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# Validity of learning devices mathematical based on quantum teaching and learning model for improving critical thinking

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Abstract. This study aims to produce learning devices based on quantum learning models and learning to improve students' critical thinking skills. Learning tools are developed in the form of Learning Implementation Plans (RPP) and Mathematics Student Worksheets (LKPD) in the eighth grade of SMP. This learning tool refers to the Plomp model which consists of 3 phases, namely the initial research stage, the development phase or the prototyping phase and the assessment phase. The product of learning said to be valid if the resultant learning were valid of content and construct. The instrument used in this research was a validation sheet containing aspects of presentation, content and material feasibility, graphics or display and language. developed Validity of who are called as validator consists of 3 experts in mathematical education, an expert in Indonesian language and an expert in educational technology. Expert validation result show that valid criteria in mathematics learning devices.

#### 1. Introduction

The ability to think critically is very important to be developed in schools so that students are able and accustomed to facing various problems around them [2]. Improving students' critical thinking skills is very necessary and urgent to develop especially when it is full of life problems or challenges. [3] Thus, critical thinking skills are very important for students, because currently science and technology are developing rapidly and allowing anyone to obtain information quickly and easily from any source and location in the world. But based on observations, the process of learning mathematics in the field cannot be said to be effective.

Research conducted by Muliana (2016) shows that the low critical thinking skills of grade VIII-D students of SMPN 1 Gambut. Student answer test results are only 14% of all students available [4]. Normaya Study (2015) clearly shows that by giving SMP Negeri 13 Banjarmasin a critical mathematical thinking ability test, of 30 students, only 2 people can answer the problem correctly and completely, while others only guess the answer [6]. Based on this question, it can be concluded that the mathematical thinking ability of students of SMP Negeri 13 Banjarmasin is still low. Problems were also encountered during preliminary studies at Padang 28 Junior High School, Padang 27 Junior High School and Padang 18 Junior High School from December 24 to 02. Mathematics learning outcomes and tests of students' critical thinking skills are still far below the minimum criteria (KKM) 75.

Based on the description of the problem above, there is a need for learning tools that can help teachers and students in the learning process in the classroom. The implementation of learning that is not optimal cannot be separated from the learning resources developed so that students are motivated to learn mathematics. One of the innovations in the learning process of mathematics that students need is learning resources. Learning resources used are Student Worksheets (LKPD) and Learning

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Implementation Plans (RPP) using the 2013 curriculum. Through RPP and LKPD, teachers can direct activities carried out by students. Such activities will help students to guide their knowledge and thinking skills. LKPD is a teaching material that has been packaged in such a way that students are expected to learn teaching materials independently. [7] Based on this opinion, LKPD can be used as a guide for students to be actively involved in learning activities and help students build knowledge so that participants can find concepts. LKPD development will be supported by RPP.

Based on the description of the problem above, there is a need for learning tools that can help teachers and students in the learning process in the classroom. The author is interested in developing learning tools based on the Quantum Teaching and Learning learning model. Quantum Teaching and Learning learning model steps are Grow, Experience, Name, Demonstrate, Repeat and Celebrate. In this learning, students are guided to attend a fun learning process.

[1] This Quantum Teaching and Learning learning model has advantages, namely: 1) always centered on what makes sense for students, 2) fosters and raises the enthusiasm of students. 3) cooperation; 4) offer brilliant ideas and processes in a form that is understandable to students; 5) creating behavior and attitudes of trust in oneself.6) learning feels pleasant, 7) tranquility of psychology. Based on the description, the author conducted a study on the development of learning tools based on the Quantum Teaching and Learning model to improve mathematical critical thinking skills

## 2. Research Method

The development model applied is the Plomp model which consists of three phases, namely preliminary research, prototyping phase and evaluation phase. This journal only discusses the steps of making a prototype of LKPD validation. In the preliminary study needs analysis, curriculum analysis, concept analysis and student analysis were carried out. Data collection techniques through observation, interviews with math teachers, questionnaires and preliminary tests with eighth grade students of Padang 28 Junior High School, Padang 27 Junior High School and Padang 18 Junior High School. The prototype-making phase is done by designing a mathematics LKPD based on the Quantum Teaching and Learning model. LKPD is developed on the basis of Tessmer's formative evaluation.

This assessment consists of self-assessment, expert validation, individual assessment, small group assessment, and field testing. LKPD that has been developed is validated by 5 experts called validators consisting of 3 experts in mathematics education, an expert in the field of educational technology and an Indonesian expert. While the RPP was validated by three experts in the field of mathematics education, and one expert in Indonesia Language. The validator will provide an assessment and suggestion about the design of learning tools to identify weaknesses and strengths, and consider the expected product specifications using a validation sheet.

Data from the validation sheet will be analyzed using quantitative analysis. Validation results from the validator for all aspects assessed will be presented in the form of tables. Analysis is done using likert scale.

#### 3. Results And Discussion

Student analysis was carried out to test the characteristics of eight grade students of junior high school. The result of the RPP sheet validation-based Quantum Teaching and Learning Models can be seen in the table 1. RPP that has been designed is valid for aspects of the implementation of learning activities, and linguistics.

Table 1. vandation-based Quantum Teaching and Learning Woders							
No	Rated aspect	Average rating score			average	criteria	
		1	2	3	4		
1	Implementation of learning	1	0.85	0.88	-	0.91	Valid
2	Learning activities	1	0.89	0.96	-	0.95	Valid
3	Linguistics	-	-	-	0.75	0.75	Valid
Average						0.87	valid

Table 1. validation-based Quantum Teaching and Learning Models

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This analysis aims to determine the content and objectives that can be presented in the LKPD model based on Quantum Teaching and Learning. The contents and objects are adapted to the existing components of the Quantum Teaching and Learning model. Student analysis is done to test the characteristics of eighth grade students of junior high school.

This analysis is taken into account in the design of the Quantum-Based Teaching and Learning LKPD which includes learning, student participation, the importance of LKPD for students and the description of LKPD that students enjoy. Whereas LKPD is produced according to the characteristics [5]. In this study, students who will be used as subjects are junior high school students.

The prototype-making phase starts with the LKPD model design based on Quantum Teaching and Learning. This design is called prototype 1. This LKPD design is based on the initial results of the research that has been done. After Quantum Teaching and Learning-based LKPD generation, researchers self-assess to validate concepts and discuss with content validity experts.

Validation of LKPD content based on Quantum Teaching and Learning models carried out by 5 experts consisting of 3 experts in mathematics education, 1 linguist and 1 expert in educational technology. The validity of the content means the compatibility between the products produced with certain criteria, the suitability of the program content that is applicable, the suitability of the learning device with the program, and the relevance of the device to the learning objectives. While the construction validity means the adequacy between the products produced with the elements of development that have been determined. LKPD building validity Quantum Teaching and Learning is achieved by preparing the device based on the subject prediction characteristics or expected behavior of the subject.

In the self-evaluation errors that the researchers found on LKPD, there are typing errors and punctuation errors. After the self-evaluation, the Quantum Teaching and Learning-based LKPD is validated by the validator. Based on the results of self-assessment and validator suggestions, improvements to Quantum Teaching and Learning LKPD have been carried out, as shown in tables 2 and 3.

# Table 2. Self-Evaluation Error and Validator Comment (Before the Review)



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After the revision is complete, the validator provides LKPD evaluation. LKPD based on global Quantum Teaching and Learning validated by mathematicians meets valid criteria with a validity index on presentation aspects and 0.926 content feasibility aspects. This means that the characteristics and relevance of LKPD with Quantum Teaching and Learning based learning can help students improve their critical mathematical thinking skills.

The next aspect is the graphic display or appearance. Graphic aspects or signs are validated by educational technology lecturers. Data analysis results of the validation of the display or display display is 0.723 with a valid category, so the display is valid. The last aspect that is validated is the linguistic aspect. This linguistic aspect is validated by an Indonesian lecturer. The results of linguistic aspects validation data analysis obtained a validity index of 0.917 with valid criteria, the average language used for LKPD was communicative and valid. The results of global validation for each aspect can be found in the table 4.

<b>Tuble 4.</b> Vandation results of the List D Quantain reaching and Learning model
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No.	Aspect of validation	Validity index	Category
1.	Presentation	0.926	Valid
2.	Didactics and content (material)	0.926	Valid
3.	Challenge (Display)	0.723	Valid
4.	Language	0.917	Valid
Avera	ge validity index	0.873	Valid

Based on Table 4, it can be seen that the average LKPD validation as a whole is 0.873 with valid criteria. Thus, it can be concluded that LKPD with Quantum Teaching and Learning based learning is valid.

### 4. Conclusion

Based on the results of the validation, it was found that the development and design produced mathematics LKPD based on the Quantum Teaching and Learning model to improve the critical thinking capacity of junior high school students who met valid criteria.

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