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Development Learning Device Based for Measuring Contextual Critical Thinking Skills Students SD Class VI Mathematical

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Abstract

Development research aims to generate a contextual based learning tools valid and practical to measure mathematical critical thinking skills of elementary school students, and knowing its potential effect on the ability of critical thinking mathematically SD Class VI 050611 Aman Damai student. Development of a model learning device refers Tessmer which consists of three stages: self evaluation, prototyping,and field test. Data collection was conducted by observation, documentation, and test. From the results of this development acquired learning device (lesson plans, worksheets and tests) material Volume Prisms Triangle and tube-based contextual that can be considered valid and practical, as well as having a potential effect in measuring critical thinking ability of students' mathematical which has not grown and familiarized.

Keywords: Learning Tool; contextual; Critical Thinking Mathematically; Students Elementary.

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1. Introduction

This way of thinking that test, connect, and evaluate all aspects of a problem situation, including the ability to collect information, memorize, analyze the situation, to read and understand and identify [1,18] defines thinking as the process that formed new mental representation through the transformation of information by the complex interaction of mental attribution that includes consideration, abstraction, reasoning, drawing, solving logical problems, formation of concepts, creativity, and smart [5] states there are six basic elements that need to be considered in critical thinking, namely: focus, rationale, conclusions, situations, clarity and overall inspection. Overall these elements can form a proper decision if considered carefully. Reference [6] also suggests that cognitive skills are at the core of critical thinking in the form of interpretation, analysis, evaluation, inference, explanation and self-regulation thus sendiri.With critical thinking is a necessity for humans to examine and sort out any possibility of life faced for safety and goodness of life. Everyone should be able to think critically, instead must be nurtured in order critical thinking skills are targeted and well structured. To practice critical thinking is necessary to start since they were in school as a place that is supposed to nurture and bring up all the abilities that may arise as a result of the education process. As a result, many schools graduate students who think superficially, just standing on the surface of the problem, rather than students who are able to think mendalam.Mathemathic as a discipline that clearly rely on the thought process is considered very good to be taught to students. It contains many aspects which are substantially lead students to think logically according to patterns and rules that have been arranged by default. So often the main purpose of teaching mathematics is not to accustom so that students are able to think logically, critically and sistematis.Salah an estimated either approach to be applied in learning mathematics is learning with contextual approach. Or contextual approach Contextual Teaching and Learning (CTL) is a learning approach that link the material studied in the context of students' everyday lives. Of the seven major components of contextual learning, it is in sync with efforts to raise the students' critical thinking skills [10] especially on the components inquire, discover, and refleksi. Reference [11] suggests the need for awareness of the contextual approach to learning is based the fact that most students not be able to connect between what they learn with how they are used in real life. Therefore, according to [3] contextual learning is a process of education that is holistic and aims to help students to understand the significance of the subject matter learned by linking the material in the context of their day-to-day (personal context, social and cultural), so that students have the knowledge / flexible skills that can be applied (transferred) from one problem / context to the problems / other contexts.

Contextual learning component as described [11] contains seven main points namely constructivism, questioning, investigating or finding, learning community, modeling, reflection, and the actual assessment. Based on Piaget's Theory of Cognitive Development, children of elementary school age (11-12 years) have not been fully able to think abstractly, in learning the presence of concrete objects are still needed. Even so must also begin to be introduced semi-concrete objects. But at this elementary level, children have started to capture the intent of a problem more clearly, consider, submit allegations, and analyze a simple relation between subject matter. This is where the role of critical thinking for elementary school children, which in this case refers to the opinion of Piaget (the characteristics of cognitive abilities of children at elementary level Class VI), has been applied.

So as to measure critical thinking ability of students' mathematical, in this study developed a learning tool contextually based on material volume is Prisma Triangle and Tubes for six graders, which includes Learning Implementation Plan (RPP) Student Worksheet (LKS) and Problem achievement test ,

This study aims to: (1) Produce contextual based learning tools valid and practical to teach the material Volume of Prisms Triangle and Tubes. (2) Determine the potential effects arising from the development of learning tools contextually based on students' mathematical ability of critical thinking in the material volume of Prisma segita and Tubes.

2. Methods

This study uses aresearch *research development* type of *formative research* [22] Development is done on learning device in the form of contextual-based lesson plans, worksheets contextually based, and problems with a valid indicator of critical thinking, practical and have potential in primary schools 050 611 effect Aman Damai.

Learning software development procedures in this study consists of three stages: *Self evaluation*, *Prototyping* (validation, evaluation and revision), *field Test* (Test pitch).at the stage *Self Evaluation* conductedof analysis and design. Researchers analyzed the students, curriculum analysis and the analysis of whether the material in accordance with the design KTSP.Then,done on learning tools that are made, including (1) RPP prepared by taking into seven components of CTL, (2) CTL-based worksheets that are used to help students improve their critical thinking skills (3) Problem achievement test, designed in a way to see the achievement standards and basic competencies and to determine the ability of critical thinking mathematically siswa.Tahap *Prototyping* (validation, evaluation and revision) is divided into two, namely *Expert Review* and *One-to-One* and *Small*Group.The results of the first prototype design developed through *self evaluation* of experts*(expertreview)*and colleagues for review *of*content,and language constructs. In parallel given also on 6 students. Their suggestions are used to revise the design of the learning device (lesson plans, worksheets and test questions). From the results of both are used as material revision. The revised learning device ofopinion *expert* and of the difficulties experienced by students while testing a *one to one* prototype calledsecond. Then the results of this revision is tested on six graders State 050611 Aman Damai.*(Smallgroup).*The suggestions and the results of tests on a second prototype used as the basis for revising the second prototype instrument was thus obtained the prototype ketiga.Teknik data collection is done through observation, documentation, and test. Observation is used to determine the practicality and effectiveness of learning tools that made this observation is the observation of the student to see the activity and participation of students during the learning takes place by using student activity observation sheet that is performed by two observers each observed four groups of each class. Documentation used to collect and assess the results of LKS workmanship. The test is used to obtain data on the effectiveness or have the *potential effect* of the learning device created and mathematical measure critical thinking skills of students.

Data analysis techniques used in this research is descriptive and qualitative analysis, which was carried out as follows: (1) The data analysis expert validation. To analyze the expert validation data used descriptive analysis

by means of revising the note validator is based on the terms of the three characteristics, namely *content*, and language constructs. The results of the analysis will be used to revise the learning device. (2) The data analysis student activity observation. To determine the activity of students during the learning process it was observed, the observed aspects in accordance with the lesson plan. Categories modified from [12]. (3) The data analysis LKS workmanship. To determine the ability of the students do LKS seen from scoring given to each point answers on worksheets. (4) The data analysis of test results. To measure the ability of students seen from the scores obtained by students in working on. Test questions are about the description which refers to the four indicators of the critical thinking skills of Ennis [9], namely: (a) Aspects related to the concept, (b) Aspects related to the generalization, (c) aspects relating to the skills and algorithms and (d) Aspects related to problem solving. Scoring criteria using the modified rubric score of Facione [19] The data workmanship student worksheets and test results are then analyzed to determine the average final score and then converted into qualitative data to determine the skill level category. Categories judgment also refers to modifications of [12]

3. Results And Discussion Of Research

In developing reasoning and strategic thinking, research conducted by [16] and [8] found a few things to be aware of teachers in mathematics, namely: the type of thinking mathematically must according to the students, the type of teaching materials, classroom management, reran teachers, and student autonomy in thinking and activity. This type of thinking mathematically expressed [16] and the characteristics of thinking expressed [8] can be used as a reference in preparing and developing instructional materials in accordance with the demands of the curriculum, student development, the ability of teachers, as well as environmental conditions. Reference [7] underlines that to cultivate the students' skills in reasoning and strategic thinking should be directed at the problem-based learning and the resolution process provided should be open, the final answer of the problem was open, and how to solve it opened. Research conducted [17,21] revealed that teachers have a very central role in the learning process through disclosure, encouragement, and the development of students' thinking process. Experience [17] showed that teachers' questions during the learning activities can effectively lead the thinking of students toward correct solutions. While [21] suggested that teachers' questions referring to effectively assist the activities and representationthinking of studentin order to achieve the correct answer.

To meet these criteria, the development of learning tools in this research through three stages, namely *self evaluation*, *prototyping* (validation, evaluation and revision) and *field*test.At the stage of *self-evaluation* (analysis and *design)*, the learning device (lesson plans, worksheets, and Problem) is designed as a prototype I. In thestage, *prototyping* the learning device validated by experts. In line with the stage of expert review was done stage *one-to-one*.Results of *expert review* and *one-to-one* used as the basis for revising the prototype II.

Draft study on a prototype device tested on aII *small group* were carried out on 050611 Elementary School sixth grade Aman Damai.of stages *small group* Thisto provide feedback about the effectiveness of LKS and instruments developed problems. The results *of a small group* form the basisto revise the prototype II to obtain III as a prototype of the final prototype (product).

a. Validation expert

Validation expertly done by 3 people Master Class VI, Department of Mathematics of expert validation is done to see the validity of the *content*, and language constructs. The results of the validation experts to the developed learning tools that include both categories and can be used to do a little revision.

b. Student activity observation data

Observations made on the activities occurred during the experiment students *small groups* and *field*tests.In the overall activity of a small group of students enough satisfactorily in accordance with the design of the activities referred to.

Furthermore, the *field* test,the observation was made during the learning process significantly. Researchers assisted by two observers in charge of observing the activity of students using observation sheet that contains 5 indicators of student activity in accordance with the stages of pre-prepared CTL researchers, each observer observing the activity of students in four groups in each class. The observations are presented in

Table 1: Observation results of student activities during learning

No	Observation of activities	Percentage (%)	Criteria
1	Students try to construct their own understanding	75	Good
2	Student expressed his opinion	83	Very Good
3	Ask friends / teachers	78	Good
4	Students learn together in their group	90	Very Good
5	Students try to investigate / find Problems	80	Good
	Average	81,2	Very Good

Generally the learning undertaken by CTL-based learning tools at each meeting declared effective. Effective means to materialize as planned in the RPP.

c. Student Worksheet (LKS)

Design LKS tested at 050611 primary school students Aman Damai (stage one to one). Separately they are required to observe, do the questions LKS and commenting instruments given problem in stages according to the amount of meetings. Researchers interact and communicate with students to see the difficulties that may be experienced during the settlement process LKS.Lembar Student Work consists of five worksheets, the LKS LKS 1 through 5. At the stage *of a small group* and *field* tests,it worked overall student worksheets group. Each worksheet prepared by the sequence step towards the understanding of the materials and constructing

knowledge students independently.

In *field* tests,after LKS workmanship in each group, then one of the groups presented their work and other groups leave a comment or question. Results of the analysis for this student worksheets are presented in

Table 2: Analysis Worksheet workman ship

No	Class/ Group	Value						Average	Criteria
		LKS 1	LKS 2 2	LKS 3	LKS 4	LKS 5	LKS 6 6		
1	VIII.1.1	80	82	72	78	72	76	76,67	Good
2	VIII.1.2	78	79	70	77	71	74	74,83	Good
3	VIII.1.3	80	80	69	76	68	75	74,67	Good
4	VIII.1.4	79	78	72	80	69	74	75,33	Good
5	VIII.1.5	80	77	70	79	68	73	74,5	Good
	Average							75.2	Good

Based on the table above can be seen that the value of the whole group on have reached the criteria. It can be concluded that the Student Worksheet (LKS) have reached the criteria of practicality, in other words it can be used by students

d. Critical thinking skills test mathematical

Having declared valid test item and corrected after tested in small groups, then can be tested at the end of the field phase test.Data student test results were analyzed to determine the average value of the end and then converted into qualitative data to determine the category mathematical level critical thinking skills of students.

4. Discussion

According to [4] that the students can easily find and understand the concepts through active thinking and problem solving not only remember but do activities to build knowledge with the exercise of a teacher or homework contained in buku.Pembelajaran that use these CTL approach has the characteristics according to [13] as follows: 1) the study was designed starting from solving the problems that exist around the students and

based on the experience that has been owned by the students using real context as a starting point, 2) learning presenting activity or exploratory, students create and elaborate models of symbolic and activities of mathematics they are not formal as a bridge between the real and the abstract, 3) do not emphasize solely on computing, algorithms and drill 4) emphasis on conceptual understanding and problem solving, 5) students experienced a significant learning process and understand mathematical reasoning, 6) students learn mathematics with understanding, actively construct new knowledge from prior knowledge of them, 7) study in a democratic and interactive, 8) appreciate the answers informal student before the student reaches the form of formal mathematics, and 9) gives attention horizontally balanced between pematematikawan vertikal.Pengembangan learning tools in the study include the characteristics of the student experience, the relationship context and concepts, understanding, arrangement, cooperation, and authentic assessment. Thus the learning tools that have been developed and the implementation of mathematics learning in this study refers to the characteristics of the CTL approach and load indicators proposed critical thinking Ennis [9] According to the expert validation*(expertreview),*criterion validity of the learning device has been in accordance with the criteria proposed [2] that aspects of the validity of a learning device must be related to two things: *the first* learning device that was developed based on a rational strong theoretical, in this learning device it refers to the characteristics of learning with contextual approach [13]; [11]; [14] and the ability to think critically [9]. *Secondly* there is consistency internally, in this case the learning device has been interrelated contextual learning approach with the critical thinking skills..

Of learning tools producedIt also fulfills the practicality. This is in accordance with the criteria required practicality [2] that the *first* experts and practitioners argue that what is developed can be applied in this case according to expert opinion (teacher) learning tools can be applied in the sixth grade elementary school. *The second* fact shows that what is developed can be applied, in this case after a trial of individual persons (one to one), test group*(small group),*and the last trial of the real situation*(fieldtest)*learning device has been can be applied properly. Learning to activate critical thinking ability of students' mathematical through contextual approach using learning tools developed also meets the criteria of effectiveness, namely (1) the average of the workmanship LKS entire groups in both classes that use the learning outcomes of this development has reached the minimum completeness and including criteria for a good value; (2) The average of the test results of all students in second grade after using the learning device development results have also been reached and the minimum completeness criteria included good value; (3) The activities of students during the learning has reached 81.2% which reflects the activity in accordance with the indicators CTL approach.

On average workmanship whole group on the LKS two classes higher than the average of test results of all students in the second grade in the group due to workmanship LKS do together, so that the existing difficulties can be helped resolved by a higher ability students. Meanwhile workmanship independently test depends on the ability of each individual, so that they also contained 16.67% of students who score less.

With reference to the software development process to learn to think critically, it is time to start a culture of critical thinking by Jacqueline and Brooks [15] has not been ditradisikan in schools. Actual elementary school students are able to think critically, but the unavailability of tools to foster and enable the critical thinking skills mathematically.

5. Conclusions And Recommendations

Conclusion

This study has yielded a contextual based learning software products subject Prisma Volume Triangle and Tubes which includes lesson plans, worksheets and learning about the test results. Based on the results of the study conclude that the learning device that was developed in this study, are considered valid, practical and has *potential effect* on learning outcomes and student activity in the classroom.

Learning tools developed in this study considered valid and practical. Valid drawn from the results of the assessment validator validator that all states either based on *content* (curriculum appropriate to the subject of prism and pyramid), constructs (corresponding characteristics / learning principles CTL) and language (in accordance with applicable rules of language is enhanced spelling). Practical drawn from the results of field trials that all students can use these learning tools with baik.Berdasarkan development process showed that the *prototype* device developed learning effectively improve students' learning activities, and results from the analysis of student activity observation during the learning by using CTL approach.

Based on the obtained development process is also that the *prototype* device developed learning have had a potential effect on students 'ability to think critically mathematically, it can be seen from the average value is 75.2 students' ability in the interval 0-100 values represented by both categories.

6. Advice

Can recommended that teachers use learning tools generated in the study as a learning material to train the students' critical thinking, then other researchers are expected to design a learning device that is better than what has been made of this.

References

[1] Adler, J. 2000. Social practice theory and mathematics teacher education: A conversation between theory andpractice.Nordic Journal of Mathematics Education, 8 (3), 31-53.

[2] Akker, JV 1999. Design Approaches and Tools in Education andTraining.Dordrecht: Kluwer Academic Publishers.

[3] Clark, K., & Borko, H. (2004). Establishing a professional learning community among middle school mathematicsteachers.In MJ Hoines and A. Fuglestad (Eds.), Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education (Vol. 2, pp. 223-230). Bergen, Norway: Bergen University College.

[3] Mone. 2007. Material Socialization and Education Unit Level Training Curriculum (SBC) SMP. Jakarta: Ministry of National Education Curriculum Center.

[4] Doppelt, Y. 2003. Implementation and Assessment of Project Based Learning in a Flexible Environment. International Journal of Technology and Design Education 13255-272

[5] Ennis, Robert H. 1995. CriticalThinking.New Jersey: Prentice Hall, University of Illinois.

[6] Facione, Peter A. 2010. Critical Thinking: What It Is and Why ItCounts.[Online] Available:http://www.telacommunications.com/nutshell/cthinking.htm

[7] Franke, ML, Carpenter, TP, Levi, L., & Fennema, E. (2001). Capturing teachers' generative change: A follow-up study of professional development in mathematics. American Educational Research Journal, 38, 653-689.

[8] Henningsen, M. & Stein, MK1997."Mathematical and student cognition: Based Classroom Support and Inhibit that High Level Mathematical Thinking And Reasoning".Journal for Research in Mathematics Education, 28, 524-549.

[9] Innabi, Hanan. 2003. Aspects of Critical Thinking in Classroom Instruction of Secondary School Mathematics Teachers inJordan.[Online] Available: http://dipmat.math.unipa.it/pdf.

[10] Johnson, Elaine B. 2010. Contextual Teaching & Learning: Making Activity Teaching and Learning Exciting and Meaningful.Bandung: Kaifa.

[11] Muslich, Masnur.2007. SBCCompetency-Based Learning andContextual.Jakarta: Earth Literacy.

[12] Nasoetion, N. 2007. Evaluation of LearningMathematics.Jakarta: The Open University.

[13] Nur, M. 2000. Application of Contextual Learning in Mathematics Subjects.Yogyakarta: PPPG Mathematics.

[14] Nurhadi. 2002. Contextual Approach. Jakarta: Ministry of Education.

[15] Santrock, John W. 2007. Child Development.Jakarta: Erland.

[16] Shigeo, K. 2000. "On Teaching Mathematical Thinking". In 0 Toshio (Ed.) Mathematical Education in Japan (PP. 26-28). Japan: (JSME)

[17] Shimizu, N. 2000. "An Analysis of 'Make an Organized List' Strategy in Problem Solving Process". In T. Nakahara & M. Koyama (Eds). Proceedings of the 2LH Conference of The International Group for the Psychology of Mathematics Education, Vol. 4 (PP. 145-152). Hiroshima: Hiroshima University

[18] Solso, RL, Maclin, OH, and Maclin, MK 2008. CognitivePsychology.Jakarta: publisher.

[19] Somakim. 2010. Upgrades Critical Thinking and Self-Efficacy Mathematics Junior High School

students with the use of Realistic Mathematics Approach. Bandung: PPS UPI. Unpublished dissertation.

[20] Tessmer, Martin. 1993. Planning and Conducting FormativeEvaluation.London, Philadelphia: Kogan Page

[21] Yamada, A. 2000."TwoPaterus of Problem Solving Process from a Representational Perspective". In T. Nakahara & M. Koyama (Eds.) Proceedings ofthe 24th Conference ofthe International Group for the Psychology of Mathematics Education, Vol. 4 (289-296). Hiroshima: Hiroshima University.

[22] Zulkardi. 2006. Formative Evaluation: What, Why, When, andHow.[On line]. Available: http://www.geocities.com/zulkardi/books.html.