EFFECTIVENESS OF COMPUTATIONAL THINKING BASED MATHEMATICS WORKSHEETS ON STUDENT'S PROBLEM-SOLVING ABILITY WITH LINEAR EQUATIONS OF TWO VARIABLES AT AMBARAWA 1 STATE JUNIOR HIGH SCHOOL

(Effectiveness Studies On Implementation Of Computational Thinking In Education And Problem-solving Ability)

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Abstract

Computational Thinking is a skill that everyone must possess, especially students, in the face of increasingly developments. Therefore, there is a need for innovation in mathematics learning integrated with Computational Thinking. This study aims to find out about the mathematic worksheets based on Computational Thinking effectiveness of the material linear equations in two variables on problem-solving ability.

The population in this study was VIII class in Ambarawa 1 State Junior High School 2021/2022, the VIII-B class obtained and became the research sample through the sampling technique, namely cluster random sampling consisting of thirty-four students. Collecting data using five essay questions about problem-solving ability test, this test is given through pre-test and post-test to research sample. Statistic analysis using Paired Sample T-Test by significance level on 5% against pre-tested data using Lilliefors Test and Fisher Test.

The result of pre-tested data showed that data is normal and homogeneous seen from $L_{counting-pre-test}$ (0,105) < L_{table} (0,1497) and $L_{counting-postets}$ (0,122) < L_{table} (0,1497) then $F_{counting}$ (1,6929) < F_{table} (1,7878). Based on pre-test and post-test data analyzed showing that there is an increase in the average value test, from 54 up to 78,47. Effectiveness analysis showed that there is a difference between the average pre-test value to the average post-test value, by the $t_{counting}$ (16,198) > t_{table} (2,034). This study concludes that the mathematic worksheets based on computational thinking (CT) are effective in increasing Student's problem-solving abilities.

Keywords: Computational Thinking, Mathematic Worksheet, Problem-Solving Ability.

Introduction

The development of Science and Technology today has an impact and influence on all fields, including the field of education. Education is one way for humans to be able to follow developments. The progress of the times has been followed by developments in the world of education, such as in Indonesia with the development of educational institutions, the development of teacher competency standards, curriculum developments, and other developments.

Based on the results of a preliminary study of class VIII mathematics teachers at the research location, SMP N 1 Ambarawa, it was found that the implementation of 2013 curriculum-based learning was hampered by the implementation of *Blended Learning* (learning mixed between limited face-to-face learning and virtual learning) so that in learning participants in learning activities of students are reduced learning is too centered

on the teacher. This results in a decrease in fighting power and academic ability. Then on the results of the subsequent preliminary Study, namely the observation of the needs of students. Where the results obtained are that on average students tend to use the way of learning mathematics with the method of practicing with questions. According to them, it is easier to understand a concept or material with practical activities on doing questions. In addition, students feel bored and bored with the learning process that takes place during the pandemic. In the implementing of mathematics learning at the research location using Package Books from the Ministry of Education and Culture and student worksheets (LKPD) from publishers.

There is a gap between expectations and learning objectives with the learning process that occurs where the learning resources used by students do not provide appropriate learning safeguards because of the lack of existing learning resources that were mold 2013 and are not by the needs and developmental stages of students.

Student worksheets are teaching materials that can be used by teachers to improve student learning scientifically activities (Nisa, 2018). Student worksheets often called LKPD, are defined as a learning device in the form of printed teaching materials that contain a summary of the material, instructions for working on assignments, and assignments in the form of items. The content contained in this LKPD is based on the Basic Competencies that students must achieve in learning (Prastowo, 2021). Worksheets has several benefits in learning, including 1) encouraging students to be active in learning, 2) stimulating students in developing concepts, 3) training students' abilities in finding and developing processing skills, 4) as a resource and learning guide for students, 5) assisting students in adding information about the systematic learning process (Umbaryati, 2016).

The term Computational Thinking was first introduced by a character named Seymour Papert in 1980. Computational Thinking is a process and structure of thinking in formulating problems as well as solutions for solutions. Can be represented by the recipient of the information (Wing, 2021). *Computational Thinking* in Indonesian means computational thinking or thinking like a computer where there is a process of inputting information, processing information, and processing output. In this CT approach, there are four steps of completion, including decomposition, abstraction, pattern recognition, and algorithms. The benefits of applying computational thinking in learning include increasing students' critical analytical thinking skills, growing students' ability to think computationally and systematically, and improving teachers' pedagogic abilities (Desiro, 2021). To thrive and survive in this ever-changing and evolving world, computational thinking becomes a fundamental part of everyone in thinking and understanding of the world (Wing, 2021).

Problem-Solving ability in Indonesian means problem-solving is a skill that must be possessed by every student in a lesson (Herlina, 2018). The factors that influence problem-solving abilities include firstly, initial knowledge where insight becomes the capital and provision for students to face and solve a problem, secondly, mathematical apperception where confidence in the urgency of mathematics affects the sense and enthusiasm of students in solving a problem. contextualand logical intelligence are the ability to analyze a student in finding information and foresight in formulating information into an expected solution (Irwan, 2019). Indicators that show a student has problem-solving abilities include being able to identify elements that are known, asked, and the adequacy of the elements needed, able to formulate problems and develop problem-solving models, able to implement solving strategies, and able to interpret the results obtained (Kusuma, 2021). So that students can have the problem-solving skills in mathematics, they must have the ability to understand concepts (Lestari, 2021). Futhermore the mathematics problem-solving ability must be equipped with mathematical literacy skills including a synergistic relationship between mathematical thinking and computational thinking (Zahid, 2020).

Based on the 2018 PISA research on the mathematical abilities of students in several countries that are ranked in the top 10 best such as China, Singapore, Japan, Korea, and Singapore. They have integrated *Computational Thinking* into their educational curriculum. In Indonesia, this approach has only recently become popular. This is in line with the statements of students and teachers at SMP N 1 Ambarawa in the preliminary study observation that they are not very Computational familiar with *Thinking*. So the application of *Computational Thinking* is deemed appropriate to improve the problem-solving abilities of students in Indonesia in learning mathematics.

There is a need for innovations in Indonesian education, especially in learning mathematics by using learning tools in the form of LKPD based on computational thinking to improve problem-solving abilities.

Method

Research design in this study using the type of experimental research. Experimental research is a research method to determine the effect of certain bending on others under controlled conditions (Sugiyono, 2018). In this study uses the one group pre-test-post-test design, only used one class that was treated or became the experimental class. The following is a design from the one-group pre-test an post-test design:

$$\boxed{O_1 \;\; X \;\; O_2}$$

Picture 1 The One-Group Pre-Test Post-Test Design

Furthermore the subject or the population in this study were students of class VIII at Ambarawa 1 Junior High Shcool, and class VIII B were obtained and used as research samples through cluster random sampling technique, consisting of 34 students. The cluster random sampling technique is a technique for obtaining samples from the population. Where this technique is used to anticipate researchers in obtaining random samples and dividing them into new groups or classes (Ismail, 2018).

The research procedures in this study consist of four stages Preparation Stage, Research Implementation Stage, Data Compilation Stage, and Research Conclusion Stage (Enggawati, 2017). Research instrument in this study include preliminary study instruments for teachers

and for students, list Of Students Score, Mathematic Worksheets Based On Computational Thinking, this instrument was obtained from previous research where this CT-based student worksheets has been tested for validity by two expert lecturers. The Validity Test of the items using The Product Moment Test and The Instrument Reliability Test using the Alpha Cronbach Test. And The Effectiveness Test using an effectiveness test technique, namely the Paired T Test. The provisions for using this test include, the sample used obtained from random sampling (in this research uses cluster random sampling technique), data in the form of interval or ratio scale (in this study the data in the form of an interval scale, namely the value of the results of the pre-test and post-test), data are normally distributed (in this study, the data were tested for normal distribution assumptions using The Lilliefors Test), Paired data of two samples have the same variance (data is said to be homogeneous if both data has the same assumption of variance value, using The Fisher Test)

Result and Discussion

The results of the test instrument trial in this study were aimed at making the items prepared and used in the study to be seen for their level of validity. Validation test was carried out by testing questions to twelve students who had received material on a linear equation system of two variables outside the class who would be given treatments (learning using LKPD). The test instrument consisting of five questions will be tested for validity, reliability, discriminating power, and the level of difficulty of the questions. test instruments will be given through before treatment (*pre-test*) and after treatment (*post-test*). The following is a description of each step of the test instrument test, namely the Validity Test and the Reliability Test.

The validity of the test instrument in this study aims to determine whether or not the items to be used are valid. The data obtained in this validity test is an essay answer.Test correlation technique *Product Moment* by comparing the value of r_{hitung} with r_{tabel} at a significance level of 5%. The item is said to be valid when $r_{hitung} > r_{tabel}$, other than this condition, the item is said to be invalid. The results of the calculation of the validity of the items. The following is a table of result of the validity test:

Table 1 The Results of The Validity Test of Question Items

Nomor Soal	$r_{counting}$	r_{table} (5%, 10)	Criteria
1.	0,936	0,497	Valid
2.	0,886	0,497	Valid
3.	0,910	0,497	Valid
4.	0,870	0,497	Valid
5.	0,921	0,497	Valid

Based on Table 1 it can be seen that all items tested for validity have valid criteria. Therefore, all items deserve to be used as test instruments in research.

This reliability test aims to determine the consistency or consistency of the items when tested at different times. the reliability test using the *Alpha Cronbach* technique, this technique is used because the scores obtained are not true or false dichotomous data (1 and 0). The higher the instrument reliability value, the higher the level of reliability. The results of the calculation of the instrument reliability test. The following is a table of result of the reliability test:

Table 2 The Result of The Reliability Test of Item

$r_{counting}$	Criteria
0,495	High Enough

Based on Table 2 it can be seen that the test instrument has high reliability criteria. Therefore, the *Problem-solving* in this study is feasible to be used in research.

After the research instrument went through a validation test, then the research test instrument in the form of *pre-test-post-test* and the LKPD product was implemented by 34 students of class VIII B SMP N 1 Ambarawa to determine its effectiveness. The pre-test and *post-test* questions consist of 5 questions. Based on the results of scoring students' answers, data obtained in the form of the results of the *pre-test* and *post-test*. The data was pre-tested before being tested for effectiveness. Data normality test results The data normality test technique used in this study is the Lilliefors Test Technique, because the data comes from essay answers. The following is a results table of the normality test calculation on the pre-test data:

Table 3 The Normality Test Calculation on The Pre-test Data

X1	Fkum	S	Z	fZ	S(Z)	L=F(Z)-S(Z)
40	4	8,904	-1,572	0,058	0,118	0,060
44	4	8,904	-1,123	0,131	0,235	**0,105**
48	4	8,904	-0,674	0,250	0,353	0,103
52	5	8,904	-0,225	0,411	0,500	0,089
56	5	8,904	0,225	0,589	0,647	0,058
60	4	8,904	0,674	0,750	0,765	0,015
64	4	8,904	1,123	0,869	0,882	0,013
68	4	8,904	1,572	0,942	1,000	0,058

The following is a results table of the normality test calculation on the post-test data:

Table 4 The Normality Test Calculation on The Post-test Data

X2	Fkum	s	Z	fZ	S(Z)	F(Z)-S(Z)
68	4	6,843	-1,530	0,063	0,118	0,055
72	6	6,843	-0,945	0,172	0,294	**0,122**
76	6	6,843	-0,361	0,359	0,471	0,112
78	2	6,843	-0,069	0,473	0,529	0,057
80	6	6,843	0,224	0,588	0,706	0,117
84	4	6,843	0,808	0,790	0,824	0,033
88	4	6,843	1,393	0,918	0,941	0,023
92	2	6,843	1,977	0,976	1,000	0,024

Based on table 3 dan 4 obtained the calculation result $L_{counting-pre-test}$ of 0,105 and $L_{counting-post-test}$ of 0,122. Then the comparison of the value of each $L_{counting}$ with L_{tabel} by a significance level of 5% and n = 34 that is, $L_{counting-pre-test}$ (0,105) < L_{table} (0,1497) and $L_{counting-postets}$ (0,122) < L_{table} (0,1497). So the conlusion of the fulfilled hypothesis is that H_0 is accepted in the other name the data is normally distributed..

The following prerequisite test is the data for the homogeneity of the data. In this study, the homogeneity test used the F (Fisher) test. The following is a results table of the homogeneity test:

Table 5 The Result of The Homogeneity Test

	Pre-test			Post-test	
$\sum \bar{X}_1$	$\sum (X_1 - \bar{X}_1)^2$	$s_1{}^2$	$\sum \bar{X}_2$	$\sum (X_2 - \bar{X}_2)^2$	$s_2{}^2$
1836	2667,98	81,6969	2668	1592,47	48,2566
	$F_{counting}$			F_{table}	
	1,6929			1,7878	

Based on the homogeneity test calculation table, the results of the calculation $F_{counting}$ of 1,6929. Then compared the value of $F_{counting}$ with F_{table} that is, $F_{counting}$ (1,6929) $< F_{table}$ (1,7878). So the conclusion of the hypothesis that is fulfilled is that H_0 is accepted or the data is homogeneous.

After the data meets the prerequisite test, then the data can be continued for the effectiveness test phase using the Paired T Test. Then the data is analyzed to find $t_{counting}$ compared with t_{table} by significance level of 5% and degrees of freedom N – 1 = 33. The following is a results table of the effectiveness test:

Table 6 The Result of Effectiveness Test on The Pre-test and Post-test Data

Total	$\bar{X}_1$	$\bar{X}_2$	$|t_{counting}|$	t_{table} (5% ; 33)
34 students	54	78,47	16,198	2,034

Based on calculations using *paired t test* and get the value $t_{counting}$ of 16,198, and t_{table} of 2,034. It can be seen that $t_{counting}$ (16,198) $> t_{table}$ (2,034). Thus the statistical hypothesis H_0 was rejected, and H_1 was accepted.

From the analysis of effectiveness test it found that learning mathematic with student worksheets based on computational thinking had an impact on student's problem-solving ability with an increased the average value test from 54 up to 78,47 in the other name its up to 31,18%. There is a significant difference in the result of the pre-test and post-test with the calculation result of $t_{counting}$ (16,198) $> t_{table}$ (2,034). In line with previous studies with development mathematic modul based on computational thinking on the material data presentation to increase student's critical thinking ability at Suruh NU Junior High school was that the result of mastery learning outcomes has increased from the low category with an average value of 86,2 (Zahwa, 2021).

Conclusion

Based on the results of the prerequisite test regarding normality and homogeneity, the data obtained from the results of the pre-test and post-test were normally distributed and assumed the same or homogeneous variance values. Then on the results of the effectiveness test of the Mathematics Student Worksheet (LKPD) on the material of the Two-Variable Linear Equation System (SPLDV) based on *Computational Thinking* (CT) on the students *Problem-Solving*, the results show that there is a difference in the average results of the *pre-test post-test* with the results of $t_{counting}$ (16,198) $> t_{table}$ (2,034). Thus the statistical hypothesis H_0 was rejected, and H_1 was accepted. It can be synthesized that there is an average difference between the *pre-test* and *post-test* ability test *problem-solving* of students namely, there is an average increase of 24,47 from 54 to 78,47.

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