



**THE EFFECTIVENESS OF BAMBOO SCIENTIFIC BOOK  
IN RAMPAH MENJANGAN FALLS REGION AS MATERIAL  
ENRICHMENT ABOUT BIOLOGICAL DIVERSITY IN GENERATING  
CRITICAL THINKING SKILL FOR HIGH SCHOOL STUDENTS**

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**Abstract:**

There are many potentials in Rampah Menjangan Falls region, one of them is bamboo. The bamboo diversity in this region can be one source of learning for students. The problem often happens on high school learning is that the usage of learning material increases from year to year, however, the content of the teaching material is not yet thorough and it is also not based on local potential. The teaching and learning activity in progress is not able yet to nurture students' critical thinking skill. Thus, one material which based on local potential is needed as material enrichment on biological diversity in generating students' critical thinking skill. One of teaching materials that can be developed is scientific book. This research aims to describe the implementation effectiveness of scientific book about bamboo diversity as material enrichment on generating high school students' critical thinking. The research type used is Research and Development. The research subject is 20 students of grade X IPA 2 SMAN 2. The data effectiveness is obtained from cognitive study result and students' critical thinking skill. Students' cognitive study result experiences significant increase with average score 43,75 on pretest and 82,5 on posttest. Students' classical accomplishment percentage shows a very good category. The result of students' critical thinking skill shows high category. The developed scientific book is stated to be effective used as material enrichment about biological diversity in generating high school students' critical thinking skill.

**Keywords:** scientific book, research and development, bamboo, effective

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## 1. Introduction

The presence of curriculum 2013 as the new curriculum in national education world is expected to complement the former curriculum. The regulation of Minister education and culture of Indonesia No. 65 Year 2013 about Process Standard of elementary and high school stated that the learning process conducted on curriculum 2013 should motivate students to actively participate in learning. Learning material has important role in learning process, by using teaching material students can be actively involved in learning. Therefore, teaching material usage may determine students' success (Waybin, 2014).

One example of teaching material is scientific book. The content of scientific book can be in form of the research result from local potentials in one region. Exploiting local potentials in learning can give positive effect to the students. When the learning uses local potentials as means of studying, the students do not feel so strange with various media applied in learning process (Hatimah, 2006). The researches based on local potentials are conducted by Mukhyati and Siti (2015), Prabowo and friends (2016), and Suwarni (2015). Based on the three former researches, it is discovered that local-potential-based-teaching-material is proper to be used and it also can be one source of learning.

South Kalimantan has numerous types of plants, one of them is bamboo. Based on initial survey conducted in Rampah Menjangan Falls Region, various types of bamboos are found. These bamboos are not planted by people around there, but they grow naturally. The bamboos are used massively in daily life. The massive bamboo using will influence the quantity and types of bamboo. Therefore, a research is needed to discover the bamboo diversity in Rampah Menjangan Falls Loksado. The research result is potentially used as learning resource and an effort to preserve plant diversity.

Biology as one science subject requires learning competence on real understanding field. One of the materials in grade ten SMA/MA in odd term is biological diversity concept. Based on initial survey towards some high school biology teachers, it is discovered that the learning on this material is still conducted conventionally and mostly the classes are teacher-centered. Biology teaching material usage on this material is totally needed. The usage of teaching material at school is increasing from year to year, however the content of the teaching material is not directed well. Usually the content of the teaching material is not in sequence and it takes resource from the book the students do not know the examples quoted in there, as consequence, it may influence the process of teaching and learning at class. Such teaching and learning activity may not be able to enhance students' critical thinking skill. Based on Rotherdam & Willingham (2009), students' success depends on critical thinking competence, solving problem, communicating, and collaborating. The critical thinking skill is one ultimate goal expected to be accomplished in education process (Haghparast et al., 2014). Therefore, thinking skill is an inexorable requirement.

The National Research Council Workshop (NRC) in 2007 about 21st century competence stated five competences need to be increased, they are adapting competence, complex communication, non-routine problem solving, self-management, and thinking system. The next workshop focuses on three skills, 1) cognitive skill (non-routine problem solving, critical thinking, and systematic thinking), 2) interpersonal skills (complex communication, social communication, cooperation, culture sensitivity, diversity), and 3) personal skill (self-management, time management, self-development, self-setting, adapting competence, and executive function). These three skills become the ultimate focus in learning.

According to OECD PISA (2015), the cognitive try out aims to measure scientific literacy presented in two groups, which are standard unit and interactive unit. Standard unit requires learning experience through scientific work, and interactive work requires the students to have technological literacy. One way to help increasing scientific and technological literacy is designing contextual learning based on students' environment.

Students' understanding about the material is different between one another (Felder, 2005), it is caused by different thinking competence. It is teacher task to develop and design thinking competence for all students (Fung, 2004; Saragih, 2008). Therefore, teacher should create learning situation that is able to motivate students to have thinking skill. Increasing learning quality through research and development in one way should be conducted to improve students' thinking competence. The explanation above supports to conduct the research about the effectiveness of bamboo scientific book in Rambah Menjangan Falls Region as material enrichment about biological diversity in generating critical thinking skill for high school students.

## **2. Material and Methods**

The type of research used is research and development type. This research uses research model modified by Borg and Gall (1983). The research is conducted for eight month (August 2017 – Juni 2018). The subject of research is 20 students of grade ten IPA2 SMAN 2 Kandangan. The effectiveness data is obtained from cognitive study result and students' critical thinking competence in working the test.

The effectiveness data is obtained from students' study result, the study result should be accomplished not less than category 'good' based on minimum accomplishment criteria (KKM) and students critical thinking skill is analyzed based on classical N-gain value. The students study result is said to be effective if the percentage of posttest classical accomplishment is higher from the pretest around 75-80%, using the formula below:

$$\text{Personal accomplishment} = \frac{\sum \text{true answer}}{\sum \text{total questions}} \times 100\%$$

**Note:** Individual accomplishment: if the student accomplishes >75 (enrichment KKM)

The classroom study result is then analyzed based on classical learning accomplishment using the formula below:

$$\text{Classical accomplishment} = \frac{\text{total accomplished students}}{\text{total students}} \times 100\%$$

The percentage result on students' study result is conversed with parameter 85-100% (very good), 70 < 85% (good), 60<70% (fairly good) and 50<60% (not good). To discover the increasing of students study result before and after they are given scientific book, it is calculated using gain formula. Students N-gain value criteria is  $g \geq 0,7$  (high),  $0,7 > g \geq 0,3$  (fair) and  $g < 0,3$  (Hake, 1999).

$$g = \frac{S_{\text{posttest}} - S_{\text{pretest}}}{S_{\text{maksimum}} - S_{\text{pretest}}}$$

**Note:** g : gain value; S pretest : pretest score; S posttest : posttest score

### 3. Results

#### 3.1 Students cognitive study result

Students study result is obtained from evaluation scoring after conducting learning activity, it is presented on Table 1 below.

**Table 1:** Students cognitive study result

Data source	Average	Maximum score	Total students		Total students	Accomplishment percentage
			Accomplished	Not Accomplished		
Pretest	43,75	100	0	20	20	0%
Posttest	82,5	100	20	0	20	100%

**Source:** Data calculation result

Based on Table 1 above, it shows that students study result increases significantly with average score 43,75 in pretest and 82,5 in posttest. Students' classical accomplishment percentage indicates category 'very good' (100%) because it is in space 80-100.

#### 3.2 Indicator Accomplishment of Critical Thinking Competence

The effectiveness of bamboo scientific book in Rambah Menjangan Falls Region based on indicator accomplishment evaluation of students' critical thinking skill can be seen on Table 2.

**Table 2:** Evaluation result of students' critical thinking

Critical thinking indicator	Acquisition of pretest score	Acquisition of posttest score	N-Gain average	Category
<b>Interpretation</b>	11	19	0,79	High
	8	18		
	10	15		
<b>Deduction</b>	10	19	0,76	High
	6	17		
	6	11		
<b>Assumption</b>	13	20	0,79	High
	8	16		
	6	13		
<b>Inference</b>	9	19	0,77	High
	7	14		
	9	16		
<b>Average</b>			<b>0,78</b>	<b>High</b>

Source: Data calculation result

Based on Table 2 above, the increase of interpretation, deduction, assumption and inference competence reaches high category. Generally students critical thinking competence reaches high category with N-Gain average 0,78.

#### 4. Discussion

The effectiveness of bamboo scientific book in Region of Rampah Menjangan Falls can be seen based on the evaluation of students' cognitive study result and the indicator achievement of students' critical thinking skill during macro scale try out. The macro scale try out involves 20 students in grade tenth IPA 2 SMAN 2 Kandangan. According to Tessmer (1998), effectiveness is being success in achieving development goals, that is to say when a learner or a teacher uses a product and it can intactly be used.

##### 4.1 Students' cognitive study result

Students' cognitive study result is scored based on pretest and posttest result by using evaluation questions in the form of multiple choices. According to Suparman (2012), the scoring instrument of cognitive study result should be in the form of written or oral test and it is answered by the students written or orally as well.

From the pretest result of the students, it is obtained the average score 43,75, while from the posttest the average score obtained is 82,5. The pretest result indicates no student accomplishes the KKM, whereas the posttest result shows that all students accomplish KKM. Based on the results, students' study result increases significantly after using scientific book. Classically there are no accomplished students on pretest, while on posttest students get 100% accomplishment. This means that the using of bamboo scientific book in learning is effective. The using of scientific book in learning process gives advantages towards the students because it can increase students learning

motivation. The increasing of students' learning motivation will next influence students' study result. The increasing of study result means students get very good understanding during the learning process.

A research conducted by Prihatin (2015) also concludes that students' study result increases after using developed teaching material, because the material helps the students during the learning. Other research conducted by Amir et al (2016) concludes that the using of learning material during the learning process will increase students' study result. Besides, using teaching material indicates the increasing of understanding or students' concept mastery after the learning. The increasing of study result is because during the pretest, students do not yet get the teaching material, and during the posttest, student has used the teaching material.

Based on Miarso (2005), Students' ability and motivation relates much with students' accomplishment. Based on Asyhar (2012), the using of teaching material on learning may increase motivation and attract students' attention to focus on presented material, so that learning effectiveness will increase as well. Therefore, the using of teaching material on learning process influences the result gotten by students.

#### **4.2 Students' critical thinking skill**

The critical thinking skill indicator being searched covers four aspects; interpretation, assumption, deduction, and inference. Students' critical thinking skill is analyzed based on obtained N-Gain. Based on the result obtained, it is discovered that students' N-Gain category indicates the increasing value of critical thinking skill from pretest to the conducted posttest. The positive N-Gain value shows the increasing students' critical thinking skill after being given the scientific group.

Based on data on table 2, it is known that students' interpretation skill gets N-Gain score 0,79, students' assumption skill obtains N-Gain score 0,79, students' deduction competence has N-Gain score 0,76, students' inference competence gets N-Gain score 0,77. Students' interpretation, assumption, deduction and inference competence is in category 'high'. The average N-Gain in every indicator of students' critical thinking skill scores 0,78 with category 'high'. Based on that explanation, it is known that generally students' critical thinking reaches category 'high'.

The increase of students' competence on doing interpretation reaches high score as in this indicator the students are directed to identify a problem. If a problem is encountered, a solution will be searched. Here, the students involve directly to determine the problem they want to solve, whereas teacher role in only to direct the students to find the relevant problem with the learning target wanted to accomplish. The students' interpretation competence will simplify problem determination about bamboo. When the students find the right problem, students can make the right prediction or hypothesis. It is in line with Nur (2008), who explained that before the students obtain and process some information, students should be able to interpret and present the codes or problem happened based on available data. Based on Facione

(2010), critical thinking skill can help someone to decide according to precise effort, systematic, logic, and consider various points of view.

The increase of students' assumption competence reaches category 'high'. It is because the students are trained to contribute their opinions about problem happened. Students should design the problem solving guideline to prove their opinions. Students assumption competence will help the students to give their opinions about various problems happened so that they will be more active in discussion during the learning process. Learning with scientific method involves the students more in the process of exchanging opinion. According to Fajeriadi (2018), the scientific method also involves students directly in the process of arranging working procedure to collect the field data. The data obtained then can be used to be analyzed by the students. Students with good assumption competence can conduct the right problem solving. The assumption competence also gets high result supported by group-based learning so the better result is obtained. Based on the research conducted by Yusran et al (2015), the group learning help the students to understand the material faster.

The increase of students deducting competence reaches category 'high'. Students' deduction competence can be seen when they analyze the bamboo observation data by using the developed scientific book. Deducting skill helps the students to prove a truth from their opinions towards the problem in interpretation process. When the data collecting procedure is right, the collected data is also relevant with the procedure requirement and also the data analysis is right, then the right information will be obtained. Students can use deduction competence to analyze the problems available and even determine the solution of the problems found during analysis process. The data analysis process is very important for the students because in this stage, the students know the truth of observation result and then compare it with the theories available. It is in line with the research conducted by Dwijananti and Yulianti (2010), which explained that students critical thinking skill will rise if they can analyze the problem right through searching the proves support their ideas.

The increase of students' competence on inferencing reaches category 'fair'. The inference competence can be seen when the student make conclusion in learning process. The students' inferencing skill helps the students to conclude a problem happened based on the available data. Here, the conclusion taken should be the answer of the problem, so that it can prove the truth from the students' opinions. The research conducted by Fajeriadi (2018), also finds that students' inference competence is in category 'fair'. When students have different conclusion, it is teacher task to direct them to the right conclusion. The students with right inferencing shows that they conduct the right deduction analysis, because the students should analyze the data with the right procedure so the conclusion obtained is right as well.

Critical thinking competence is totally needed and it should be the part of students' competence (Beaumont, 2010). The increase of students' critical thinking can not be separated from students' active role in learning process. A research conducted by Nuriyanah and Aminuddin (2015), obtained the result that students' critical thinking

skill reaches category 'good'. This increase is because the students begin to be actively engaged in learning process, it is can also be seen from the increase of students' activity. Based on Aji et al (2014), to have the students understand the material deeper and meaningfully and think critically, it needs the learning activities which provide them direct activities, therefore they can built and develop their knowledge based on their real and daily experience. The activities which give direct experience for students can be conducted with simple and easy things. It can be done by maximizing the local environment.

Based on Zaini (2016), the learning which involves the teacher actively in learning process will retard the students to solve problems by themselves. Therefore, the students' involvement in learning will increase the critical thinking skill. The increase of critical thinking skill may enhance the increase of students' cognitive competence. The increase of students' cognitive competence can increase Indonesian education rank which is still in low-grade based on the mapping of *The Learning Curve 2013*.

## 5. Conclusion

Scientific book is effective based on students 'cognitive learning outcomes that show very well with 100% classical completeness and students' critical thinking skills that show high category.

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