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Computational Thinking Learning to Improve Slow Learner Critical Thinking Ability in LinearProgramming Materials at SMA Muhammadiyah 3 Yogyakarta

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Abstract
The purpose of this study was to determine the effect of computational thinking (CT) approach in improving the critical thinking skills of slow learner student. This research is an experimental research design with Single Subject Research A-B. Students used as subjects in this study were class XI students at SMA Muhammadiyah 3 Yogyakarta who were choosed based on the results of the CFIT test and the data on the results of daily assessments conducted by mathematics subject teachers. Data collection through test of critical thinking, observations and interviews. Based on the results of critical thinking tests, it is known that there has been an increase in students' skill from the baseline phase with scores of 18, 22 and 21 to 84, 83 and 85 in the intervention phase. Likewise, the results of the analysis on conditions show that the intervention phase has direction and stability that significantly increases compared to the baseline phase. With the CT approach, the slow learner student don' t focus on applying formulas in solving linear program problem, but rather decomposite the problem so that problem identification can be done well and problem solving based logical and precise reasons.

Keywords: computational thinking, critical thinking, slow learner

Introduction
Preparation various of student abilities in overcoming problems, possesing knowledge, construct thinking patterns and attitude procedures carried out through education [1]. Through education in schools, students should be construct higher-order cognitive skills in stages as their progress, including critical thinking [2]. Critical thinking is a skill that involves self-regulatory assessment that aims and is not only recognized as important skill, more than that as an essential [3].

Critical thinking is an intellectual process that is regulated with the aim of working actively in understanding, applying, analyzing, synthesizing (evaluating) information by observing, collecting data, processing data by reasoning, reflecting and communicating the results obtained [4] [5]. Critical thinking can also be interpreted as the ability to analyze and evaluate information obtained by a person [6]. In applying critical thinking skills, it can be seen from the indicators used in problem solving such as providing simple explanations, building basic skills, concluding, providing further explanations, and developing strategies and tactics to conclude [7]. Therefore, critical thinking can be interpreted as a person's ability to be able to understand, apply, carry out analysis, evaluate information, so that in the end a person can solve a problem according to the steps of critical thinking.

The ability to think critically must be possessed by all students, including students who have low cognitive abilities (slow learner) as a means of increasing the student's ability to express ideas or ideas in solving a problem [8]. Slow learner students include students who have special needs, where these students have low cognitive abilities, but are not persons with disabilities [9]. Low learner students can be defined as students with slower learning abilities than their peers, but do not have mental disabilities. The thing that differentiates it from students in general is that slow learner students have less than optimal achievement

compared to their peers, but they can still get good academic achievement even though they are not as fast as students in general [10] [11] [12]. Based on the IQ test intelligence, slow learner students have scores in the range 75-90 or are categorized below the average with low scores in almost all of the subjects [13]. Therefore, the ability of slow learner students is different from other students, so that in class placement it would be better if these students were not put in the same room as students in general.

Based on the results of the CFIT test conducted at SMA Muhammadiyah 3 Yogyakarta, it was found that some students still had results in the range 72-75. This means that some students at SMA Muhammadiyah 3 Yogyakarta have cognitive abilities that have not been able to develop optimally. Therefore, we need a learning model that stimulates the slow learner's critical thinking ability.

The learning approach that can be used to stimulate the critical thinking skills of slow learner students is the computational thinking approach. The Computational Thinking (CT) approach is one approach that can be used in learning. Using the CT approach, learning can train the brain to be more accustomed to thinking in a structured, critical and logical manner. The learning process with a computational thinking approach has its own charm because it has a concept that aims to solve the problems faced, so that it can be resolved quickly in a short time, requires little human resources, as well as physical and digital storage space. The result of the work produced by the CT approach is the right and accurate answer because it uses steps and stages of thinking that are coherent and systematic [14].

There are four learning techniques using the CT approach, namely decomposition, pattern recognition, abstraction, and algorithm design. Decomposition is the ability to break down complex problems into smaller, more detailed parts. Pattern recognition is the ability to recognize common similarities or differences which will later be used to assist in making predictions for completion. Abstraction is the ability to extract unneeded information and draw conclusions from the information needed so that a person can use the information to solve similar problems. Meanwhile, algorithm design is the ability to arrange steps in solving problems structurally, logically and critically [15]. The CT approach is only used to solve problems related to computer science, but the CT approach can also be used to solve problems of various problems, one of which is to solve problems in the eye in this case related to linear program problems.

Based on the description above, the researcher is interested in seeing the effect of the computational thinking approach to improve the critical thinking skills of slow learner students on linear program material. The type of research that researchers want to use is experimental research with a single subject or better known as Single Subject Research (SSR).

Materials and methods

This research is an experimental study using the Single Subject Research (SSR). Single Subject Research (SSR) or the so-called single-subject design measures the related variables or target behavior repeatedly over a certain time period and comparisons are not made between individuals or groups but compared with the same students in different conditions [16].

The SSR phase is divided into two, namely the baseline phase (early phase) and the intervention phase (experimental phase). The baseline is a condition used in measuring aspects of student behavior for some time before the treatment is carried out, while for the measurement time span, this baseline determination is called the baseline phase. Intervention is a condition that is used to measure students' abilities after treatment is done using learning, while for the measurement time span, this intervention is called the intervention phase.

The research design used the SSR A-B design. The basis of using the A-B design involves the baseline phase (A) and the intervention phase (B). Design A-B is the basic design of single student research. For the A-B design there was no repeated measurement where the baseline phase (A) and the intervention phase (B) were each carried out only once for the same student [16].

This SSR research was conducted at SMA Muhammadiyah 3 Yogyakarta. This research was conducted in the odd semester of the 2020/2021 school year starting from September 21, 2020 to September 26, 2020 (for 6 days). The subject used in this study is a student with a slow learner category as evidenced by the results of the CFIT test, namely a student with the initials "TAR" class XI IPS 2 SMA Muhammadiyah 3 Yogyakarata.

The research data collection was divided into two phases, namely the baseline phase and the intervention phase. The baseline phase was carried out for 3 days with a duration of about 45 minutes per day. In this phase the subject is given a critical thinking test of the linear program material. The test results are used as the student's initial data before the treatment is carried out in the intervention phase. Furthermore, the intervention phase was carried out for 3 days with a duration of about 60 minutes per day. In this phase the subject was given treatment in the form of learning activities using computational thinking (CT) - based learning, then given a test of critical thinking skills of linear program material.

The data analysis techniques in this study were data reduction, data presentation and verification. Meanwhile, the data collection techniques in the study were divided into 3, namely tests (carried out during the process in the baseline phase and the intervention phase), observation and interviews. While the research instrument used was used to collect data in the form of tests, observations and interviews. The data obtained will be analyzed based on 2 conditions during the study, namely analysis in conditions and analysis between conditions.

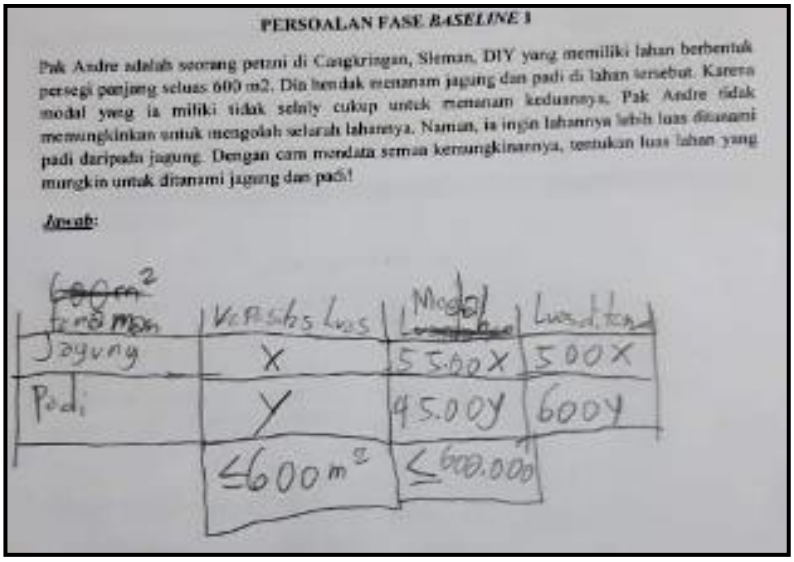
Results & Discussion

This research was conducted at SMA Muhammadiyah 3 Yogyakarta. Based on the results of preliminary observations and interviews it is known that students who are the subject of this single study have low cognitive abilities with CFIT test scores in the range 70 - 90, namely CFIT 3A with a score of 72 and CFIT 3B with a score of 75. In addition, based on the results of the interview with a teacher who teaches mathematics that the value of the linear program material is still low. So far, students have not understood how to solve problems to be simpler so that they can abstract in mathematical sentences and solve mathematical problems with the right steps on linear program material.

Furthermore, the researcher tried a research instrument that

explored student's answers by asking them to work on several problems according to their ability to measure the level of thinking skills in solving linear program problems as the initial stage of this research, namely as the baseline phase. In addition, the researcher will also provide a final test as an intervention phase after students are given action using a computational thinking approach.

In the baseline phase students are asked to complete critical thinking questions given to measure students' initial understanding of linear program material as in Figure 1.


PERSOALAN FASE *BASELINE 1*

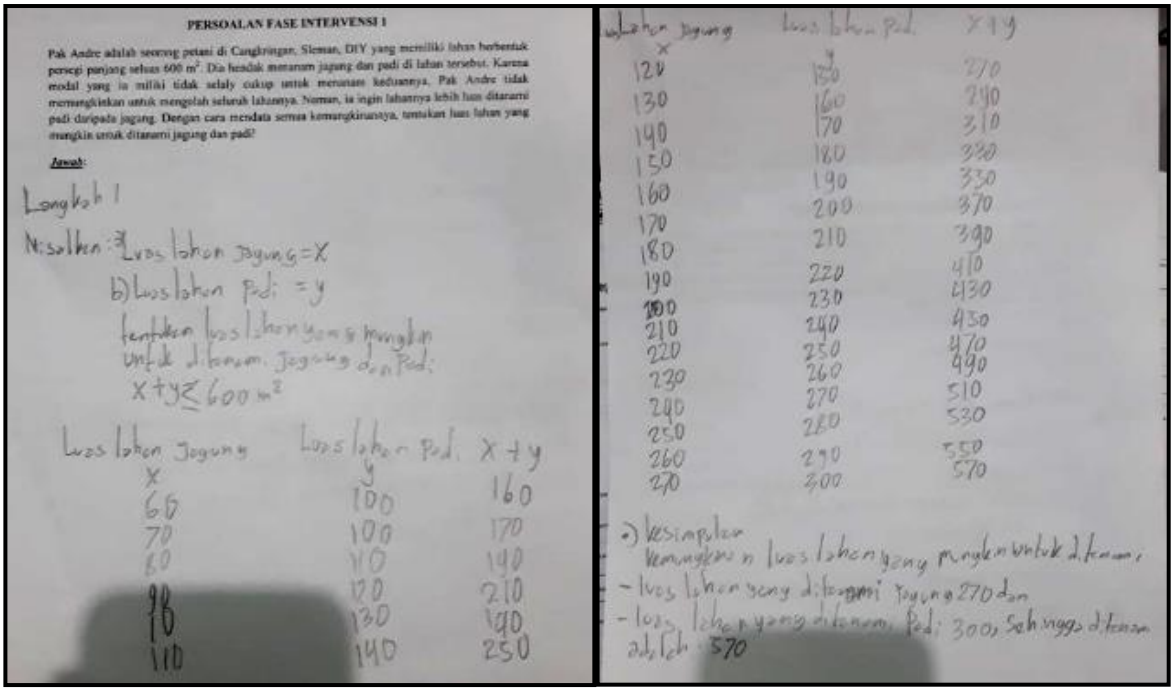
Pak Andre adalah seorang petani di Cangkringan, Sleman, DIY yang memiliki lahan berbentuk persegi panjang seluas 600 m2. Dia hendak menanam jagung dan padi di lahan tersebut. Karena modal yang ia miliki tidak selalu cukup untuk menanam keduanya, Pak Andre tidak memungkinkan untuk mengolah seluruh lahannya. Namun, ia ingin lahannya lebih luas ditanami padi daripada jagung. Dengan cara mendata semua kemungkinannya, tentukan luas lahan yang mungkin untuk ditanami jagung dan padi!

Jawab:

~~600m²~~	Variabel Luas	Modal	Luas lahan
Jagung	X	55.00X	500X
Padi	Y	45.00Y	600Y
	≤600 m²	≤600.000	

Fig. 1: Student Questions and Answers in the Baseline Phase

Based on Figure 1, it is known that students do not understand how to solve critical thinking problems according to the stages of completion. At the focus stage, students still do not understand the problems presented because they are too complex. This can be seen from the students' answers in the picture where the answers are still answers that do not reflect the complex questions presented. At the reason stage, students cannot provide relevant reasons at each step of completion because they cannot understand complex problems as seen from the answers in Figure 1. In the critical thinking problem solving stage which is the next situation, students cannot use a lot of appropriate information. With problems because the problems presented are very complex. This can be seen from the answers of these students who could not solve the problem in coherent steps. The next stage, namely clarity, students cannot explain the terms contained in the questions because the questions are still complex. It can be seen from the new students who answered directly that they did not write down the terms needed to solve the problem.


PERSOALAN FASE INTERVENSI 1

Pak Andre adalah seorang petani di Cangkringan, Sleman, DIY yang memiliki lahan berbentuk persegi panjang seluas 600 m². Dia hendak menanam jagung dan padi di lahan tersebut. Karena modal yang ia miliki tidak selalu cukup untuk menanam keduanya, Pak Andre tidak memungkinkan untuk mengolah seluruh lahannya. Namun, ia ingin lahannya lebih luas ditanami padi daripada jagung. Dengan cara mendata semua kemungkinannya, tentukan luas lahan yang mungkin untuk ditanami jagung dan padi!

Jawab:

Langkah 1

Misalkan: a) Luas lahan jagung = X

b) Luas lahan Padi = y

tentukan luas lahan yang mungkin untuk ditanam Jagung dan Padi:

$X + y \leq 600\ m^2$

Luas lahan Jagung X	Luas lahan Padi y	X + y
60	100	160
70	100	170
60	110	140
90	120	210
10	130	140
110	140	250

Luas lahan Jagung X	Luas lahan Padi y	X + y
120	150	270
130	160	290
140	170	310
150	180	330
160	190	350
170	200	370
180	210	390
190	220	410
200	230	430
210	240	450
220	250	470
230	260	490
240	270	510
250	280	530
260	290	550
270	300	570

c) kesimpulan kemungkinan luas lahan yang mungkin untuk ditanami,
- luas lahan yang ditanami jagung 270 dan
- luas lahan yang ditanami Padi 300, sehingga ditanam adalah 570

Figure 2: Student Questions and Answers in the Intervention Phase

In the intervention phase, students are given learning with a computational thinking approach. Furthermore, after being given the action by the researcher, the students were given similar comprehension test questions. The questions given in the intervention phase are presented in Figure 2 above. In the intervention stage, after being given treatment in the

form of learning with a computational thinking approach, students can explore their ability to solve critical thinking problems in three-dimensional material. From the child's answer in Figure 2 above, in the critical thinking step, the focus stage of the student has understood the meaning of the complex problem given by the researcher. This can be seen from the students being able to understand the problem and being able to make steps and ideas to solve the problem. In the next stage, the student's reason is able to provide relevant reasons for each step of solving the complex problem, as seen in the steps for solving the students' reasons. Furthermore, for the situational stage in solving critical thinking problems, students are able to use a variety of information on the problem. At the clarity stage, students are also able to explain the terms that exist in the complex problems presented in order to be able to solve them in steps according to the computational thinking approach.

The results of the study for 6 days, with 3 days (every day 1 session for 45 minutes) in the baseline phase, and 3 days (every day 1 session for 60 minutes) in the intervention phase, the results obtained are as shown in Table 1 below.

Table 1. Score of Critical Thinking Ability Test Results.

	Date	Score
Baseline	September 24, 2020	18
	September 25, 2020	22
	September 26, 2020	21
Intervention	September 28, 2020	84
	September 29, 2020	83
	September 30, 2020	85

In the baseline phase, critical thinking scores were obtained related to the student's linear programming questions, namely 18, 22, and 21, while in the intervention phase, the critical thinking scores of students' linear program questions were obtained, namely 84, 83, and 85. Linear program material during these two phases, the students' critical thinking test scores are represented in Figure 3 below.

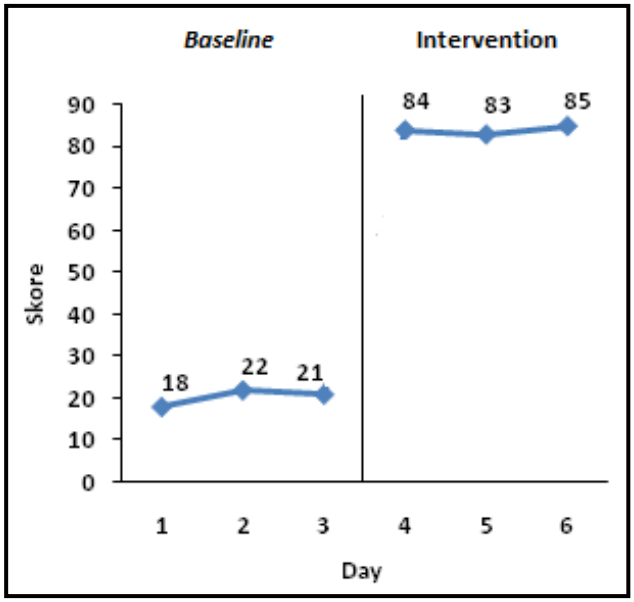
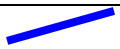


Fig. 3: Visual Analysis of Baseline Phase and Intervention Phase

From the graph in Figure 3 above, it can be seen that there is an increase in the understanding of slow learner students when given learning the computational thinking approach on the linear program material which is illustrated by the increase in the graph from the baseline phase A to the intervention phase B. the components of phase length (interval length), direction trend, level of stability, rate of change, data trace and range are analyzed according to the phase. The analysis components in the above conditions can be seen in Table 2.

Table 2. Summary of Analysis Results in Conditions.

Conditions	A1	B2
Length of Condition	3	3
Estimation of Direction Tendency		
Trend of Stability	Variable 33%	Stable 100%
Trace Trends		
Stability Level and Range	19,23 – 21,43	77,63 – 90,38
Level of Change	22 – 18 = 4	85 – 83 = 2

Based on Table 2 above, it is known that the trend is increasing in condition B2 rather than condition A1. With the level of stability tendency in condition B2 reaches 100%, which means the stability is fulfilled. For the analysis between conditions, the visual results are presented in Table 3 below.

Table 3. Summary of Visual Analysis Results between Conditions

Conditions	B2/A1 (2:1)
Number of Variables	2
Change in Direction Tendency and Effect	 (=) (=)
Changes in Stability Trend	Stable to stable
Level Change	(18 – 85) = (+) 67
Overlap Percentage	0%

The components between conditions include the number of variables that are changed, changes in trend direction and their effects, changes in stability and their effects, changes in data levels, and data that overlaps. In the analysis between the first conditions there was a change in trend direction and effects. Based on the overlap results, as shown in table 3, it can be concluded that, the smaller the percentage of overlap, the better the effect of intervention on target behaviour, namely the ability to think critically of slow learner students. Overlap here is defined as data from research that overlaps with each other.

Based on the results of the research above, it is known that in the implementation of research students are guided to solve critical thinking problems in linear program material. Researchers used two conditions, namely three days in the baseline phase (A) and before being given treatment (intervention) four days in the intervention phase (B). In the analysis in conditions, the baseline conditions (A) obtained observations of 18, 22, and 21 so that the data shows a fixed direction. Then in the intervention phase (B) scores were 84, 83, and 85. In the analysis, the intervention phase had an increasing trend toward direction and stability than the baseline phase. In the baseline phase, the variable

stability tended to be unstable with a percentage of 33%, while the intervention phase was more likely to be stable with a percentage of 100%. So that the analysis between conditions shows an overlap percentage of 0%, where there are no points in the intervention phase that are in the baseline phase range. From the results of this analysis, it is known that learning with the computational thinking approach has a significant effect in increasing the critical thinking skills of slow learner students.

Conclusions

Slow learner students who have limitations in the ability to think critically in solving linear program problems because the learning that is carried out emphasizes lecturing and memorizing concepts only. By providing learning with a computational thinking approach, which gives slow learner students the opportunity not only to apply formulas in solving linear program problems, but rather in decomposing problem activities so that problem identification can be done well and problem solving can be based on logical and precise reasons. To gain experience discovering concepts independently, analysis of critical thinking problems in slow learner students' linear programming material increases. This can be seen from the increase in the critical thinking ability test results of slow learner students in the baseline phase with scores of 18, 22, and 21 being 84, 83, and 85 in the intervention phase. This is the case with the results of the analysis in conditions which show that the intervention phase has a direction and stability which is significantly increased than the baseline phase. Through observations and interviews, it is also known that the consistency of the answers indicates the critical thinking ability of slow learner students on the constructed linear program material.

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