Development of Science Teaching Materials Contained with Character Education with Problem-Based Learning Model Settings to Improve Student Character and Critical Thinking Skills

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ABSTRACT
This study aims to produce science teaching materials with character education in a valid, practical, and effective problem-based learning model setting to improve students' character and critical thinking skills. The development of learning tools refers to the 4-D development model which consists of defining, designing, developing, and disseminating. The development stage is only carried out until the development stage. Data were collected by tests, questionnaires, and observation sheets, and analyzed using descriptive statistics. The results showed (1) the teaching materials were stated to be very valid with an average score of 3.84, (2) the teaching materials were declared very practical with an average score of 3.71, (3) the teaching materials were declared feasible. effective for improving critical thinking skills with a t count of 14.07 (t count > t table), (4) teaching materials are declared effective for improving student character with an increased student character development value. Based on the results of the study, it can be concluded that physics teaching materials containing character education with problem-based learning model settings meet valid, practical, and effective criteria for improving the character and critical thinking skills.

Keywords: *character education, critical thinking skills, problem-based learning, teaching materials*

1. INTRODUCTION

XXI century education about developing literacy, competence, and character. [14] the hope is that students can solve real-life problems that contribute to higher-order thinking skills (HOTS), collaboration, communication, innovation, creativity, and problem-solving in the learning cycle. [13] thinking skills are classified into two levels, namely low-order thinking and high-order thinking. Both are elements of the cognitive field. The purpose of XXI century education is to mature students in mastering the skills that will later be needed in facing challenges in everyday life.

Until now, the essential problem faced by the world of education is how to endeavor to empower thinking capabilities [6] and develop understanding [1]. In a study, learning achievement (achievement) as measured by the attainment of test scores is not more important than an understanding [1], because learning achievement is only dominantly focused on memorizing knowledge. Based on this problem, many efforts have been carried out by the private sector or the government.

On a national scale, actually education reform is not enough just to implement curriculum changes and special programs, these changes should be interpreted by changing thinking [2] and attachment to self-expansion. Changes in attitudes and thinking refer to teaching activities in the direction of learning and how to stimulate or encourage learning and learning how to learn [7]. Learning must be packaged and based on the nature of learning, not only focusing on learning outcomes such as rote-memorization [1]. The direction of education reform should be learning according to constructivism patterns. The meaning of learning itself is the construction of understanding and knowledge through cycles of social interaction and psychic operations [1].

Gardner [5] explained regarding the application of learning reform that the general intention of education should be focused on achieving understanding to master various aspects of the discipline. Understanding is a psychic cycle of

the emergence of transformation and adaptation of knowledge [5]. Based on Gagne's taxonomy, the level of understanding is at the level of verbal information, according to Reigeluth's taxonomy at the level of understanding correlations (understand relationship), based on Merrill's taxonomy at the remember paraphrased level, according to Anderson's taxonomy at the level of declarative knowledge (declarative knowledge), and according to Bloom's taxonomy at the level of comprehension [7]. This explanation shows that understanding requires limited knowledge at a lower level and is a limitation in achieving higher level knowledge, for example individual policy, insight, evaluation, synthesis, analysis, and application.

From that description, in science learning understanding is defined as the ability to: (1) explain concepts, principles, and procedures, (2) identify and select concepts, principles, and procedures, (3) apply concepts, principles, and procedures. The three dimensions of understanding in this study are basic thinking skills in the realm of thinking skills [6]. Understanding is a basic thinking skill which is essential in achieving critical thinking skills. The ability to think critically is a structured cycle that includes a psychic cycle in which it deals with solving problems, making decisions, conducting analysis, and scientific inquiry activities [4]. Critical thinking is the basis for providing analysis of arguments and presenting knowledge in every interpretation and meaning. Systems thinking like this promotes thinking that is convincing, concise, believable, rational, and cohesive [4]. Individuals who have critical reasoning skills will later be able to step and behave on the basis of rules, maturely think about the things they see, listen to or consider and solve the problems they are living in [9]. According to [4], the characteristics of individuals who have critical thinking competence are emotionally stable, transparent, likes to classify, conscientious, respects the views and feelings of other individuals, likes to demand, and acts quickly when conditions require it. It was further conveyed that a strong result arises between thinking and understanding. Proficiency in understanding a teaching material well is a sign of students who have critical thinking competence.

The current situation is just the opposite, science learning is packaged for critical thinking competencies and has not been handled in a structured way. Teachers are less creative in creating learning situations that focus students' attention so that they can integrate the construction of knowledge gained in class and then apply it to everyday experience outside the classroom. The impact is the failure to achieve educational goals in the field of science.

On the other hand, the expansion of various Indonesian human cultures is still far from the expectations of national education intentions, because the learning cycle that has been applied so far has focused more on the cognitive domain that emphasizes memory or memorization or intelligence quotient (IQ) but does not advance spiritual competence quotient (SQ). and emotional quotient (EQ). That is why character education needs to optimize its quality and intensity at all levels and educational pathways, by integrating it into all subjects in schools.

The statement above indicates that science learning should be made to be able to improve the character and advance the potential of students' critical thinking skills. Critical thinking skills are needed in advances in technology and information. In adapting to increasingly advanced technology and information advances, it is not enough just to memorize science subject matter without a critical thinking cycle. In the current progress of science and technology, students are emphasized to be able to seek information by being transparent, carrying out assessments, being able to solve problems, thinking critically, and making decisions. If learning is packaged in a way that allows them to exercise more thought, the student's abilities can develop optimally. What is meant by the packaging of learning is science teaching materials that can support the emergence of students' thought processes to the maximum.

The way of thinking that students can implement greatly facilitates them in internalizing new ideas or ideas by their initial knowledge. The integration of new knowledge according to initial insight and takes place with the process of accommodation and assimilation. This process can be accelerated by using a problem-based learning model. Previous research has proven the effect of problem-based learning models on science process skills and students' problem-solving abilities [11] (Surayanah, 2016). That is why, the packaging of science learning should be focused on developing science teaching materials with character education in a problem-based learning model setting.

2. METHOD

This research is an expansion of research in the field of education which is understood by research and development (R&D), namely the development of teaching materials for the 4-D model (Four-D Model) described by Thiagarajan and Semmel [12]. The development of this teaching material was only carried out in three phases: (1) define, (2) design, (3) develop, while phase (4), namely disseminate, was not carried out due to limited time.

First, define determines and interpret the provisions at the beginning of learning by carrying out an analysis of the intentions of the material boundaries developed by the device.

Both designs are carried out in preparing and compiling teaching materials by reviewing existing teaching material patterns, for example: (a) designing assessment tools in the form of critical thinking competency tests, character observation sheets, teacher and student response questionnaires, teaching materials, observation sheets, and validation sheets (b) the design of teaching materials is carried out by quoting sources from the internet, science books, and textbooks, by integrating character education.

Third, develop (development) intends to create drafts of teaching and learning tools that have been improved based on the instructions of experts and practitioners, as well as data obtained from class tests. This development activity includes: (a) instrument validity (character instruments and critical thinking skills tests), (b) validity of teaching materials (handbooks, worksheets, lesson plans, syllabus, and assessments), (c) field trials. Character indicators such as curiosity, collaboration, friendship, discipline, responsibility, and honesty. The field test subjects were 22 class VIII students of MTs Al Khairiyah for the 2020/2021 academic year.

Determination of the validity of teaching materials with an average of at least or equal to 2.5. Student character if at the end of learning the average character value is the lowest or equal to 2.5 with the category starting to develop. Meanwhile, the effectiveness of teaching materials can be observed from the results of character observations and critical thinking skills test scores.

The developed teaching materials are said to be effective in improving students' critical thinking skills if the test scores (tcount > ttable) and the significance number is less than 0.05.

3. RESULTS AND DISCUSSION

3.1 Results

After carrying out the instrument feasibility test by experts, the developed teaching materials are validated using instruments that have been tested for feasibility. To carry out the validation of teaching materials that have been developed, 4 validators are involved, which include 2 lecturers who become experts and 2 teachers who become practitioners. Based on the results of the validation of teaching materials by validators, the developed teaching materials are suitable for use in teaching and learning.

The results of the empirical validity test of the items on critical thinking skills were analyzed using the point-biserial correlation formula, it was found that 25 questions were valid because r count > r table. Furthermore, the test reliability results were calculated using the Kuder-Richardson 20 formula (KR 20) to obtain a result of 0.84, thus the test has high reliability.

The validation of teaching materials is carried out through two stages, namely the stages of expert validation and empirical validation. Expert validation is carried out through teacher discussion forum (FGD) activities. Achievements of validation of teaching and learning tools are shown in Table 1:

Table 1. Teaching Material Validation Results

No	Components of teaching materials	Mean	Category
1	Guidebook	3,86	Very valid
2	Evaluation tool	3,81	Very valid
Mean		3,80	Veri valid

Table 1, it shows the results of construct validation and content validation of teaching materials in the form of guidelines and evaluation tools carried out with FGDs in a very valid and appropriate classification position because they are based on teaching material design guidelines that contain character education with problem-based learning model settings.

The second validation phase, namely empirical validation, is carried out during field tests (class tests). During this field test, constructive input was taken, so that in the end the books that were created had good quality based on what was expected. The practicality of teaching materials can be seen from: 1) the implementation of teaching materials, 2) teacher responses, and 3) student responses. Table 2 the achievement of reviewing the implementation of teaching materials.

Table 2. Observation Results of Learning Implementation

Meeting	Mean	Category
1	3,59	Very practical
2	3,71	Very practical
3	3,76	Very practical
4	3,83	Very practical
Mean	3,78	Very practical

According to Table 2 data, the implementation of learning increases at each meeting. The average total score experienced learning in practical classification. Meanwhile, the teacher's response to teaching materials obtained a score of 3.84 and the student's response to experiencing learning obtained a score of 3.71, both with very practical classifications.

The effectiveness of the developed teaching materials is seen based on the character values of students and the value of students' critical thinking skills. The achievement of observing student character values increases in each cycle. The following is the achievement of observing character values presented in Table 3.

Table 3. Average Character Value

No	Character	Observation			
		I	II	III	IV
1	Honest	2,30 (starting to look)	3,00 (start growing)	3,15 (start growing)	3,10 (start growing)
2	Responsibility	1,65 (starting to look)	1,80 (start growing)	3,40 (start growing)	3,45 (start growing)
3	Discipline	2,40 (starting to look)	2,45 (start growing)	2,40 (starting to look)	3,20 (start growing)
4	Friendly	2,35 (starting to look)	3.45 (start growing)	3,20 (cultured)	3,55 (cultured)
5	Cooperation	2,30 (starting to look)	3,15 (start growing)	3,55 (start growing)	3,65 (cultured)
6	Curiosity	2,30 (starting to look)	2,90 (start growing)	2,75 (start growing)	3,65 (cultured)

According to the observational data on character values in Table 3 above, the average student character value increases each face-to-face. The effectiveness of teaching materials is also determined by the critical thinking skills test scores as shown in Table 4.

Table 4. Summary of Pre-Test and Post-Test Results

Pre-test & Post-test	Mean	Std. Deviation	t	df	Sig
	7.909	2.635	14,708	21	.000

Following Table 4. It can be interpreted that the application of teaching materials containing character education with the problem-based learning model setting on students' critical thinking skills, is indicated by a statistical t-test value of 14.708 with a significance number of 0.000. If the number is significant ($p < 0.05$) then H0 is rejected and H1 is accepted. So students' critical thinking skills after learning by using teaching materials containing character education with a problem-based learning model setting, are better than before using teaching materials containing character education with a problem-based learning model setting.

3.2 Discussion

The results of construct validation and content validation of teaching materials in the form of guidebooks and assessment instruments carried out with FGDs are in a very valid and appropriate classification position because they are based on guidelines for designing teaching and learning tools that contain character education with problem-based learning model settings. Teaching materials that are developed according to a very valid classification are influenced by many aspects: (1) teaching materials that are developed are based on aspects of content validity, namely according to the theoretical content and material used as a guide in designing and construct validity, (2) the elements of teaching materials that are developed based on the descriptors/indicators specified in the validity instrument. Even though the teaching materials developed are in a very valid classification position and are suitable for use in teaching and learning activities in the classroom, there are still many suggestions that must be followed up to provide perfection to the device. After carrying out improvements to the weaknesses that have been detected, the device is validated empirically with field tests (class tests).

The practicality of the device can be seen based on the results of observing the implementation of teaching and learning. The practicality of the teaching and learning tools developed must be reflected and followed up. In addition, the good response shown by students in the learning that has been carried out is influenced by the involvement of students in the model used in learning. A problem-based learning model that provides the widest possible opportunity for students to be able to identify the teaching materials being studied and relate them to real-world conditions will motivate students to be able to apply them in their daily lives. This is in line with Raub's research [8] that cycles of learning activities using the problem-based learning model trigger students' interest in learning the subject matter because this learning provides opportunities for students to relate the content of teaching materials to the real world. This interest encourages students to be more interested and trains students thinking skills.

The results of the research also found that the teaching materials developed were effective in increasing the character and critical thinking skills of students. In this study, it was found that the increase in character values was triggered by the use of problem-based learning models. In addition, it was found that students' critical thinking skills in the field of science after using science teaching materials containing character education with problem-based learning model settings were better than before using science teaching materials containing character education with problem-based learning model settings, indicated by statistical t-test values of 14.708 with a significance value of 0.000. If the number is significant ($p < 0.05$) then H0 is rejected and H1 is accepted. So students' critical thinking skills after learning by using teaching materials containing character education with a problem-based learning model setting, are better than before using teaching materials containing character education with a problem-based learning model setting.

The problem-based learning model has broader learning phases and more complex and analytical learning stages in creating critical thinking competence in students. The problem-based learning model can develop students optimally, meaning that learning does not force students to memorize concepts, but can motivate students to construct knowledge in their hearts and be able to apply their insights.

The problem-based learning model is part of the learning model that provides space for activating knowledge. There are five phases in the problem-based learning model, namely (1) introduction (starting new class), (2) problem setting (starting new problem), (3) problem-solving/follow-up strategies (problem follow-up), (4) presentation (performance presentation) and (5) the end of the activity/closing (after the conclusion of the problem). By integrating these five phases in a learning cycle, it is very likely to increase students' conceptual understanding and familiarize students' thinking competencies which in turn will have an impact on positive critical thinking competencies.

Preliminary activities include (a) presentation of learning objectives and (b) apperception. Setting the problem (starting a new problem) includes a) Presentation of the problem. b) Internalization of problems by students. c) Provision of tasks includes: submitting hypotheses, gathering facts, synthesizing existing data with inquiry activities, making required notes, and compiling activities or examinations related to efforts in solving problems. d) Providing arguments on the problem. e) Identification of learning resources. At this stage, after being given a problem, students and their groups solve the problem, analyze and find sources related to the problem, define, and formulate the problem and research objectives, and can compile steps of investigation to be able to solve the problem.

Overall, the stages of the problem-based learning model can empower students' critical thinking competencies. The problem-based learning model provides opportunities for students to learn to "experience" not just memorize, apply concepts, and get used to students' thinking competencies to the fullest. This means that students are not only inactive recipients of teacher instructions but are active in building their insights.

Apart from being determined by the value of critical thinking skills, the effectiveness of teaching materials is also determined by the character values of students. In this study, it was obtained that the addition of the average character value was triggered by the use of contextual learning models in science learning. This is in line with Sadia's

view [10] who said that contextual learning is estimated to play a role in fostering the character of empathy, fostering a sense of tolerance for oneself or other individuals, collaboration, discipline, and independence. Contextual learning guides and makes it easier for students to relate what they learn at school to their daily lives. Contextual learning is a holistic learning cycle and aims to make it easier for students to understand the meaning of teaching materials by connecting them with everyday life so that later students have flexible and dynamic insights and competencies in building their knowledge actively. In learning physics using problem-based learning models can form the character of curiosity, collaboration, friendship, discipline, responsibility, and honesty.

Based on the acquisition of scores of critical thinking skills and the average value of the observed characters, it can be said that science teaching materials contain character education with problem-based learning model settings that effectively optimize the character and competence of students' critical thinking. Obtaining natural science teaching materials with character education in a problem-based learning model setting that is effective is triggered by many aspects including:

First, the teaching materials are developed and arranged based on the 2013 curriculum guidelines and adapted to the developmental characteristics of class VIII students at MTS Al Khairiyah, which can later direct students to meet and solve their own problems under the guidance of the teacher, practicum activities are carried out very close to the world of students who will later teach and learning becomes interesting and students' curiosity grows and in the end, students become enthusiastic about learning.

The two teaching materials developed are designed in such a way that the appearance becomes attractive. The guidebook is displayed in an organized manner with the flow of teaching materials from the easiest to the most difficult and with the help of attractive and easy-to-understand pictures that support student understanding so that in the end it will make students happy to read it. While the teacher's handbook is structured in such a way that will direct teachers in teaching and learning in class both in learning cycles and in assessment.

The three teaching materials developed are aligned with existing accommodations in schools and the community which will later assist students or teachers in finding tools and materials used in learning activities, especially in conducting practicums. Thus, in general, teaching materials that have been successfully developed have fulfilled the totality of the quality aspects of good teaching materials, namely effective, practical, and valid.

4. CONCLUTION

(1) teaching materials are very valid with an average score of 3.84, (2) teaching materials are very practical with an average score of 3.71, (3) teaching materials are effective in growing critical thinking competence with a t count of 14.07 (t count > t table), (4) teaching materials are effective in growing student character with the value of student character development increasing.

Based on the results of the research and development carried out by the researcher, he can present a number of suggestions including (1) Teachers should apply science teaching materials with character education in a problem-based learning model setting as an alternative to increasing students' critical thinking competence because science teaching materials contain character education. the problem-based learning model setting has been proven to be able to increase students' critical thinking competencies. (2) Development of natural science teaching materials with character education in a problem-based learning model setting in research and development on temperature and heat material. For further development, it is necessary to carry out development on other subjects either by teachers or researchers. (3) Critical thinking skills in this study were only carried out for a few face-to-face meetings. To familiarize students with critical thinking competencies as a whole, the application of learning models to familiarize students with critical thinking competencies needs to be applied on an ongoing basis for all subjects.

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