Making teaching materials by utilizing the Cibodas Botanical Garden in an effort to improve plant literacy and classification skills of high school students

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Abstract. The development of teaching materials by utilizing the Cibodas Botanical Garden (CBG) to train plant literacy and plant classification is currently not yet developed. Teaching material by utilizing the KRC was made to determine the feasibility and readability of teaching materials, train students in improving the ability of plant literacy and classification of plants, and student responses to teaching materials. The method used in this study is the ADDIE development method. The subjects in this study were 24 students of 10th grade high school students whose school was close to CBG. The instrument used was the validation sheet, cloze test, plant literacy questions, matter of plant classification, and student response questionnaire. The results showed that the average percentage of the feasibility of teaching materials is 88.85% with very decent criteria. Readability test obtained a percentage of 67.1% with high criteria. The plant literacy test obtained an N-GAIN value of 0.35 with moderate criteria and an increase in the plant classification test obtained an N-GAIN value of 0.31 with moderate criteria. Furthermore, the analysis of student responses obtained 84.1% with good criteria. Based on these results, it can be concluded that teaching materials using the KRC are appropriate and can help students improve their literacy and classification abilities.

1. Introduction

Indonesia is a country with mega biodiversity country and has more than 40,000 species of seed plants and 2400 mosses [1]. Plants have different advantages in producing scientific discoveries. However, knowledge about plants is currently declining, this is due to the basic factors including the lack of an interesting explanation about plants in schools [2]. One of the media that can be used as sources for studying plants is teaching material. Teaching material is one of the learning media that contains material or subject matter that is arranged systematically, which is used by teachers and students in the learning process [3]. The information to be delivered and the environment to be arranged are flexible, depending on the learning objectives to be achieved [4]. The effectiveness of teaching materials in learning depends on how teachers develop and utilize these teaching materials.

Indonesia as a country with great natural potential, has a lot of local natural potential that can be utilized as a source of learning. Local potential is the potential of specific resources owned by the region, including natural, human, technological and cultural resources that can be developed to develop...
themselves nationally [6]. One of the local potentials that can be used as a source of learning is the Cibodas Botanical Garden (KRC) area in Cianjur Regency, West Java Province.

The results of interviews with several high school teachers also showed that teaching materials used during the study of biology, especially plants, are only using books from school, contextual learning is lacking so that it is not relevant to students’ environmental conditions. As a result, the material provided is less associated with contextual examples, learning activities that use student worksheets are not in line with the conditions of students, teachers, and the school environment [5]. These conditions lead to the importance of developing teaching materials about plants that take and incorporate local resources into teaching materials that are relevant to local conditions so that they can support student learning needs.

Plant literacy consists of 4 levels, namely nominal level, functional level, structural level, and multidimensional level [7]. Plant identification is one of the basic but complex domains in biology [7]. The acquisition of basic skills in plant identification is in line with the ability to detect, describe and learn about the main concepts of biology, such as taxonomy, diversity, variety and ecology, so that it becomes the basis for understanding biology. The ability to determine species is not only a major competency in biology, but also an important part of understanding conservation [8, 9, 10]. Therefore classification skills must be trained early on in students so that their understanding of biology is increasing. But in fact, people who have the ability to accurately identify species are lacking. This fact is caused by the lack of student interest in studying plants [11].

Based on the description above, it is felt necessary to make efforts to improve the ability of plant literacy and classification capabilities through the development of teaching materials by utilizing local potential. Furthermore teaching material will contain an explanation of the various types of typical plants that exist in the Cibodas Botanical Garden, training activities in teaching materials are expected to help students to improve their literacy and classification abilities.

2. Method
The method used in this study is the ADDIE development method (analyse, design, develop, implement, evaluate) [12]. At the implement stage the pre experimental design research method was used, with the one group pretest-posttest design. The use of this research design to capture data through pretest and posttest activities to determine the ability of plant literacy and classification skills of students in the experimental class. The instrument used was the validation sheet, cloze test, plant literacy questions, matter of plant classification, and student response questionnaire. The subjects used in this study were students of grade 10 Mathematics and Natural Sciences at Mande Cianjur.

3. Result and Discussion

3.1. Feasibility analysis and readability of teaching materials
The assessment of the feasibility of teaching materials is carried out by a team of experts consisting of two expert lecturers and one Biology teacher. The results of the validation of the feasibility of teaching materials are presented in Table 1.

| No | Assessment                  | Percentage (%) | Criteria     |
|----|------------------------------|----------------|--------------|
| 1  | Material eligibility         | 87.88%         | Very decent  |
| 2  | Eligibility of graphics      | 89.82%         | Very decent  |
|    | Average                      | 88.85%         | Very decent  |
Based on the data analysis results of the feasibility of teaching materials using Cibodas Botanical Gardens in Table 1, it is known that in terms of the feasibility of the material, teaching materials using Cibodas Botanical Gardens obtained a percentage of 87.5% with very decent criteria. This shows that the teaching material by utilizing the Cibodas Botanical Garden has a very good scope, accuracy and expertise in accordance with the learning objectives, namely to improve the ability of plant literacy and plant classification. Teaching materials must meet the appropriateness of content in the form of good material coverage, accuracy and expertise [13]

In addition, teaching materials can motivate students to seek further information so as to create meaningful learning for students. Which states that student motivation in learning will make learning more interesting and meaningful, and when there are difficult problems students will do it easily [14]. One of the principles of learning by using teaching materials is to motivate students in learning [15]. Some of the benefits of teaching materials on learning are to increase student motivation, and teaching material is used as material that contains an explanation of how to look for applications, relationships, and the relationship between one topic with another topic [16].

Then in terms of the feasibility of graphics, teaching materials obtained a percentage of 89.82%, with very decent criteria. This shows that teaching materials using the Cibodas Botanical Garden are interesting and appropriate to use. Teaching materials must be interesting, using colorful pictures and illustrations that attract students to read [17]. Another opinion also revealed that the contents of the module must be easy to understand and use interesting images, so students feel happy using the module [18]. The average percentage of the overall feasibility of teaching materials was 88.85%, with a very decent category. Thus, teaching materials utilizing Cibodas Botanical Gardens are suitable for use in high school students in class 10. Furthermore, the readability test conducted by students obtained the following results (Table 2).

Table 2. Analysis of the readability test of teaching materials based on Rankin dan Culhane (1969)

| Part   | Average | Percentage (%) | Criteria | Information          |
|--------|---------|----------------|----------|----------------------|
| 1      | 17.46   | 67.1%          | High     | No revision needed   |

Based on the data in Table 2, it is known that the average percentage of the results of the overlap test on teaching materials is 67% with high criteria and does not need revision. This shows that the teaching material is feasible and can be used on a larger scale.

3.2. **Analysis of increasing plant literacy**

Analysis of increasing plant literacy is done by calculating the value of N-GAIN. The results of the N-GAIN analysis are presented in Table 3.

Table 3. Results of N-GAIN analysis of plant literacy based on Hake (1999)

| Pretest | Posttest | N-GAIN | Criteria |
|---------|----------|--------|----------|
| 3.64    | 5.85     | 0.35   | Medium   |

Based on the data in Table 3 shows that the value of N-GAIN in the plant literacy test scores 0.35 with medium criteria. This shows that there is an increase in the ability of plant literacy in students with moderate levels after using teaching materials. This result is supported by the presentation of teaching materials that integrate material and plants in the Cibodas Botanical Garden, helping students improve plant literacy.

This opinion is in line with research which states that modules developed based on local potential can increase students’ scientific literacy [19]. With these results, it shows that teaching materials can also be used as a guide for students in learning plants. Other research also proves that the development
of instructional materials based on local potentials that are oriented to surrounding problems can significantly improve student learning outcomes [20, 21].

Analysis of increasing plant literacy is also done based on each indicator of plant literacy. The results of the analysis are presented in Figure 1.

![Figure 1. Figure of increasing plant literacy in each indicator [7]](image)

Based on Figure 1 the highest increase in plant literacy occurs at the multidimensional level and the lowest at the functional level. This data shows that after students use teaching materials by utilizing the Cibodas Botanical Garden, the ability of students to define terms in plants is still low. Multidimensional level is a level of high-level thinking (HOT) at the level of information processing and analysis. Higher-order thinking levels namely gathering and understanding basic knowledge, information processing and analysis, as well as high-level reasoning and thinking [22]. Collecting and understanding basic knowledge is the initial level of learning but in formal education this is often the final level of learning. This is in line with the results of research showing that multidimensional levels experience the highest increase compared to other levels [22].

Plant literacy is part of scientific literacy [8], students who have the ability to plant literacy means that they have a general understanding of the concepts, principles, theories, and processes of plants and show concern for relationships science, technology and social. To understand plant literacy, students first understand natural knowledge and inquiry knowledge [23]. This means that teaching material that presents and trains the ability of plant literacy can help students obtain their literacy abilities.

3.3. Analysis of increasing plant classification

The results of the N-GAIN analysis on plant classification tests are presented in the following Table 4.

| Pretest | Posttest | N-GAIN | Criteria |
|---------|----------|--------|----------|
| 4.85    | 6.6      | 0.31   | Medium   |

Based on Table 4, it is known that the average N-GAIN value on the plant classification test is 0.31 with moderate criteria. These results indicate that teaching materials using the Cibodas Botanical Garden can improve students' classification skills. Teaching materials by utilizing the Cibodas Botanical Garden integrate material with examples of plants in the Cibodas Botanical Garden, so students feel motivated to learn it. Learning that motivates students can have a good effect, such as students being motivated to know what is learned, how much has been learned, and how much can be gained from the learning process [14]. In addition, learning by connecting the context of local potential with learning material can help students learn based on the facts found [24].

Teaching material using the Cibodas Botanical Garden also provides a column for "sharpening plant classification" that can help students practice their classification skills. To be able to classify plants requires continuous training [7, 25]. This opinion is also supported by research which suggests that students exercise and activities in learning can link students' initial knowledge with new knowledge
Another opinion also states that the practice or training presented in the culture-based module can improve students' scientific process skills in this case classifying plants, but also can foster curiosity in students [18]. Therefore, the practice questions on teaching materials by utilizing the Cibodas Botanical Garden have a good impact on plant classification skills in students.

3.4. Analysis of student responses

The results of the analysis of student responses are presented in Table 5.

Table 5. Analysis of student responses based on Purwanto (2008)

| Average | Percentage (%) | Criteria |
|---------|----------------|----------|
| 80.7    | 84.1           | Good     |

Based on Table 5 it is known that the average percentage of student questionnaire responses was 84.1% with good criteria. In general, students respond positively to teaching materials by utilizing the Cibodas Botanical Garden. Teaching material using the Cibodas Botanical Garden can attract students and is easy to understand because it contains plant contents in the Cibodas Botanical Garden, which generally students often encounter. Teaching materials also help students in learning in addition to textbooks and worksheets that are commonly used in schools. In addition, the material in teaching materials can add insight and knowledge to students. The existence of additional information or material in teaching materials also increases students' knowledge about the role of plants in human life.

Teaching material also presents material that attracts students to read it and is not boring. Good teaching materials are teaching materials that attract students' interest in reading [17]. Furthermore, teaching materials use language that is simple, and communicative so it is easy to understand. In line with that teaching materials must use good and correct Indonesian language so that it is easily understood by students [17]. Teaching material is able to motivate students and provide high curiosity because in it there are activities to train students to obtain their knowledge independently. Teaching guidelines by integrating independent learning activities can motivate students to intensively find out about the subject being studied [7]. With these results, the teaching material by utilizing the Cibodas Botanical Garden is well used in the learning of high school students in class 10 on plant material.

4. Conclusion

Based on the results of the study, it can be concluded that teaching materials by utilizing the Cibodas Botanical Garden are sufficient for high school students with very good criteria. Teaching materials using the Cibodas Botanical Garden are also able to improve the ability of plant literacy and classification of plants with moderate criteria. In addition, student responses to teaching materials are also good, so teaching materials by utilizing the Cibodas Botanical Garden can be implemented on a broader scale.

5. References

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