers and students to assess the practicality of using the product. The following is the result of the assessment in question.

| Table 2. Validity and Practicality Score |
|-----------------------------------------|
| **Score percentage** | Interpretation | **Score percentage** | Interpretation |
| 91% | Very valid | 95% | Very practical |

The handbook validity is related to the aspects of the lesson presentation and language. In terms of the lesson presentation, the validator assesses that it is in accordance with the invertebrates topic and the writing of the scientific name is appropriate. This valid assessment relates to the identification process of invertebrate animals which is carried out carefully and base to valid references. Besides that, the language used in this handbook was simple and easy to be understood by students.

Relate to the validity of handbook as a learning media, it display clear images of invertebrates, appropriate color selection, attractive book design and appropriate type of book material. Images and illustrations on printed teaching media will clarify the message or information presented. The images of invertebrates that are displayed on the handbook are also accompanied by a description of the location where the invertebrates were found, making the information obtained by students more meaningful and increasing its value as a learning media.

Regarding the practicality of using handbooks the main characteristics that add value to this media are their small size and very easy to carry anywhere. This advantage is especially true if students want to use it as a guide for identifying invertebrates in the field. In learning process, this handbook was printed in a size of 10 x 12 cm so that it would be easier for students to carry and use it.

3.6. Field test

Field test stage are carried out by teaching invertebrate materials and asking students to use the handbooks. The trial was conducted on 21 grade X students at MAN Bintan. From the test it is known that the use of handbook increases student motivation and helps all students achieve learning completeness.

| Table 3. Student Motivation Improvement |
|----------------------------------------|
| **Attitude Aspect Criteria** | **Average** | **N-gain** | **Category** |
| | Before using handbook | After using handbook | |
| Interests and concerns | 61% | 92% | 0.8 | High |
| Relevance | 54% | 87% | 0.7 | High |
| Hope | 67% | 90% | 0.7 | High |
| Satisfaction | 63% | 89% | 0.6 | Moderate |
| **Overall average aspect** | **60%** | **90%** | **0.7** | **High** |
Learning motivation is an indicator of the handbook effectiveness which consists of four aspects, namely interest and attention, relevance, expectation and satisfaction. Based on limited trial, students’ learning motivation had increased by using handbook media. The use of handbooks generate interest and increase motivation. It can be assumed that the colorful elements, contextual pictures and simplicity of the presentation of the handbook are very helpful to attract students’ attention. An open questionnaire filled out by students provided data that students were more motivated to learn because handbook packaging was attractive in terms of design and content.

| Completeness Criteria | Amount of Students | Percentage | Interpretation                      |
|-----------------------|--------------------|------------|------------------------------------|
| Student score > 72    | 21                 | 100%       | 100% of student achieve learning mastery |

The results of the assessment of the handbook conclude that this handbook fulfill the criteria as a contextual learning resource with local potential content in the coastal area of Bintan. Field testing also provides results that it has a good impact on learning outcomes by increasing student motivation and learning completeness. Learning resources that provides information about fauna found in familiar areas makes students think more actively and ask questions. Asking a lot of questions can be one of the parameters for cognitive activity in learning. Johnson says that learning with contextual approach, students are invited actively to be able to connect the content of the material to the context of everyday life of the students, so that it can bring understanding and intact meaning [12]. Learning process by applying contextual teaching and learning can increase student learning activity [13,14].

The activeness of cognitive processes in learning the topics with contextual and relevant lessons helps students achieve learning outcomes. Simultaneously, learning a context that is familiar to the students’ environment also increases learning motivation. Students’ interest to the subject matter increases because they read topics that are very close to them and also be able to observed in learning activities. The research of Amalia et al. revealed that the application of learning using coastal natural media can significantly increases motivation and learning outcomes of junior high school students [15]. Contextual system helps the students in looking for the meaning of what they are learning through synchronizing the academic subjects and the context of their daily life; private context, social, and culture [12].

4. Conclusion
The contextual biology handbook is proven to be an effective and practical learning resource to help students identify the biodiversity of local Invertebrates in Bintan Island. The results of the assessment of the handbook conclude that this handbook fulfill the criteria as a contextual learning resource with local potential content in the coastal area of Bintan. Field testing also provides results that it has a good impact on learning outcomes by increasing student motivation and learning completeness. The contextuality presented in this research product encourages the achievement of student learning outcomes and increases learning motivation.

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