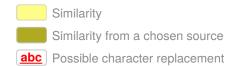# Doc vs Internet

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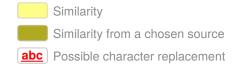34. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2923.1989.tb01581.x   0.6%

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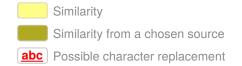80. https://link.springer.com/chapter/10.1007/978-981-4021-75-3_9 — 0.33%

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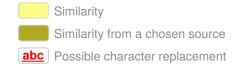126. http://iopscience.iop.org/issue/1755-1315/106/1   0.27%

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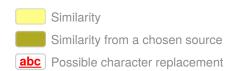
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How to develop problem based teaching materials?

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ABSTRACT: The purpose of this research is to develop problem-based teaching materials on the Science at primary school level (IPA SD) course. This research is R and D used 4D method, which consists of define, design, develop and disseminate. The instrument used questionnaire and observation sheet. In analyzing data the researcher used qualitative and quantitative data analysis techniques. The results showed that to develop teaching material the problem-based teaching materials consist of several phases including define, design and development. The subject of this reasearch is fourth semester of PGSD universitas Kanjuruhan Malang students in academic year 2015/2016. The problem-based teaching materials has some characters as follows; problem orientation, group activities, explanations and conclusions. The feasibility of the results from material experts showed 81%, from presentation showed 91.6% and language 77% . The study result imply that in developing teaching materials, the first thing to be consider is to perform needs analysis.

1. INTRODUCTION

Nowdays the purpose of learning is more focused on product-oriented. The results of the learning analysis that has been done, it is known that students often have difficulty when they face questions that require higher/ critical thinking skills.

In everyday life, According Bassham, Irwin, Nardone, & Wallace (2011) critical thinking skill is useful in making decisions and giving opinions based on reasons to defend decisions that can be rejected or accepted intelligently. Critical thinking skill is the ability to think at higher level which can be indicated by the following categories. Bloom (2001) They are interpreting, logically defining, analyzing causality, evaluating and predicting and solving a problem.
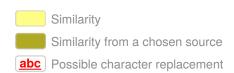
Critical thinking skill can be taught to students through learning (academic activities) (Pieterse et al. 2016) Furthermore Vong & Kaewurai (2016)where teachers use methods, ways of teaching thinking skills and appropriate curriculum materials (Gadzella & Masten, 1998; Halpern, 1993, McMillan, 1987). Zikovic (2016) explain that In learning thinking skills, students must be able to communicate effectively and solve problems efficiently and require students to engage actively in problem-solving skills.

One of the learning activities that can develop critical thinking skills is problem based learning. Dolman said (2005) Problem-based learning is considered a model of mental learning based on constructive, independent and collaborative activities added Norman (21012) through practice and reflection. Yew & Goh (2016) The principle of constructivism is positioning students as active knowledge seekers through schemata activities.

Furthermore, Yew & Goh, (2016) added Problem-based learning is an effective learning and affects student's learning abilities especially for long-term retention of knowledge and it is easy to be applied. According to Arlahrah

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(2016); Ghou (2014) Problem-based learning enables students to be active in learning, responsible, able to overcome some problems and teach critical thinking skills to perform real-world analysis and problem solving

Johnson & Johnson (Hamruni, (2012), there are several steps in the application of problem-based learning model a). Defining the problem, b). Diagnosing the problem, c). Formulating alternative strategies including defining and implementing preferred strategies, assessing the actions through discussion activities d). Doing evaluation.

Related study has been done by some researchers such as Arlahlah (2016); Ghorgiu, et.al (2014); Gurses et.al (2015) and Mat et.all (2011) have been implementing problem-based learning in their teaching, but most of the previous study is more focused on implementing problem-based learning models, not on the development of problem-based learning materials. There are several studies that develop problem-based teaching materials such as Rajaguguk & Simanjuntak (2015); Supriyono, 2013) attempted to develop problem-based and constructionist teaching materials, but the results of the development have not demonstrated the complete steps or syntax of problem-based learning models.

This study attempts to develop problem-based learning materials that integrate syntax of problem-based learning entirely, so that the syntax come into view in the problem-based learning teaching material. Procedure of development in this research using 4D Thiagarajan which before doing the development, the researcher should analyze the requirement of research subject in detail, so that the teaching material is appropriate and able to overcome the problem experienced by the research subjects.

2. METHOD

The research method used in this study was research development (R and D) teaching materials that refer to 4D Model by Thiagarajan, but this research only reaches stage III.
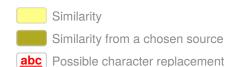
First stage is define. The defining stage consists of several steps:

a. Preliminary analysis: This stage is a step to do learning observation of teaching materials and learning process in the existing class. The test subjects at this stage are lecturers and 40 students who follow the primary school science course in 2014D class of Universitas Kanjuruhan Malang. It consists of 9 male and 41 female.

b. Analysis of the students stage: the students were analyzed by observing the way they learn the students' mean score. Students' learning methods were measured using observation sheets, while the students' mean score was derived from the scores on prerequisite subjects, primary school science (IPA SD)

c. Concept analysis stages; Concept analysis is an activity to develop the concept of the subject into a concept map of science learning materials that are elaborated into several more detailed parts.

d. Task analysis stage. This stage is to develop the material into several tasks or competencies that must be possessed by learners.

The second stage of 4D stage is the design stage, the design stage consists of several steps, namely:

a. Preparation of test questions, the results of the defining stages of student competencies developed into several master questions as test item.

b. Selection of form and media: Determination of learning form in teaching materials in accordance

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with the results of character analysis and learning style of the students in the defining stage,

c. Determine the strategy; what should be done in this stage is to determine the strategy based on the results of the preliminary study done to the classroom.

Furthermore, The stages developed in the problem-based teaching materials are as follows: 1) Defining the problem, by presenting a problem, 2). Diagnosing problems, 3). Formulating alternatives problem solving individually, 4). Defining preferred strategies by providing student worksheets for discussion, 5). Evaluation. In the teaching materials, the researcher gave worksheets to the students to analyze with their group.

The third stage of the 4D is the development stage. The development stage consists of several stages:

a) Expert validation, The expert in this study consists of material, language and presentation experts. The three experts have assessed the feasibility of the teaching materials that have been developed in accordance with each scope using a questionnaire with a scale linkert.

For the questionnaire assessment based on Indonesian education Authorities indicators as follows: Table.1 Aspects of assessment of problem-based teaching materials

Table 1. Indicator of teaching material assessment aspect

Aspect	Sub Aspect
Material	The appropriateness between comptencies
	Material accuracy
	Material novelty
	Encourage critical thinking
Layout	Cover
	Layout Technique
	Layout of Learning
	Coherence and the demands of the flow of thought

Aspect	Sub Aspect
Language	Assignment
	Communicative
	Dialogic and Interactive
	Compatible with the development of learners
	Compatible with Indonesian language rules
	The use of terms, symbols or icons

After getting the result of validation then the researcher started to do revision. The next validation are user validation. In this case the user was one of the lecturers of primary school science (IPA SD). The questionnaire given to the lecturer is the same as that given to the expert.

While the data gathered from the the student analysis (preliminary study), students analysis and the questionnaire validation results were made in the form of scoring analysis using rating scale and percentage (%). Calculation results can be given meaning in Table 2. Arikunto (2007):
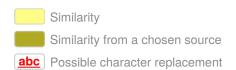
Table 2. level of achievement and qualification conversion

Achievement level	Qualification	Explanation
90% - 100%	Very feasible	No revision
75% - 89%	Feasible	No revision
65% - 74%	Quite feasible	Revision
55% - 64%	Less feasible	Revision

3. RESULT AND DISCUSSION

Based on the result of the research have done, there were some define stage. The following are the detail steps: a). Preliminary study: Teaching material in the primary school science (IPA SD) course used power point and structured task, there were no authentic material such as module or other references. b). Analysis of students characteristics: The result of student characteristic analysis, the students do the presentation activity with the level of activeness about 40%

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and the level of question on the presentation activity was still struggling in the realm of Cognitif 1 -Cognitif 3 (bloom's cognitif). Furthermore the result of observation on student learning style shown in table 3. Student learning style Education of Primary School Teacher 2014D

Table.3. Students Learning Style

Gender	Visual	Audio	Kinesthetic
Male	3	1	1
Female	28	7	-

Based on table 3. Students learning style of Education of Primary School Teacher 2014D class was known that more students about 77.5% of students use visual learning style, 20% use audio learning style, and the rest 2.5% of students learn by kinesthetic. That conclude more of student visual learning style.

The result of students learning, it can be described that students competencies or the students average score were good. It can be seen from students who got score 80-100 were 42,5% or 17 students from the total 40 students and 40 % students got score between 60-80. while students who got under 60 were only 7 students or 18.5%

Concept analysis, the following is the result of developing concept maps. Detail information can be seen on table 4.

Table 4. concept maps of IPA SD teaching material

Course	Concept	Material
IPA SD lesson	Teaching concept of IPA SD	The nature of science learning Science learning Learning concept of science in primary school
	Learning theory of IPA SD	The theory of behavior in science
		Cognitive theory Constructionist theory Other theories
Process skills in science learning		Basic process skills Integrated process skills

Task Analysis stage has a result as follow the development of the concept is translated into structured tasks in accordance with concept maps that have been developed. The results of the competencies set by the students are then developed at the design stage.

The second stage on 4D is design stage. In this stage the researcher formulated design based on the result of the define stage. There were several steps in this stage, they were: a). Selection of form and media. Media that have developed in this activity were authentic/ printed and electronic. The consideration of using both printed and electronic media because of the students learning style by visual type of learning that was 77.5%. b) Preparing test item. the results of the defining stages of student competencies developed into several master questions as test item. Test items were developed in accordance with indicator/ competencies. Test items should be relevant with the average students competencies, c). determining the form of strategy. In this study the strategy was selected by internalizing problem-based learning in teaching materials.

The result of the development of problem-based teaching materials, consists of several steps, namely: 1). Defining the problem. At this stage researcher develop students' ability in thinking through asking students to try to relate their experience with the problems presented, this process is called assimilation. According Baharudin & Wahyuni (2012) Assimilation is the cognitive process and the absorption of

new experiences when one combines existing knowledge. Assimilation with high-quality questions can develop thinking skills (Jansen, 2011), 2). Diagnosing problems, at this stage students analyze the various factors causing, inhibiting and trigger a problem. This stage can develop student's ability to analyze. Diagnose/formulate problems cause learners to seek relationships, clarity and similarity so that students can analyze and determine the priority selected Hamruni (2012), 3). Formulate alternatives problem solving individually. Problem-solving skills will develop students' ability to make decisions. According to Jansen (2011) It is very good for the brain to provide tasks / solve problems that are challenging, new and complex. The fourth stage in Problem Based Learning is to determine the strategy through discussion. Discussion will open mind and complementary thinking for an individual person. Slavin (2005) states that students who learn cooperatively or work together in learning will make students more responsible and get more motivation in learning.

Fifth stage is evaluation. This stage can be defined as a stage to reflect on a decision or activity that has been done. An individual will be able to evaluate when the person has been able to analyze and draw relationships on a variable. Evaluating is categorized as C5 level and included in critical thinking skills. Mat et.al (2011) and the findings of Jalani & Sern (2015) said problem based learning is designed to help students in developing their critical thinking skills, solving problems based on acquired knowledge.

The third stage in 4D is the development stage. In the development stage carried out validation by experts and lecturers of the course. Results from expert validation are shown in table 5:

Table 5. Result of expert validation

Aspect	Percentage (expert)	Percentage (lecture)	Qualification
Material	81%,	81%	Feasible
Layout	91,6%,	77%	Feasible
Language	77%	76%	Feasible

The results of the expert validation in table 9 showed on the aspects of the material, presentation and language getting decent criteria but there is still little revision to do and some suggestions for product improvement.

4. CONCLUSION

Based on the results of research that has been done can be concluded that in developing teaching materials, the first thing to be consider is to perform needs analysis. Needs analysis includes: analysis of teaching materials that is used, learners character, and analysis of materials and learners competencies. Needs analysis is done as an effort to overcome the problems faced by research subjects and adjusted to the characteristics of research subjects. Teaching materials used in learning will lead to the characteristics of teaching materials it self.
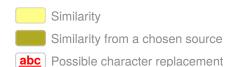
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