

Conceptual Framework of Conceptual Problem Based Learning (CPBL) Model to Facilitate High School Students' Critical Thinking Ability

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Abstract. Learning to facilitate critical thinking requires a set of specific learning models that aims to trains critical thinking skills that in this study is the development of conceptual problem based learning model. This study aims to develop a conceptual problem-based learning model to facilitate high school students' critical thinking skills. This study is a development research that will produce a model of learning products, namely a valid Conceptual Problem Based Learning Model to facilitate high school students' critical thinking skills. Validation of CPBL learning model includes two components namely content validity and construct validity. The result of data analysis shows that the CPBL model can be declared valid with reliability percentage of 97% (reliable) based on syntax model assessment that is: 1) prior knowledge; 2) organize; 3) investigate; 4) analyze; 5) evaluate; to facilitate critical thinking skills.

1. Introduction

One of the essential skills students must have in the 21st century, namely critical thinking skills [1]. In line with that, [2] stated that high-level thinking skills, one of which is critical thinking, should be the focus of the development of learning in Indonesia, because it is believed to have the potential to make a person possess life skills, creations and innovations so as to solve various life problems which is increasingly complex in the 21st century.

Learning products that guide high-level thinking students have been adopted and contained in the TIMSS (Trends in Mathematics and Science Study) and PISA (Program for International Student Assessment) questions [3]. Further, [4] have conducted a comparative study of the National Examination (UN), TIMSS and PISA questions. The results of the study found that the UN question more measured the dimensions of factual knowledge at the level of application, the TIMSS question more measured the dimensions of conceptual knowledge at the level of analysis, and the PISA problem measured knowledge at the level of analysis and evaluation. The description shows that secondary school learning in Indonesia does not emphasize high-level thinking, so that when faced with problems requiring high-level thinking skills, middle school students are relatively difficult. The TIMSS report in 2007 stated that only 5% of Indonesian students could work on high and advanced categories, which needed reasoning (critical thinking). On the other hand, 78% of Indonesian students can only work on low category questions that require knowing or memorizing. While Asian countries such as Japan, Korea, Taiwan, Hong Kong, Singapore, Malaysia and Thailand are above Indonesia [5].

In addition, the results of the PISA study show that Indonesia ranks the bottom 10 of 65 countries. It is also known that Indonesian students master lessons only to level 3, while other countries have levels 4, 5 and 6 [6].

The learning model that exposes students to authentic problems and facilitates students to solve these problems, such as the Problem Based Learning (PBL) model has the potential to train students' thinking skills [7][8][9]. This is reinforced by the results of [10] and [11] which stated that students taught with PBL models have higher thinking performance than those using conventional methods (information discussion). The results of the study indicate that there is the potential to train thinking skills including critical thinking with PBL models. However, PBL in addition has advantages, there are also weaknesses and limitations in its implementation, according to [12], if students do not understand what to solve the problem, then they do not want to learn, [13] stated that one of the characteristics of PBL is learning orientation focused on authentic issues given compared to scientific disciplines or academic concepts that are taught. This causes the application of PBL tends to not be able to accommodate material relating to conceptual and declarative knowledge, because PBL discussion of material is very dependent on the problem solved, which generally are conditional knowledge, so the problems solved by students may be less representative, as said Dods in [14], students in PBL may have in-depth knowledge of the material related to the problem being solved, but not representative of the content of the subject matter. These shortcomings have led to the innovation of researchers developing PBL models by integrating the activities of identifying prior knowledge and expanding the results of identification of initial knowledge and the anchor of knowledge towards advanced learning materials that specifically train students' critical thinking skills.

The CPBL model is based on the weaknesses of the PBL model according to some experts who stated in learning that implementing the PBL model students tended not to understand conceptual and declarative knowledge [14] and the idea that prior knowledge needed learning, advance organizers to accommodate weaknesses submitted by researchers and experts beforehand. Prior knowledge is a collection of individual knowledge and experience gained throughout their lives and what he brings to new learning experiences. An initial knowledge of students determines the possibilities of new learning, and what individuals already know has more or less influenced what they will learn [15].

2. Method

This research is a development research that produces a new learning model product, in this case the CPBL model. According to [16][17] the framework of a quality product includes three criteria, namely validity, practicality, and effectiveness. At this stage, only the validity of the model developed was carried out. The validity carried out contains elements of content validity in the components of the model, including syntax (syntax), social systems (social systems), reaction principles (principles of reaction), support systems (support systems), and the impact of models (effects of the models). The model developed will be validated by experts and practitioners. Technically, the model validation developed will be carried out in a focus group discussion (FGD) activity facilitated by the Science and Mathematics Education Study Center, IKIP Mataram (PKPSM IKIP Mataram).

The instrument used in this study is the learning model validation sheet. Validation is intended to obtain suggestions and input from the validators (experts and practitioners), analysis of the model validation sheet is done by descriptive analysis. The results data were analyzed descriptively qualitatively by making the average score obtained from the validator. The evaluation of the validity of the learning model consists of 5 rating scales namely, very less = 1, less feasible = 2, decent enough = 3, feasible = 4, and very feasible = 5. Scores obtained from expert assessment, then converted into scale qualitative data 5, [18] in Table 1 below.

Table 1. Criteria for Learning Devices Based on Average Validator Values

Interval	Category
$0.0 \leq V \leq 1.0$	Invalid
$1.0 < V \leq 2.0$	Less valid
$2.0 < V \leq 3.0$	Valid enough

3.0 <V ≤ 4.0	Valid
4.0 <V ≤ 5.0	Very Valid

The average value of validation and reliability of the learning model developed is determined based on the values given by the validator. The reliability of the calculated learning model uses the percentage agreement equation by Emmer and Millett in [19], the instrument is said to be real if it has a percentage agreement of $\geq 75\%$.

$$\text{Percentage Agreement} = 100(1 - \frac{A - B}{A + B})$$

Description:

- A = The frequency of behavioral aspects observed by the observer by giving a high frequency.
- B = The frequency of behavioral aspects observed by other observers by providing a low frequency.

3. Result and Discussion

The initial stage after formulating the hypothetical framework of the CPBL learning model is product validation that has been developed. Validation of the CPBL learning model includes two components, namely content validity and construct validity. Content validity includes all components that make up the learning model must be based on the state of the art knowledge the components assessed in content validity are the need for the development of CPBL learning models and model designs based on current knowledge which is generally valid category. The results of this assessment are based on the purpose of developing the CPBL model to improve students' critical thinking skills as a need for the competence of the main graduates of 21st century skills and the demands of the applicable school curriculum. The results of the validation of the CPBL model are presented in Table 2 below:

Table 2. Results of validation of the Conceptual Problem Based Learning (CPBL) model

	Validity aspect	Average	Category
Content validity	• The need for developing Conceptual Problem Based Learning Model	4.40	Very valid
	• The Conceptual Problem Based Learning Model is designed based on the latest knowledge	4.20	Valid
Construct validity	• Consistency and logicalness of model components internally	4.05	Valid
Average		4.21	Valid
Reliability		0.97	Reliable

Table 2 shows that the CPBL model can be declared valid with a percentage of reliability of 97% (reliable) and has very strong potential in facilitating students to develop critical thinking skills of students and in accordance with the demands of 21st century skills as emphasized by [20].

The results of data analysis results from model validation by competent experts can be concluded that the learning model developed was valid with several revisions. The score of content validity and construct of the learning model from 5 validators is 4.2 with a valid category with the consistency of the assessment of the four validators in the reliable category (97%). The results of this validation were obtained through a Focus Group Discussion (FGD) mechanism which is a focused discussion that aims to obtain specific information that is specific.

The process of developing CPBL learning models follows the research flow of the development of [21] and the integration of quality product characteristics according to [16][17]. This model is formulated based on preliminary studies and theoretical studies so that the elements of need and

sophistication that are important components in the validity of quality product content can be fulfilled, while the consistency of the components of the learning model developed such as: theoretical rationality, goals and impacts, learning environment and social system, the principle of reaction, and the support system.

The learning process basically has a scientific basis, this process in practical activities emphasizes the observation of facts that are closely related to the environment [22]. This opinion is in accordance with the components of the construction of the learning model related to the principle of reaction in the reflective-metacognitive learning model that has been developed. The aim of developing this learning model is also in accordance with the current demands (need) which according to [23] in science education workshops and 21st century skills development recommends that in learning, students emphasize 21st century skills learning. such as: 1) ability to adapt or adapt to the environment, 2) communication skills, 3) ability to solve problems that are not routinely found by students, 4) self-management / self-development, and 5) systems thinking. These skills need to be learned to face today's global demands. Furthermore, [24] emphasized that in student learning emphasized the ability to train (1) understand complex information, (2) theory, analysis and problem solving, (3) use of tools, procedures and problem solving and (4) conduct investigations. In line with this opinion [25] states that in the preparation of quality products must pay attention to the elements of need (current needs) and the state of the art (conformity to the theory and relevance of all the constituent components of the products compiled). The components that have been described have been fulfilled by the reflective-metacognitive learning model that has been developed.

The development of the PBL model into CPBL is based on the weaknesses of the PBL model according to some experts who stated in learning that implementing the PBL model students tended not to understand conceptual and declarative knowledge [14] and the idea that prior knowledge needed learning, advanced organizers for accommodate weaknesses conveyed by researchers and experts beforehand. Prior knowledge is a collection of individual knowledge and experience gained throughout their lives and what he brings to new learning experiences. An initial knowledge of students determines the possibilities of new learning, and what individuals already know has more or less influenced what they will learn[15]. Abstract concepts and difficult to understand sometimes structured in the minds of students in different ways based on what their goals are. Many previous studies have shown that students develop their beliefs and ideas in definite concepts and phenomena that are found to be initial knowledge and bring that knowledge into the classroom [26]. Further [22] stated that in facing a confusing problem, individuals will try to connect new knowledge with prior experience (prior knowledge) and construct new meaning. Even more clearly it is said that a lot of at least the initial knowledge that students have determines effectiveness in designing problem solving strategies [27]. To teach understanding of concepts to students, in the first syntax, students are given or facilitated in defining and classifying terms in important concepts in teaching material delivered. The description shows that prior knowledge is an important component and must be considered in the learning process. Ausubel in [28] confirmed that the most important factor that influences meaningful learning is the level of the initial cognitive structure students have when learning takes place and can be extracted using prior knowledge.

In addition to prior knowledge, advanced learning also requires advance organizers, who emphasize understanding and mastering concepts from the material or topics studied by students [28]. This advanced organizer is a recommended teaching tool by Ausubel to link new learning materials with initial knowledge [15]. Giving examples to illustrate key attributes or attribution and giving additional examples related to important concepts contained in the material to be taught is also integrated into the advance organizer syntax in the learning model developed. The hypothetical phases (steps) of the CPBL model are listed in table 3.

Table 3. Syntax of the CPBL Model

Phase	Teacher activities
Phase 1 Prior knowledge	1. The teacher explains the learning objectives, logistics needed, and motivates students to get involved in problem solving activities and explore students' initial knowledge 2. Defining important concepts related to learning material. 3. Classify terms contained in the definition of learning material concepts.
Phase 2 Organize	1. Give a pilot to illustrate key characteristics or attributes in concepts in teaching material. 2. Give more demonstrations and ask students to categorize concepts, explain the categorization, or ask students to generate examples of concepts students propose. 3. The teacher performs conceptualization through step-by-step organizer related to the problem, namely the comparative organizer, activating existing schemes or reminding about what is already known that might not be recognized as being relevant to the problem. 4. The Expository organizer is providing new knowledge according to the topics that will be needed to understand the information that is coming. (problem to be resolved). 5. The teacher reviews concepts related to problems with questions to students. 6. Ask students to formulate a plan to solve problems that will be solved.
Phase 3 Investigate	1. The teacher helps students in groups to solve problems that will be investigated according to the plans that have been prepared. 2. Gather the appropriate information 3. Carry out experiments
Phase 4 Analyze	1. Analyze the results of investigations that have been carried out. 2. Looking for explanations and solutions according to the plans that have been set
Phase 5 Evaluate	1. Evaluating the learning process 2. Ask students to make concept maps of the material being studied

Critical thinking has long been the goal of education, critical thinking can teach students to make good planning, improve student performance, and have the potential to prepare students who are successful in real life [29]. In another hand, [1] includes critical thinking skills as one of the essential skills to be taught to students. The development of the CPBL model aims to train middle school students' critical thinking skills. Critical thinking skills are students' awareness of what is thought, trusted, copied, and conveyed in a rational way [30] which is shown through observing, asking questions, and finding solutions to problem solving [31].

Further [32] describe that critical thinking is important to teach because each individual thinks and this activity is a natural human sifal, but often there is bias and distortion in a person's thinking process and critical thinking is needed to overcome it. Critical thinking is the art of analyzing and evaluating for the purpose of improving the quality of one's thinking. The indicators of critical thinking skills used in this study are 6 (six) indicators of critical thinking skills resulting from the consensus summarized by [31], namely interpretation, analysis, inference, evaluation, explanation, and self-regulation.

4. Conclusion

Based on the results of the study it can be concluded that the conceptual problem based learning model is declared valid to train students' critical thinking skills.

The results of data analysis show that the CPBL model can be declared valid, but needs some improvements such as consistency regarding the objectives to be achieved, namely the ability to think critically.

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