The Development of Textbook Supplement on Cooperative Integrated Reading Composition Model to Improve Students' Mathematical Communication Ability.

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Abstract

The textbook supplement of Cooperative Integrated Reading Composition (CIRC) model is an innovative textbook for three variable linear equation systems and contains indicators of mathematical communication abilities as well as the steps of the CIRC learning model. The purpose of this research was to produce textbooks of the CIRC learning model on three-variable linear equation system in class X which has the potential to improve students' mathematical communication abilities. This research used Research and Development (R&D) with 4D *Models* which are adapted into 4P Models. However, this research had three steps, they were 1) *Define*; 2) *Design*; and 3) *Develop*. Based on the result of the study, it was found that the textbook supplement on CIRC learning models can be use in learning with an average percentage of 91.23%, it means that the textbook supplement was very feasible. In addition, the readability test of textbook supplement use Cochran Test and the result shows that the students had the same understanding of the textbook supplement. the textbook supplement getting e-copyright from Directorate General of the Intellectual Property and ISBN from National Library of the Republic of Indonesia was ready used for the next steps, that was testing in classroom learning.

1. Introduction

Education was a business process that carried out consciously through guidance, teaching, and training activities to facilitate future social life. According to the Law of the Republic of Indonesia number 20 of The Year 2003 concerning about National Education System, education was a conscious effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state. One of the compulsory subjects that must be studied by students is mathematics. Basically, mathematics had an important role in education. This can be seen from mathematics taught at the elementary, secondary and tertiary levels of education. In studying mathematics, students were required to achieve the competencies set out in the curriculum. One of the objectives of learning mathematics in the 2013 curriculum as contained in the Regulation of the National Minister of Education Number 59 of The Year 2014 was that students had the ability to understand mathematical concepts, explain the interrelationships between concepts and apply concepts or algorithms in a flexible, accurate, efficient, and precise way in solving problems. In line with this, according to (Clark et al., 2005) mathematical communication ability had an important role in learning mathematics.

Based on the results of the Program for International Student Assessment (PISA) survey, it showed that the competence of Indonesian students was still under the standard of PISA. PISA 2018 results, Indonesia was ranked 74th out of 79 participating countries with an average score of 396 (OECD, 2018). One aspect of the ability used in the assessment of the PISA mathematical process was mathematical communication. Therefore, one of the causes of Indonesia's low ranking in PISA was due to low

mathematical communication ability. This was in line with Lusiatri's research (2022) at one of the public junior high schools in the city of Semarang, data obtained that students had not been able to communicate their ideas. Learning is still dominated or teacher-centered so that students have not been able to express a problem in the form of symbols, diagrams, or mathematical models.

Improving students' mathematical communication ability can be done in several ways, one of which was by choosing a learning approach that emphasizes more activeness so that students were free to think and question what they receive from the teacher. The learning model used, of course, also affects mathematical communication. The learning model chosen should be able to create an atmosphere of active, creative, fun student learning and can learn mathematics easily. Because with the right learning model can realize the achievement of learning objectives. This was in line with The Regulation of the Minister of Education and Culture Number 65 of The Year 2013 which states that learning in schools should be fun, interactive, inspiring, challenging and motivating students. One of the learning models that can make students active, creative, and able to learn mathematics easily is the Cooperative Integrated Reading Composition Model, hereinafter referred to as CIRC. Karimah (2017) revealed the results of his research, namely the average mathematical communication ability with CIRC learning is higher than ordinary learning, seen from the post test results. Thus it can be concluded that the mathematical communication skills of students who receive learning with the CIRC approach were better than those who receive conventional learning.

Based on the description above, the textbook supplement on CIRC learning model will be arranged based on indicators of students mathematical communication ability. The purpose of this study was to determine the validity of textbook supplement on CIRC learning model from three validators and the readability of textbook supplement on CIRC learning model from five students.

2. Method

This study was Research and Development (R&D) that uses 4-D Models developed by Thiagarajan, Semmel, and Semmel (1974). 4-D Models consist of four main stages, namely define, design, develop, and disseminate. Then, it was modified into three steps, they are 1) Define, 2) Design, and 3) Development.

Through this modified research method, a textbook supplement product was developed to improve the mathematical communication ability of tenth grades through CIRC learning model on three-variable linear equation system material. The implementation of this research began with the design of the textbook supplement which was validated by 3 validators in November 2021 to validate the textbook supplement. Validation aims to determine the level of feasibility in textbook supplements based on indicators of students' mathematical communication ability. Furthermore, the readability test was carried out on 5 students of senior high school 1 Pekalongan to find out whether the supplementary textbook was easy to understand or not by students.

The textbook supplement that was developed contains indicators of mathematical communication ability and steps of CIRC learning model. Thus, the supplement of textbooks was expected to have the potential to improve students' mathematical communication ability. This research was conducted in November 2021 to validate the feasibility of textbook supplements by the three validators and in December 2021 a limited readability test was conducted.

The feasibility level test for textbook supplements in this study contained three aspects of feasibility, namely, the feasibility of content, presentation, and language adapted from BSNP (2015). Qualitative research on textbook supplements was carried out through a checklist assessment. The textbook supplements were coded with a qualitative scale and then the qualitative value was changed to quantitative with the following conditions. The converting qualitative value to quantitative value is presented in table 1 below:

Table 1. Converting Qualitative Value to Quantitative Value

Mark	Number
Very Worthy	4
Worthy	3
Worthy Enough	2
Not Worthy	1

(Mardapi, 2008: 122)

The data analysis technique for the feasibility of teaching material is calculated by finding the percentage of feasibility using the following formula below.

$$P = \frac{f}{N} \times 100\%$$

(Sudijono, 2014, h.43)

Keterangan
P : percentage of feasibility score
f : number of scores obtained
N : the maximum number of scores

The criteria for the feasibility level of teaching material according to Akbar (2013) can be seen in Table 2 below.

Table 2. Criteria for Feasibility Level of Teaching Material

Eligibility Level	Criteria
$1\% \leq P \leq 50\%$	Not Feasible
$50\% < P \leq 70\%$	Feasible Enough
$70\% < P \leq 85\%$	Feasible
$85\% < P \leq 100\%$	Very Feasible

The textbook supplement of CIRC learning model deemed worthy to be tested If the assessment results is > 70%, then the teaching material were suitable for use in learning activities. However if the assessment score is 70% then the teaching material need to be revised again.

Analysis of readability test data uses the Cochran Test with the following formula below.

$$Q = \frac{(k-1)\left[k\left(\sum_{j=1}^{k} G_j{}^2\right) - \left(\sum_{j=1}^{k} G_j\right)^2\right]}{k \sum_{i=1}^{N} L_i - \sum_{i=1}^{N} L_i{}^2}$$

Keterangan:
k : number of columns
N : number of lines
$\sum_{i=1}^{N} Li$: total number of successes in line i
$\sum_{i=1}^{N} Li^2$: square of the total number of successes in line i
$\sum_{j=1}^{k} Gj$: total number of successes in column j

(Djarwanto, 2003: 70)

Decision making is based on the following hypothesis.
H_0: There was no differences in opinion among the five students regarding their understanding on the textbook supplement on CIRC learning in the three-variable linear equation system material.
H_1: There was differences in opinion among the five students regarding their understanding on the textbook supplement on CIRC learning in the three-variable linear equation system material.

The test criteria used are decline H_0 apabila $Q \geq X^2{}_{(\propto;k-1)}$ with $\propto= 0{,}05\%$.

3. Results & Discussions

3.1. Define

The define stage was the initial stage by analyzing and identifying problems in the form of initial analysis, student analysis, concept analysis, task analysis and formulation of learning objectives. The results obtained from this define stage, it was still found that students have low mathematical communication skills as evidenced by preliminary studies.

Based on the problems described above, classroom learning also requires innovation in order to increase students' enthusiasm for learning. One of the efforts made by researchers to improve the mathematical communication ability of class X students was to provide additional learning tools in the form of a supplement to the CIRC learning model textbook. Furthermore, the researchers analyzed the characteristics of high school students, KI and KD, the concept of the material, and set learning objectives according to the 2013 curriculum and using the CIRC learning model.

3.2. Design

The design stage includes the selection of visual media, format selection, and initial design. Based on the initial analysis and student analysis, a textbook supplement entitled "The Textbook Supplement "Lebar" for Class X" was determined as a learning aid in the form of printed media containing three-variable linear equation system material in accordance with the 2013 Curriculum and oriented to the CIRC learning model. Format for the textbook supplement refers to a design made with a combination of attractive pictures, writing and colors on A4 paper. The textbook supplement consists of 52 pages that can be used in two learning meetings. The font used were Times New Roman, Berlin Sans FB, Bodoni MT Black, Bauhaus 93, Arial Rounded MT Bold, Arial Black, Bernard MT Condensed and font size 12-18pt. The discussion of the material contains indicators of mathematical communication ability as well as learning steps for the CIRC model. The textbooks supplement were equipped with problem illustrations and evaluation of three-variable linear equation system material problems. Then the textbook supplement was designed using Canva and equipped with pictures to attract students' attention. Before validation, textbook supplements were consulted with the supervisor. The supplementary textbook revised by the supervisor was called Draft I.

3.3. Develop

The results at this development step were validated of Draft 1 by three validators, they were two supervisors and a senior high school mathematics teachers. The validator provides an assessment related to feasibility test of the textbook supplement. The teaching material from the validation and revision of the validator was called Draft II. Draft II was given to five students to determine the level of readability. The draft I and draft II of the textbook supplement can be seen in Figure 1 and Figure 2 below.

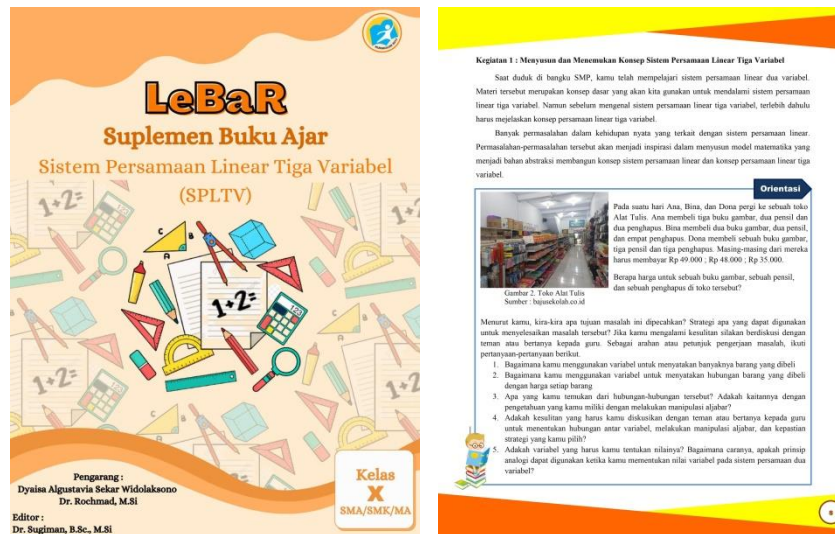**Figure 1.** Draft I of The Textbook Supplement "Lebar"

Figure 2. Draft II The Textbook Supplement "Lebar" (Final Product)

The results of the feasibility test of the textbook supplement on CIRC learning model in three-variable linear equation system material for class X reached the percentage of 91.23% and was included in the "Very Feasible" category. The feasibility of each aspect was presented in table 3 below:

Table 3. The Feasibility Test Results of Teaching Material in Each Aspect

Aspects that Observed	P(%)	Criteria
Contents	90.83	Very Feasible
Language	90.38	Very Feasible
Presentation	92.05	Very Feasible

The results of the feasibility test show that the textbook supplement on CIRC learning model in three-variable linear equation system material for class X very suitable for use in learning mathematics.

The results of the readability test of the textbook supplement on CIRC learning model in three-variable linear equation system material for class X obtained value $Q = 10.38 < x^2_{(\propto;k-1)} = 16.919$. This result showed no differences opinion among the five tenth grade students regarding their understanding of the textbook supplement on CIRC learning model in three-variable linear equation system material for class X.

After testing the achievement of feasibility and readability test, the textbook supplement were rearranged to given e-copyright that received by Directorate General of the Intellectual Property on November 18, 2021 and ISBN from National Library of the Republic of Indonesia.

4. Conclusion

Based on the results of the study, it can be concluded that (1) the development of the textbook supplement on CIRC learning in the three-variable linear equation system material have three steps, they are Define, Design, and Develop; (2) the feasibility test of the textbook supplement on CIRC learning in the three-variable linear equation system material reached a percentage of 91,23% and were included in the "Very Feasible" category; and (3) the readability of textbook supplement based on CIRC learning in the three-variable linear equation system material using the Cochran test showed that the students had the same understanding of the textbook supplement.

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