

Teaching Material Development with Challenge Based Learning (CBL) Basis to Improve Critical Thinking Ability on Human Reproduction System Material of Class XI IPA 4 Students at MAN Pinrang

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Abstract. The study aims at (1) developing teaching material based on Challenge Based Learning (CBL) basis in Human Reproduction System material, (2) Obtaining data of validity and effectiveness of teaching material with CBL basis on Reproduction System material, and (3) describing students critical thinking ability improvement after teaching by using teaching material based on CBL. The study is research and development. The study was conducted at MAN Pinrang in March 2016 to June 2016. The subject of the study was the students of class XII IPA 4 at MAN Pinrang of academic year 2015/2016 which consisted of 38 students. The development design referred to 4D development model by Thiagarajan consist of 4 stages, namely defining, design, development, dissemination with the teaching product in forms of student's book with CBL basis and student's work sheet with CBL basis. The result of the study reveal that (1) the teaching material with CBL basis developed has met valid criteria with the total mean score for all assessment indicators $V=100\%$. The validity of teaching material is stated at the level of strong relevancy with content validity coefficient more than 0.75 or $V>75\%$ from the ideal score 100%, (2) the teaching material with CBL basis has met effective criteria based on the result of students' response on students' book with the mean of positive response is 97.37% and the response on the student's work sheet with the mean of positive response is 91.58%; (3) the critical thinking ability of grade XI IPA 4 students at MAN Pinrang after being taught by employing teaching material with CBL basis has improved by 18.34 with the mean score 61.06 in cycle I and 75.39 in cycle II.

Keywords: Challenge Based Learning, Critical Thinking Ability.

INTRODUCTION

Education is a continually running process to create human resources with qualified, educated, peaceful, open-minded, democratic, and competitive individuals to face globalization era. Based on the Indonesian Constitutions No 20 year 2003, the System of National Education is to foster students' potency in order to be educated, skillful, creative, and self-sufficient pupils.

Teachers, a determiner the success of educational objectives, must play important role in students' learning experience. Instead of mastering lessons, a teacher should have developed learning materials with some approaches, strategies, models, innovative learning methods in case of sharpening the ability to think, motivation, activities, students' learning records established in the prevailing curriculum.

The phenomena which were experienced at MAN Pinrang and reflection results as a teacher showed that most teachers were notable develop learning materials based on students' need yet. The learning materials used at school were guidebooks from certain publisher in a limited numbers and being not owned by each of students. In addition, the provided LKS as supportive materials in learning process were released from different publisher. This caused asynchronous circumstances between the learning models and materials applied in the classroom. As a result, learning process was monotonous and passive due to the rigidity of the content flow of the guidebooks, which basically rely on 'ancient' paradigm.

Critical thinking ability is cognitive processes and mental activities in order to gain knowledge. Facione (1990) dan Richard Paul (1995) inStedman (2009) stated that critical thinking is a process in what someone is

able to think systematically in case of capable to interpret, analyse, evaluate, and conclude. The critical thinking process might lead someone to comprehend argumentation of different values, understand the existence of inference and interpret it, recognise mistakes, use language in expressing ideas, realise and manage egoism, and emotion, be responsive with divergent opinions (Costa & Kallick, 2000). A student with a critical thinking ability could finish given challenges through systematic ways. This might maximize students' cognitive competence that is indicated by score results of study.

The interviews conducted with researcher's colleagues illustrated that the assessment process at MAN Pinrang did not measure the ability of students' critical thinking in Biology classes at the same grades in the sense that teacher's knowledge of students' critical thinking was still low. Such phenomena has the same sound with Rofi'uddin's research findings (2000) in Fitrihidajati (2010), which showed the plaint about the low ability of students' creative-critical thinking in elementary schools up to university. Furthermore, critical thinking paradigm was not well-handled instead of it could be integrated with all subjects.

To cope with happening problems in Biology classes at MAN Pinrang, it is necessary to provide a teaching material with suitable learning models in order to increase students' knowledge and train the students' ability in thinking critically. It is required an effective learning model in which students are stimulated by *learning by doing* model relating to daily activities (contextual) or faced obstacles.

Learning by doing model could be applied through Challenge Based Learning (CBL). It is a learning model relying on daily activities (contextual) or faced problems (global issues) that were then solved by students (*problem solving*) (Johnson L., et al, 2009). In CBL, students are challenged to cope with present issues or current phenomena that must be solved to discuss. The settlement is a kind of real actions and solutions from simple matters experienced in daily lives.

Challenge Based Learning is demonstrated as a particular form of problem-solving model with nature and realistic problems. Such learning model consists of features of experience-approach and project-based learning. In this case, Teachers stimulate huge ideas covering the whole of learning process. Huge ideas are certainly related to problems close to students' lives. Those enormous ideas trigger essential questions and challenges that must be answered. The learning processes might be activities in solving challenges helped various questions and sources. The learning outcomes are indicated by alternative solutions to the offered challenges (Johnson, L., et al., 2009). Such model is considered to stimulate the students' critical thinking ability.

The research findings applied CBL in learning process showed that there was a significant improvement of the students' learning outcomes, the comprehension of concept and mathematical reasoning, creative-thinking skill, innovative thinking ability in mathematics, physics, biomedical technique, biotransport, and biomechanics (Roselli, R. J., 2004; Harris, T.R. & Brophy, S. P., 2005; Roselli, R.J., 2006; Martin T., et al, 2007; dan Haqq, 2013).

Regarding the explanation above, the research provided instruments developed into classroom through CBL model was reproduction system. The lessons of reproduction system were extremely related to students' daily activities, especially the second grade students at senior high school as teenagers with some various problems. The learning activities were expected to guide students gaining information about organs of reproduction and reproduction health. The stimulated challenges through CBL model enforced the students to think alternative ways of promoted problems. This was hoped to educate the students in sexual activities and divergence happening in recent years.

Based on the problems, it is important to carry out a research entitled *Teaching Material Development with Challenge Based Learning (CBL) Basis to Improve Critical Thinking Ability on Human Reproduction System Material of Class XI IPA 4 Students at MAN Pinrang*".

Problem Statements

Based the research background, the researcher formulated research question as follow:

1. How is the validity of the materials about reproduction system in biology class, which was developed through *Challenge Based Learning* model?
2. How is the students' critical thinking ability at the second grade of XI IPA 4 MAN Pinrang after having learning reproduction system materials through *Challenge Based Learning*?
3. How are the students' responses on reproduction system materials through *Challenge Based Learning*?

Research Objectives

1. To describe the validity of the materials about reproduction system in biology class, which was developed through *Challenge Based Learning* model?
2. To describe the students' critical thinking ability at XI IPA 4 MAN Pinrang after having learning reproduction system materials through *Challenge Based Learning*.
3. To describe students' responses on reproduction system materials through *Challenge Based Learning*.

REVIEW RELATED LITERATURE

Constructivist Learning in Biology

Biology is a discipline of natural science that supplies many learning experiences to comprehend concepts and processes of science. The learning experience might consist of observing natural phenomena, compose hypothesis, operating tools and materials well in laboratory work, asking, classifying and interpret data, discussing the results of oral and written observation, exploring factually relevant information in order to examine opinions or solving daily problems (BSNP, 2006).

The supposed approach in learning Biology is constructivism. The constructivist approach is an education philosophy emphasizing that knowledge could be actively constructed by students through the development of their mental processes.

The Characteristic Model of *Challenge Based Learning*

Challenge Based Learning is a sophisticated learning model which correlates based problem learning, project based learning, and contextual learning focused on actual phenomena in real life (Johnson L., *et al.*, 2009 and Johnson L., & Adams S., 2011). CBL holds problem-solving to be prior attention, open access with 21 century invention, oblige students to work in collaborative ways, arrange time under teachers' controls (Johnson L., *et al.*, 2009). The Learning Frameworks of *Challenge Based Learning* are as follow: a) Big idea, b) Essential Question, c) The Challenge, d) Guiding Questions, e) Guiding Activities, and Guiding Resources, f) Solution – Action, g) Assesment, h) Publishing.

Teaching Material Based on *Challenge Based Learning*

The developed materials in the research were *Students' Books* (BS) and *Students' Worksheet* (LKS). The '*Students' Books* (BS) were compiled based on CBL principles, containing lessons and challenges, which were integrated in *Students' Worksheet* (LKS). Meanwhile, *Students' Worksheets* (LKS) based CBL contain challenging exercises and projects were correlated to real problems which is happening or correlated with students themselves.

The Development Model of 4D

The steps applied systematically began with phase of defining, designing, developing, and disseminating. In the developing phase, it was executed an expert validity and limited tryouts.

Critical Thinking Ability

Critical thinking in this study was organized processes involving mental activities, which included ability to express arguments, hold deduction and induction, evaluate, determine, and execute.

METHOD

The research was observation and development to create a product which was the materials about reproduction system in biology class. The research was developed based on the development model of 4D consisting of 4 phases (defining, designing, developing, and disseminating).

The research objective was to develop the set of materials about reproduction system which was then analyzed and validated by the lecturers of Postgraduate Program at Makassar State University (UNM). After having been validated, the materials then tested to students at XI IPA class 4 MAN Pinrang, with limited tryouts through Class Action Research (CAR). Data collection of critical thinking ability is by essay test. The executed stage was just accomplished till developing phase, while the dissemination phase could only be introduction to the biology teachers at MAN Pinrang context.

RESEARCH FINDINGS AND DISCUSSION

Data Analysis of Validation Results

The validation was conducted by the lecturers in Biology Department of by using validation sheets. The validation sheets were used to collect the assessment data of materials' expediency. The validation results were descriptively analyzed as illustrated in the following pictures:

Table 1 Validation Result of *Students' Books*

		Validator I	
		Irrelevant Score (1 – 2)	Relevant Score (3 – 4)
Validator II	Irrelevant Score (1 – 2)	0	0
	Relevant Score (3 – 4)	0	25

Table 2 Validation Result of *Students' Worksheets*

		Validator I	
		Irrelevant Score (1 – 2)	Relevant Score (3 – 4)
Validator II	Irrelevant Score (1 – 2)	0	0
	Relevant Score (3 – 4)	0	31

If the coefficient of validity is higher than 75% ($> 75\%$), it demonstrates that the measurement or inference is valid (Ruslan, 2005). Based on the given assessment by two experts, it was found that the validity gained was 1 or $V = 100\%$. It indicated that assessment results from two evaluators had 'significant relevance' with the content of validity coefficient more than 0.75 or $V > 75\%$, this might come to the conclusion that the created '*Students' Books*' and '*Students' worksheets*' were valid.

The Data Analysis of Students' Critical Thinking Ability

The learning materials about reproduction system in biology class which had been validated were then examined in tryouts to 38 students of XI IPA 4 MAN Pinrang through Class Action Research (CAR). The tryouts were conducted to describe the students' critical thinking ability and students' responses toward the developed learning materials. The limited tryout results that measured the students' critical thinking ability presented in Table 3.

Table 3. The Distribution of Students' Achievement in Critical Thinking Ability Test Cycle I and II

Interval Score	Cycle I		Cycle II		Category
	Frequency	Percentage (%)	Frequency	Percentage (%)	
91 – 100	0	0	2	5,26	Good
81 – 90	0	0	10	26,32	Satisfactory
70 – 80	10	26,32	20	52,63	Fair
< 70	28	73,68	6	15,79	Poor
Total	38	100	38	100	

Table 1 illustrates that 38 students joining the biology class applying learning materials about reproduction system of human based CBL cycle I, 0% students were in good and satisfactory categories, 10 students (26.32%) were in fair category, and 28 students (73.68%) in poor category. Meanwhile, in cycle II, there were 2 students (5.26%) in good category, 10 students (26.32%) were in satisfactory category, 20 fair students (52.63%), and 6 pupils were in poor classification (15.79%). Based on the standard score criteria established at MAN Pinrang, the learning outcomes are demonstrated by the following table (table 4).

Table 4. Score Passing Category in Students' Critical Thinking Ability Cycle I and II

Interval Score	Cycle I		Cycle II		Category
	Frequency	Percentage (%)	Frequency	Percentage (%)	
0 – 69	28	73,68	6	15,79	Not Passed
70 – 100	10	26,32	32	84,21	Passed
Total	38	100			

The data in table 2 illustrates that the number of students who did not classically pass in the cycle I was 10 accounting for (26,32%), while there were 28 ones had not passed (73,68%) due to not achieving KKM. In the cycle II, there was an increase in the number of students passing classically accounting for 32 students (84,21%), and still 6 students were not (15,79%). The results were similar to objectives of developing the reproduction system materials in Biology class in order to have students think critically in the sense of helping them able to answer questions required high level of thinking.

The Data Analysis of Students' Responses

The data of students' response after leading learning processes with material based CBL model was obtained from students' response questionnaires distributed after all learning process cycle I and cycle II finished. The resume of result data analysis of students' responses can be seen in table 5.

Table 5. Analysis Result of Students Response Questionnaires

No.	Response	Students' response toward (%)		
		Learning Activities	<i>Students books</i>	<i>Worksheets</i>
1.	Positive	94,38	97,37	91,58
2.	Negative	5,62	2,63	8,42

The students' response results in the table above illustrates that 94.38% students conferred positive responses toward the learning activities applying CBL based materials, 97.37 % students responded positively toward '*students books*', and 91.58% students' responses were positive toward '*worksheets*'. Based on the results, it can be concluded that biology based CBL materials about reproduction system developed had fulfilled the effective criteria. According to Hobri (2010), the way of determining an effectiveness observed from students' responses is that there are 80% students or more confer positive responses from all research subjects.

Discussion

Based on validity result, teaching material with CBL basis (*Students Books* and *Students Worksheets*) were valid with the validity gained was 1 or V= 100%. It shows that the steps of teaching learning process in lesson plan (RPP) had relevance with the *Students books* and *Students Worksheet* used.

The using of CBL model and teaching material with CBL can improve critical thinking ability of grade XI IPA 4 students at MAN Pinrang. It is shown by their score enhancement from cycle I to cycle II. The improvement of students critical thinking ability due to the learning steps in the CBL integrated in *students books* and *worksheets* provide the opportunity for students to develop their critical thinking skills, e.g. activity formulate main ideas (big idea) stimulate students' ability to provide feedback/ arguments on the problem given by the teacher and the problems that exist in the worksheet; settlement activity challenges provide opportunities for students to actively ask, share information in a group discussion, linking the material received with the real situation that is happening around them, as well as provide solutions to the given phenomenon.

The results obtained are in line with previous research which states that the CBL is able to develop students' ability to do research, linking theory and practice, problem solving, critical thinking, creative thinking, analyzing, synthesizing, working together, asking questions, and reflect on learning outcomes (Johnson & Adams, 2011; O'Mahony et al., 2012; Haqq, 2013; Marin et al., 2013; and Shuptrine, 2013).

From the research, the majority of students responded positively to the learning process because they assume that learning by using teaching materials based CBL giving them a learning experience that is much more than before, they are more easily understand the material when it is presented in the form of animation, as well as facilitate them to more active in learning both independently and in groups. Most students also responded positively to the CBL based teaching materials used during learning. This is illustrated by their response stating that the *students books* and *worksheets* that are used enough to help them in building their biology knowledge.

CONCLUSION

Based on the research findings, the researcher came to conclusions as follow:

1. The developed learning materials has fulfilled valid criteria which were validity score gained 1 atau $V = 100\%$ showing there was a strong relevance between the developed '*students books*' and the '*worksheets*'.
2. The ability of students' critical thinking has significantly increased accounting for 14.34 % from cycle I to cycle II that was shown in the number of students obtaining classical passing score, 32 students (84.21%). It shows that the based CBL based materials could help improve the ability of students' critical thinking.
3. The result of students' responses demonstrate that 94.38% students conveyed positive responses toward learning activities utilizing the CBL based materials, 97.37% students accorded positive responses to the *students' books* and 91.58 gave positive ones toward the *worksheets*. Based on the findings, it can be concluded that the developed biology based CBL materials about reproduction system has fulfilled the effective criteria.

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