The Effectiveness of Learning Packages Integrated Computational Thinking Skills on Elementary School Students’ Abilities in Thinking Computationally and Solving Mathematics Computational Problems

Hisyam Ihsan1, a), Sutamrin2,b), Fajar Arwadi3, ,b)

Author Affiliations

(Use the Microsoft Word template style: Author Affiliation) or (Use Times New Roman Font: 10 pt, Italic, Centered)(if authors share the same affiliation, list the affiliation one time and number accordingly)

1Universitas Negeri Makassar, A.P. Pettarani Street, Indonesia, 90222.

 2Universitas Negeri Makassar, A.P. Pettarani Street, Indonesia, 90222

3 Universitas Negeri Makassar, A.P. Pettarani Street, Indonesia, 90222

.

Author Emails

a) Corresponding author: hisyamihsan@unm.ac.id b) tamrin.mm@unm.ac.id

c)fajar.arwadi53@unm.ac.id
(Use the Microsoft Word template style: *Author Email*)or (Use Times New Roman Font: 10 pt, Italic, Centered)

**Abstract.** This study aims to determine the effectiveness of the learning packages integrated computational thinking skills on elementary students’ ability in thinking computationally and solving mathematics Computational Problems. This research is pre-experimental research with the design of one group pre-test and post-test. 92 Elementary School Students actively participated in this research. The research gathered data in the form of the test result of the students both in the pre-test and post-test. The data was collected by using test, observation, and interview techniques. The study suggests that the application of the model is able to improve students' abilities in solving Mathematics Computational Problems. The Effectiveness of the model study method is seen from the results of the pretest and posttest by using the Paired test Samples T-Test with the help of SPSS 24.0 for windows. The analysis results obtain the value of Sig. (2-tailed) is equal to 0.000 or less than 0.05, so it can be suggested that there is a significant difference between the learning outcomes in pre-test and post-test implying that students’ abilities in thinking computationally and solving mathematics computational problem significantly increase.

# Introduction(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

Computational thinking is important basic skills possessed by students, which is as important as the other basic abilities are the same as reading, writing and arithmetic skills [1]. Learning with computational thinking skills will allow students to think abstractly, algorithmically and logically, and ready to solve problems. Computational thinking (CT) is a way to find a solution of a problem with certain algorithms or procedures [2]. Computational thinking is a skill in identifying patterns then solve complex problems into a series of steps to provide solutions and build representation of the known problem data. This thinking technique allows students to change complex problems into a series of steps that are easier to solve provide an efficient way to think creatively. Specifically, computational thinking skills covers (i) Decomposition: breaking problems into parts, (ii) Pattern recognition: Analyzing the data, look for patterns to make sense of the data, (iii) Abstraction: Removing unnecessary details and focusing on the critical data, (iv) Modelling-simulation: Creating models or simulations to represent processes, (v) Algorithms: Creating a series of ordered steps taken to solve a problem, and (vi) Evaluation: Determining the effectiveness of a solution, generalizing, and applying it to new problems Therefore, computational thinking can train the brain to think logically and creatively. It is supported by [3] who argue that computational thinking is important to teach to students and useful for the future.

Some researchers argue that thinking mathematics plays an important role in computational thinking and vice versa computational thinking have an important role in mathematical thinking [4]. The idea to integrate computational thinking in mathematics education has been long discussed. One of the driving factors the integration of Computational Thinking into the mathematics curriculum is a response to scientific disciplines increasingly computerized due to practice massive in the professional world [5].

However, recently, there has not yet been a learning model particularly aimed to apply in classroom to increase the computational thinking skills of students. The model theoretically indeed includes some learning packages such as text lesson plan, books, student worksheet, and learning outcome test. Therefore, for gradual activity, this research tries to design the learning packages integrated Computational Thinking Skills. The learning packages consist of book, lesson plan, student worksheet, and mathematics computational thinking test. They have been validated theoretically in previous research [6] that they include and elicit computational thinking skills as they describe what computational thinking are, the components of the computational thinking skills, and the application of the skills in solving mathematics problems. The present research would specifically to measure the abilities of students in having knowledge and solving mathematics computational problems as the computational thinking skills.

# METHOD(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

This study applied pre-experimental research using a one group pretest post-test design. There were three classes that were set as an experimental class of which the learning packages was applied. Before applying the learning packages, the students were given pretest to see their initial abilities. After carrying out the learning, students were given post-test to find out the influence of the learning packages. The effectiveness of the packages would be seen from the difference in the average score of the pre-test and that of post-test. The population in this study were all students in SD Inpres Malengkeri 1, Makassar. The sample are three classes consisting of 92 students which was taken using a random sampling technique with the assumption, they all never learn specifically how to think computationally. To determine the effectiveness of the learning packages, several indicators should be satisfied. The data collected in this study are the test results of the students both in the pre-test and the post-test which were analyzed using SPSS through Paired samples T-test. The average score of students in the post-test is expected greater than 74.9 by referring the minimum completeness criteria of 75. For statistical testing purposes, a hypothesis is formulated as follows:

H0 : $μ\leq $74.9 against H1 : $μ$ > 74.9, where $μ$ is the average score of the students

The classical completeness of the students after being taught using the learning package is expected more than 79,9% (Prabandari, 2017) and calculated using the proportional test formulated with the following hypothesis:

H0 : $π\leq $79.9% against H1 : $π$ > 79,9% where $π $is the parameter of the classical learning completeness

Moreover, the average of normalized gain (increase) of the students' score after utilizing the learning packages is greater than 0.29. For the purposes of statistical testing, the working hypothesis is formulated as follows:

H0 : g $\leq $0.29 against H1 : g > 0.29

where g = normalized gain average score parameter. The value of g is given by:

$$g=\frac{S\_{pos}-S\_{pre}}{S\_{max}-S\_{pre}}$$

Where $S\_{pos}$ is the post-test score, $S\_{pre}$ is the pre-test score, and $S\_{max}$ is the maximum score.

## FINDINGS(Use the Microsoft Word template style: *Heading 2*) or (Use Times New Roman Font: 12 pt, Bold, Centered)

The first activity is giving the students a pre-test in the topic of extraordinary crimes. The test consists of a set of question measuring the indicators of the computational thinking based on (2005). Then, the learning packages are used in the learning by teachers for several meetings in the class. After that, the post-test is given to the students. The results of the pre-test and the post-test are shown in the Table 1.

Table 1. Descriptive Statistics of the Pre-Test and the Post-Test

|  |
| --- |
| **Descriptive Statistics** |
|  | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| Pre-testPost-testValid N (listwise) | 929292 | 1826 | 7888 | 46,9161,08 | 19,817,3 |

Based on the information obtained in the Table 1, the mean of the pretest results and posttest of 46.91 and 61.08 with a standard deviation of 19,8 in the pretest results and 17,3 in the posttest. scores the highest pretest and posttest scores are respectively 78 and 88, while the lowest scores for pretest and posttest are respectively 18 and 26.

Before applying Paired Samples T-Test, the test of normality is undertaken. The data both in the pre-test and the post-test respectively satisfies normality with sig. 0,347 and 0,231 and the lower bound of the true significance are 0,2 and 0,15 which means the normality. The results of the Paired Samples T-Test can be seen in the Table 2.

Table 2. The Result of The Paired Sample T-Test

|  |
| --- |
| **Paired Samples Test** |
|  | Paired Differences | t | df | Sig. (2-tailed) |
| Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference |
| Lower | Upper |
| Pair 1 | PreTest - PostTest | -14.16216 | 9.41781 | 1.54828 | -17.30222 | -11.02211 | -9.147 | 36 | .000 |

The test results show the value of Sig.(2-tailed) equal to 0.000 or less than 0.05 so that it can be concluded that there is a significant difference between the post-test and the pre-test.

The average student learning outcomes after being taught using the learning packages of which the hypothesis has been concerned obtain the value of p (sig.(2-tailed) is 0,000 < 0,05 or the average of the students’ score is more than 74.9. It means H0 is rejected and H1 is accepted. The average posttest learning outcomes of the students is more than the KKM value.

The completeness of the students’ learning after being taught using the learning packages reach a significant level 0,05 with the value z(0,5-0,05) = z0,45 = 1,64. Meanwhile, the z-count =2,0125 ≥ z0,45 = 1,64 implying that H0 is rejected and H1 is accepted so that it can be withdrawn a conclusion that the mastery of learning mathematics classically in statistics reached 79.9% of the total number who took the test.

The average of the normalized gain of students after being taught using the learning packages obtain the value of p(sig.2-tailed) is 0,000 < 0,05 showing the average of the normalized gain is more than 0.29. It shows that the gain index is 0.7. This means index gain is in the interval g ≥ 0,70, which means that H0 is rejected and H1 is accepted, namely the normalized gain of students’ scores is in the category high.

Thus, from these indicator satisfactions, it can be concluded that the application of the learning packages is effective in improving the abilities of the students in solving mathematics computational problems.

# CONCLUSION

This study aims to know the effectiveness of the learning packages integrated computational thinking skills on elementary school students’ abilities in thinking computationally and solving mathematics computational problems. Based on several indicators, it is found that the learning packages which consist of book, lesson plan, student worksheet, and mathematics computational thinking test are effective to use to improve students’ abilities in thinking computationally and solving mathematics computational problems.

#

# References(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

References should be numbered using Arabic numerals followed by a period (.) as shown below and should follow the format in the below examples.

1. Mohaghegh, D. M., & McCauley, M. (2016). Computational thinking: The skill set of the 21st century..
2. Kalelioglu, F., Gulbahar, Y., & Kukul, V. (2016). A framework for computational thinking based on a systematic research review.
3. Adler, R. F., & Kim, H. (2018). Enhancing future K-8 teachers’ computational thinking skills through modeling and simulations. Education and Information Technologies, 23(4), 1501-1514.
4. Rambally, G. (2017). Integrating computational thinking in discrete structures. In Emerging research, practice, and policy on computational thinking (pp. 99-119). Springer, Cham.
5. Juškevičienė, A., & DagienĖ, V. (2018). Computational thinking relationship with digital competence. Informatics in Education, 17(2), 265-284..
6. Ihsan, H., Arwadi, F., & Sutamrin, S. (2022, April). The Elementary Education Assessment and Learning Integrated 21st Century-Computational Thinking Skills in Mathematics: Global Design Stage. In 1st World Conference on Social and Humanities Research (W-SHARE 2021) (pp. 6-9). Atlantis Press.