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Effectiveness of Local Potential-Based Biodiversity E-booklets on Students' Critical Thinking Skills

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Abstract

Cirebon Regency is one of the areas in West Java which is located on the coast of the Java Sea and has good natural resource potential, causing the biodiversity in the Cirebon area to be relatively high and attractive, thus having potential that can be used as a learning resource. This study aims to analyze the effectiveness of implementing the local potential-based biodiversity e-booklet on critical thinking skills according to Ennis, which consists of aspects of providing simple explanations, building basic skills, concluding, further clarification, setting strategies and tactics. This research is a development research or Research and Development (R&D) that adopts the Sugiyono model (2017) with the research subject of 101 students of class X SMA Negeri 1 Losari, MAN 5 Cirebon and SMA NU Ciledug. The sampling technique was purposive sampling with a one group pre-test post-test design. The pretest and posttest questions consist of 20 multiple choice questions according to the critical thinking aspect according to Ennis. The results showed that the local potential-based biodiversity e-booklet was effective for improving critical thinking skills with the results of the N-gain test in the high category (35.67%), medium (58.53%), low (5.80%) with the average N-gain is 0.63 which is included in the medium category and classical completeness reaches 86.14%. Biodiversity e-booklets based on local potential are effectively used to improve students' critical thinking skills..

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INTRODUCTION

Cirebon Regency is one of the areas in West Java which is located on the coast of the Java Sea. The northern part is lowland, while the southern part is mountainous, which is close to Mount Ciremai. The condition of its unique geographical location and good natural resource potential make Cirebon one of the regencies that has various tourism sectors. Natural tourism in Cirebon is diverse, such as mangrove forests, beaches, hot springs, forest tours, lakes and so on. The existence of these various natural resources causes the biodiversity in the Cirebon area to be relatively high and attractive, thus having potential that can be used as a learning resource.

The potential of local natural resources in Cirebon can be used as a source of learning for students of various levels of education. Learning resources are everything that supports the teaching and learning process, including learning materials (Prastowo, 2011). Learning resources must be arranged according to the needs of users, namely user geography, ethnography, and local potential (Yani et al*.,* 2021). The use of relevant learning resources is expected to be able to support the achievement of learning objectives properly.

Local potential-based education needs to be implemented and developed in accordance with the diversity of regional natural resource potentials as an effort to prepare students who have local knowledge related to the social, geographical, and cultural environment of the region as well as develop attitudes and behaviors to preserve existing resources in their area. The potential and local wisdom of the area can be integrated in biology learning and poured in the form of teaching materials so as to create contextual learning (Jayanti et al*.,* 2017).

Contextual learning is an approach to student-centered learning that bridges students' real life into the learning environment to gain knowledge and practical experience (Ahdhianto et al*.,* 2020). Student-centered learning has a positive effect on student achievement (Hartikainen et al., 2019). Learning that is oriented to mastery of the material has proven to be successful in short-term memory competitions but fails to equip children to solve long-term life problems (Zubaidah, 2017). Teaching materials can be developed by integrating local contextual potential, namely e-booklets.

Booklets are small and thin books containing information accompanied by pictures. Booklets have advantages, including being easy to carry because they are small in size, equipped with systematic explanations, and pictures as illustrations, which make it easier for students to understand a concept or fact (Rahmatih et al*.,* 2017).

Local potential-based e-booklets are teaching materials in which they present material on biodiversity and relate it to the potential of local natural resources in the Cirebon area so that the material presented is contextual and it is hoped that learning will be more meaningful and can improve critical thinking skills and attitudes environmental care.

The 21st century has significantly experienced rapid development in the fields of science and technology. Critical thinking skills are needed in developments in the world of education and the workforce in the 21st century (Elisanti et al*.,* 2018). The learning process in the 21st century should be more than just memorizing facts and understanding general concepts of subject matter as happened in the era of industrial development in Indonesia (Ramandha et al*.,* 2018). Teaching critical thinking skills has always been a learning-oriented goal for all disciplined teachers (Irwan et al*.,* 2019). Including Biology subject.

Critical thinking skills are needed by students related to the needs of students to solve the problems they face in everyday life. Critical thinking involves the ability to draw logical conclusions and make informed decisions (Kaliky & Juhaevah, 2018). Critical thinking is a system of ideas that focuses on conclusions and evaluations based on the analysis of things, events, and events (Umrzokova & Pardaeva, 2020).

Critical thinking skills of students in Indonesia are still one of the problems in the world of education. This students' critical thinking skills need to be trained and improved. The results of the 2015 PISA (Program for International Student Assessment) show that the average PISA score of Indonesians is ranked 62 out of 70 countries (Irwan et al*.,* 2019). Meanwhile, the results of the 2018 PISA ranking study have decreased compared to the

2015 PISA results. Indonesia is one of the countries in the 10 lowest rankings (OECD, 2019).

Basic competence (KD) regarding the concept of biodiversity is found in KD 3.2 Analyzing various levels of biodiversity in Indonesia and their threats and conservation and 4.2 Presenting the results of observations of various levels of biodiversity in Indonesia and proposed conservation efforts, thus students must have knowledge about the potential and problems in their area as well as the ability to think critically and solve problems related to biodiversity, especially those in the surrounding environment. This study aims to determine the effectiveness of the use of local potential-based biodiversity e-booklets on students' critical thinking skills.

METHODS

This research is an R & D (Research and Development) research, namely the research method used to produce certain products, and test the effectiveness of these products (Sugiyono, 2019). The product developed is an e-booklet teaching material that utilizes the potential of local natural resources for biodiversity in Cirebon in the Biology subject of class X SMA/MA and tests its effectiveness on students' critical thinking skills.

The subjects in this study were 101 class X students of SMA Negeri 1 Losari, MAN 5 Cirebon and SMA NU Ciledug. The technique of determining the sample is purposive sampling, namely the determination of the sample with certain considerations. The consideration in determining the sample of this research is that the sample group has been determined by the school, thus the researcher cannot determine the sample individually at random, but the determination of the sample class group. This research was conducted with a quasi-experimental method. The design of the pre-experimental method is in the form of a one group pre-test post-test design (Sugiyono, 2017).

The instrument used in this study was 20 multiple choice questions for critical thinking. The aspect of the critical thinking group used in this study is the critical thinking aspect according to Ennis which consists of five aspects, namely (1) providing a simple explanation; (2) building basic skills; (3) conclude; (4) further clarification; (5) set strategy and tactics (Nejmaoui, 2018).

The implementation of learning in this study was carried out directly with a student capacity of 50%, thus learning for each school was carried out twice a week. Prior to the implementation of learning, links to access local potential-based e-booklet teaching materials are distributed to students so that they can be studied before the implementation of learning.

Research on the effectiveness of using e-booklet products based on local potential that was developed on students' critical thinking skills was measured based on the increase in pretest and posttest scores which were analyzed using the N-gain index. The N-gain test is used to obtain a neutral N-gain value, this is to eliminate the assumption that the largest posttest value shows the best learning outcomes. The gain formula used is as follows:

$$Gain\ Index = \frac{posttest - pretest}{maximum\ score - pretest}$$

The N-gain value obtained is interpreted with the classification in the following table :

Table 1. Classification of N-gain according to Hake (1999)

Coefficient Interval	Criteria
N-gain > 0.7	High
0.3 < N-gain < 0.7	Medium
N-gain < 0.3	Low

Local potential-based e-booklets can be said to be effectively used in the learning process if the overall average value of the N-gain pretest and posttest results is minimum in the medium category and the minimum classical completeness is 80% with a KKM of 75.

RESULTS AND DISCUSSION

Biodiversity e-booklet teaching materials based on local natural resource potential which were developed after being validated by experts were then applied in learning or called broad-scale trials to test the effectiveness of teaching materials that had been developed on students' critical thinking skills according to aspects according to Ennis.

Students' critical thinking skills in learning materials on biodiversity by applying e-booklets based on local potential were obtained from the pretest and posttest scores. The pretest value aims to determine the initial ability level of students before carrying out learning activities, while the posttest value is used to determine students' classical completeness criteria. The results of the pretest and posttest are presented in Table 2.

Table 2. Student Pretest and Posttest Values by Applying E-booklet Teaching Materials Based on Local Potential Biodiversity Materials

Indicator	Pretest			Posttest		
	SMA N Losari	MAN 5 Cirebon	SMA Ciledug	SMA N Losari	MAN 5 Cirebon	SMA Ciledug
The highest score	70	70	75	95	90	95
Lowest score	15	15	15	55	60	60
Average score	46.29	45.4	37	81.57	79.12	78.13
Number of students completed	0	0	2	31	29	27
Number of students incomplete	35	34	30	4	5	5
Classical completeness	-	-	6.25%	88.57%	85.29%	84.37%
Average score of the pretest			43.02			
Classical completeness average pretest			1.98 %			
Average score of the posttest			79.60			
Classical completeness average posttest			86.14 %			

Table 2 shows that the results of the pretest have an average value that is still below the KKM, which has not reached 75. At the end of the lesson, a posttest is given to measure the difference in learning outcomes. The posttest results showed that the posttest mean score was higher than the pretest mean. This cognitive learning result has fulfilled one of the indicators of learning effectiveness on biodiversity material by applying e-booklet teaching materials based on local potential, namely student learning outcomes achieve classical completeness > 80% with KKM = 75. These results are supported by research results. (Melati et al., 2020) which states that the average student learning outcomes using the developed booklet are above the KKM, increasing activity (Suniah; et al., 2018) and improve student learning outcomes (Hanifah; et al., 2020).

The N-gain test was conducted to determine the magnitude of the increase in student learning outcomes before and after being given treatment in learning material on biodiversity by applying e-booklets based on local potential. The average N-gain score to prove that there was a greater increase than before and after learning. This is supported by the results of research (Pujiasih et al., 2021) which states that the application of booklets to learning can

improve critical thinking skills. The results of the N-gain test are presented in Table 3.

Table 3. Student N-gain Test Results by Applying E-booklet Teaching Materials Based on Local Potential Biodiversity Materials

School	Category N-gain (%)			Average	Criteria
	High	Medium	Low		
SMA Negeri 1 Losari	37.15	54.28	8.57	0.64	Medium
MAN 5 Cirebon	32.35	58.82	8.82	0.60	Medium
SMA NU Ciledug	37.5	62.5	0	0.65	Medium
Average	35.67	58.53	5.80	0.63	Medium

Table 3 shows that the increase in student learning outcomes (N-gain) is on average 0.63 with moderate criteria so that by applying local potential-based e-booklet teaching materials it can be said to be effective in learning biodiversity materials. The learning outcomes of students' critical thinking skills in learning materials on biodiversity by applying e-booklets based on local potential were obtained from the pretest and posttest scores. The average student pretest result was 43.02 and the posttest average was 79.60, which means that the posttest score was higher than the pretest score. The success of learning by applying local potential-based e-booklet teaching materials in learning materials on biodiversity is evidenced by learning outcomes that have reached aspects of critical thinking skills which can be seen in Figure 1.

The results of the posttest have reached the classical completeness class > 80% with a KKM of 75 and higher, namely 86.14%. These results indicate that learning by applying local potential-based e-booklet teaching materials is effectively applied in learning biodiversity materials to improve critical thinking skills. This is in line with the research results (Utami & Aznam, 2020; Siburian et al., 2019) which explains that integrated learning of local potential can improve students' critical thinking skills and understanding of concepts (Lidi, 2019).

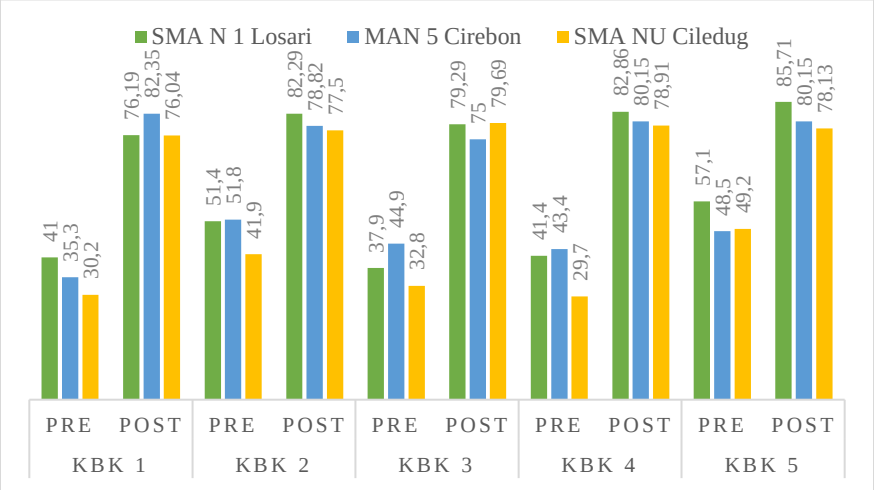

Figure 1. Pretest and Posttest Score Aspects of Critical Thinking Skills

Figure 1 shows the pretest and posttest scores for SMA Negeri 1 Losari, MAN 5 Cirebon and SMA NU Ciledug. The average pretest score for SMA Negeri 1 Losari is the largest compared to the average pretest scores for MAN 5 Cirebon and SMA NU Ciledug. The difference in mean pretest scores

between the three schools did not show a large difference. The average pretest scores of the three schools for each aspect of the KBK still have not reached the KKM. These results describe the initial knowledge of students from the three schools is the same. When the posttest is carried out, it will be clear whether there is a significant difference or not between the difference between the pretest and the posttest in terms of students' critical thinking skills.

The student's completeness on the pretest score is still low because students are still not used to getting learning and answering questions based on local potential so that students take longer to answer the questions listed on the question sheet. Based on the pretest scores from the three schools, it is known that students' critical thinking skills are still low. This is in line with the opinion according to (Syafitri et al., 2021) which states that the critical thinking ability of students in Indonesia is still relatively low. This is based on a four-year study of International Trends in International Mathematics and Science Study (TIMSS) with the characteristics of high-level cognitive questions that can measure students' critical thinking skills, showing that Indonesian students consistently fall in the lower ranks.

This low critical thinking skill can be caused because students are accustomed to learning that prioritizes the memory process and are not accustomed to applying concepts in real life which can be seen from the learning resources used such as textbooks that present general material. This is in line with the research results (Priyadi et al., 2018) which resulted in the finding that students' low critical thinking was because students were accustomed to concepts and were not accustomed to applying concepts in real life. Other research is (Agnafia, 2019) explained that students are less able to think critically because in learning they still prioritize the process of memory and understanding. Students still focus on memorizing a concept in learning and the concepts obtained only come from books and teachers. The critical thinking skills of students who are still classified as lacking need to be improved and re-evaluated the learning process carried out, because with an appropriate learning process critical thinking skills can increase. One of the efforts made is the use of teaching materials in learning.

The posttest scores for each aspect of critical thinking from the three schools increased when compared to the pretest scores and the posttest scores on all aspects of the KBK had reached the KKM. This is because learning that presents material is associated with the potential and problems around it so that it is contextual and can encourage students to analyze problems and solve them using the knowledge learned in class and can improve critical thinking skills. This is supported by the results of research (Widana, 2018) which explains that the presentation of contextual problems can also increase students' learning motivation. These contextual problems can be related to theoretical knowledge in class with everyday life situations. Other supporting research is (Mashami et al., 2021) explained that contextual learning modules containing material explanations based on problems or facts around humans can build students' thinking skills.

Compared with the pretest and posttest scores (Figure 1), it shows that in every aspect of critical thinking each school has increased. The average N-Gain acquisition of students' critical thinking skills for each aspect can be seen in Figure 2 below.

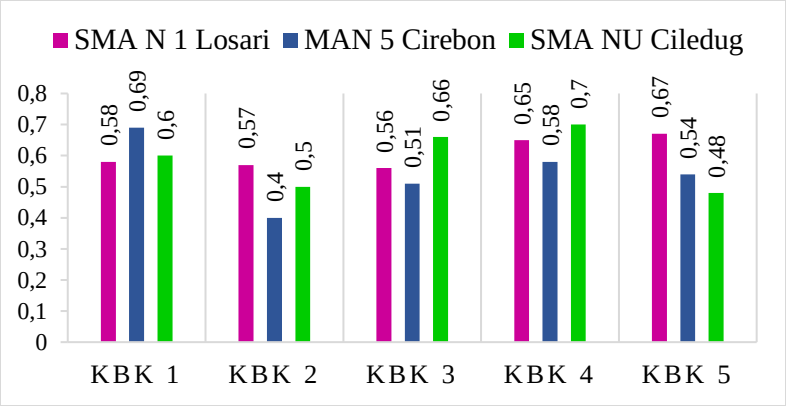

Figure 2. N-gain Test Results for Critical Thinking Aspects

Based on the research results, e-booklets based on local potential can effectively improve students' critical thinking skills seen from the classical completeness of the posttest scores of students at SMA Negeri 1 Losari, MAN 5 Cirebon and SMA NU Ciledug reaching 86.14%. As well as the average posttest scores of the three schools for each aspect of critical thinking: giving simple explanations, building basic skills, inference or inferring, further clarification and managing strategies and tactics have reached the KKM. This is in line with the research results (Rosvita et al*.,* 2020) learning using contextual-based teaching materials can train students' critical thinking skills very well.

Learning by using e-booklet teaching materials on biodiversity based on local natural resource potential that is contextual in nature can provide benefits for students to be able to see firsthand examples related to biodiversity material so that students can prove and apply the theories or concepts they have learned into their own context. everyday life. This is in line with the opinion (Kahar & Fadhilah, 2019) which states that by observing directly students will have the opportunity to connect theory and reality. Other research is (Fuadati & Wilujeng, 2019) explained that the use of local potential in learning can increase the curiosity of students.

In SMA Negeri 1 Losari, the highest gain value is in the aspect of KBK 5 (setting strategy and tactics). Aspects of managing strategies and tactics are related to students' abilities in determining an action to solve problems. Learning using e-booklet teaching materials based on the potential of local natural resources can facilitate students to be able to determine actions during observation activities and after observations contained in exploration and discussion activities. Discussion activities are one way to train critical thinking skills because in discussions there is an exchange of opinions and in the process of exchanging opinions, students can consider, reject, or accept their own opinions or the opinions of others so that they are in accordance with group opinions, and through discussion students can also reduce disagreements. between himself and other students (Arfianawati et al*.,* 2016) This is in line with research (Sundari & Sarkity, 2021) which explains that in learning, giving directive questions by the teacher is proven to have a positive impact on students before deciding on a way out of the problem. These activities help students in building meaning from a concept that is useful for the development of critical thinking skills. Other supporting research is (Rohmah & Nurita, 2017) explained that students learn to find learning concepts independently useful for improving the process of critical thinking skills. While the lowest gain value is in the aspect of KBK 3 (concludes). The ability to conclude the lowest compared to other aspects of KBK can be caused because students are less careful in reading the information presented in the questions and students are accustomed to learning by receiving information from the teacher. This is supported by the results of research (Sundari & Sarkity, 2021) which explains that to make reasonable and rational

conclusions, one needs relevant information related to the problem at hand. Students do not master the relevant information related to the problem, meaning that students do not master the concepts correctly. Other supporting research is (Luzyawati, 2018) who found that many students are accustomed to learning by only receiving information from the teacher, so that when they are faced with giving further explanations to a problem, most students have difficulty.

In MAN 5 Cirebon the highest gain value is the aspect of KBK 1 (giving a simple explanation). The high increase results were due to the use of e-booklets based on local potential to explore students' ideas/ideas and beliefs through the questions contained in the Bio Quiz and Apperception activities. The skill of making simple explanations is a basic skill for students to be able to think critically (Sundari et al*.,* 2018) This skill is related to the ability to focus the mind on a problem and efforts to solve it. To be able to provide an explanation, students must be able to use the knowledge they have and relate it to the context of the problem at hand (Sundari & Sarkity, 2021) This is supported by the results of research (Luzyawati, 2018) which explains that students are able to provide an explanation of the facts obtained from the results of the analysis of an information or image and discuss through question and answer according to the concept being studied. This finding is also supported by research (Hanim, 2020) which states that the ability to provide simple explanations can be honed through stimulation or stimulation by the teacher to condition students to create learning interactions to help students explore the material to be studied. While the lowest gain value is the aspect of KBK 2 (building basic skills). This can be caused because students are not used to learning based on the potential of local natural resources and observing activities in the surrounding environment so that the aspect of building basic skills is the lowest aspect compared to other aspects of KBK. This is supported by the results of research (Yolanda & Wahyuni, 2020) who found that students were still not able to solve problems and connect mathematical concepts in everyday life which indicated that students' mathematical connection abilities were still low. Other supporting research is (Primayana *et al.,* 2019) explained that through the application of the contextual learning model based on the environment students indirectly gave meaning to students, besides that students were also able to relate the material studied to real world conditions and motivated to make connections between knowledge and its application in life.

In SMA NU Ciledug, the highest gain value is the aspect of KBK 4 (further clarification). The questions in the discussion material contained in the Bio Quiz activity involve critical thinking skills so that students feel challenged and raise their curiosity to find solutions to these problems. The questions contained in the Bio Quiz are related to information or problems in the Bio News or Bio Supplements section presented. Thus, the skill of providing further explanation effectively increases. This is supported by the results of research (Suhita, 2019) which explains that the indicator of providing further explanation is the highest with the application of learning that uses a problem in everyday life to be identified and solved, because this learning encourages students to discuss and provide many opportunities for opinion. While the lowest gain value is the aspect of KBK 5 (setting strategy and tactics). Obtaining the lowest gain value compared to other aspects of KBK is due to the fact that students are not familiar with environmental exploration and learning activities that link the potential of local natural resources with learning materials. This is supported by the results of research (A'yun et al*.,* 2020) which explains that students' ability to observe the application of a concept and formulate alternative solutions still needs to be trained in learning.

CONCLUSION

Based on the analysis and discussion of the research results, it can be concluded that the local potential-based biodiversity e-booklet teaching materials are effective for improving aspects of critical thinking skills according to Ennis, namely aspects of providing simple explanations, building basic skills, concluding, further clarification, setting strategies and tactics with the average N-gain is 0.63 which is in the

medium category and classical completeness reaches 86.14%.

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