

THE DEVELOPMENT OF CANVA-ASSISTED PROBLEM-SOLVING APPROACH TEACHING MATERIALS TO IMPROVE STUDENTS' MATHEMATICAL COMMUNICATION ABILITY ON VOCATIONAL SCHOOL BASED ON LEARNING INDEPENDENCE

Neng Hendriawati Amirudin¹, Luvy Sylviani Zanthi²

¹IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.

nenghendriawati100@gmail.com,

¹IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.

lszanthy@gmail.com

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ABSTRACT

Mathematical communication ability and learning independence is one of the things that students must have and master in order to achieve competency in learning, especially in learning mathematics. This research has the aim of improving mathematical communication skills and learning independence of class X students of Al-IHSAN Batujajar Vocational School through the development of mathematics teaching materials on sequences and series material using a problem solving approach assisted by the Canva video application. The research method used is the research and development (RnD) Plomp model. The instruments used are teaching material validation tests, mathematical communication skills tests and non-learning independence tests. The validation instruments were given to ICT experts and material experts. As for the ability and independence tests given to class X students of SMK Al-IHSAN. From the results of the study it was found that the teaching materials developed showed very valid results based on the results of ICT expert and material expert assessment and based on the results of student assessments it was found that the teaching materials were very feasible to use and received very practical criteria. In addition, the application of the problem solving approach in learning can improve students' mathematical communication skills and also student learning independence in terms of the results of post-test data analysis.

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Corresponding Author:

Neng Hendriawati Amirudin,
Department of Mathematics Education,
Institut Keguruan dan Ilmu Pendidikan Siliwangi,
Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
Email: nenghendriawati100@gmail.com

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INTRODUCTION

At the beginning of 2020, Indonesia and even the world were shaken by the outbreak of a terrible pandemic, namely Covid-19. During the Covid-19 outbreak, many things changed in our society's lives which were caused by the policy of Imposing Restrictions on Community

Activities (PPKM) which also had an impact on learning activities in schools. Prior to the outbreak of the Covid - 19 pandemic, students were free to study in an offline school environment, turning online as a result of school closures aimed at reducing the spread of Covid - 19.

However, this situation certainly raises various kinds of problems ranging from selecting appropriate teaching methods, lack of mastery of technology, conditioning students to participate in learning, and so on that are technical in nature. This is supported by Fikri et al., (2021) that the obstacles encountered are still fundamental, starting from limited services, lack of mastery of learning technology and also obstacles in the internet network. Likewise, Mamluah & Maulidi, (2021) who explained that schools are preparing policies in the form of technical rules regarding distance learning and teachers who are not ready to face distance learning so that evaluations are needed to optimize learning.

The application of online learning also affects students' cognitive and affective abilities, one of which is communication skills and student learning independence. Including students' mathematical communication skills and also student independence. The students' own mathematical communication ability is the student's ability to interpret or express mathematical ideas either orally or in writing whether in pictures, graphs or diagrams. As stated by Parinata & Puspaningtyas, (2022) that mathematical communication skills are a way to convey an idea, both strategy and solution in solving mathematics in oral or written form. While student learning independence is a situation where students take the initiative to overcome a problem or obstacle without the help of others with the responsibilities they have so that the results obtained are maximized. Reski et al., (2019) explained that independent learning is the ability of students to learn without coercion and also the interference of others.

The importance of mastering mathematical communication skills can assist students in solving a given problem as well as a means of communication between students and teachers in the learning process. As stated by Yanti et al., (2019) mathematical communication is taught in schools so that students are able to read and understand what is ordered and discussed on a problem. However, based on the results of research conducted by Mulqiyono, et al., (2018), and Noviana, et al., (2018), regarding students' mathematical communication skills, it shows that students' mathematical communication abilities are still relatively low. Coupled with the outbreak of the Covid-19 pandemic, of course, it will greatly affect this ability.

Likewise student learning independence, there are still many students who in learning activities are very dependent on the teacher. Where students prefer to be guided and directed in learning activities compared to trying to find out independently. Even though learning independence is important for every student to have, so that students have more responsibility and high initiative in learning so that they can determine the targets and goals they will achieve in learning. So it is only natural that learning independence needs to be a concern because students who have strong learning independence will not give up easily so that it affects learning success (Yanti et al., 2019). However, Sojanah & Kencana, (2021) said that student learning independence is still very low. This can be seen from students' attitudes in learning, where students still need guidance from teachers, delays in submitting assignments and cheating, and so on. In addition, the level of student confidence in mathematics. As stated by Woi & Prihatni, (2019), students think that mathematics is a difficult subject so students lack confidence and are more dependent on others.

Of course, this forces teachers to change their teaching style by utilizing existing technology. So that it can facilitate students in learning activities both with or without teacher guidance when online or offline. Therefore, there is a need for an innovation that can overcome these

problems, one of which is by developing teaching materials. Where these teaching materials can facilitate students to learn online, either with the guidance of a teacher or independently. Based on the previous explanation, the researcher intends to develop an innovative teaching material by utilizing technology accompanied by the selection of learning approaches. And one of the features or platforms that can be used is the Canva application. This Canva application is a graphic design application that is easy to operate. Many interesting features are offered by Canva, one of which is the video creation feature. So that it can assist researchers in developing effective teaching materials.

In addition, an appropriate learning approach is needed, which of course can support learning activities while online or offline which can be applied side by side with the use of this technology. One of them is the Problem-Solving approach. The Problem-Solving Approach itself is a learning series that focuses on how the process of solving problems faced by students scientifically with the aim of mastering the material being taught, practicing problem solving skills and showing a relationship between theory and reality. With four steps of problem-solving, namely understanding the problem, planning a solution strategy, implementing the plan that has been made, and checking the results.

Some research results indicate that the application of the Problem Solving approach can be an alternative in improving students' mathematical abilities, one of which is students' mathematical communication skills as the results of research conducted by Tambunan, (2021) show that the application of problem solving-based learning can improve mathematical reasoning and communication skills. This research is supported by the research results of Widiatmika, et al, (2019) and also Nufus et al, (2021) which show the same thing that the application of the problem solving approach has an effect on improving mathematical communication skills. In addition, this problem solving approach also affects the affective enhancement of students including student learning independence. Wijayanti & Wardono, (2020) explained that the application of a problem-solving based learning approach can increase student learning independence. This is in line with the results of research by Mulyana, Supyan & Zhanty, (2019) and Panjaitan, Mansyur, & Syahputra (2023) which show the same thing.

Therefore, the researcher is interested in conducting a study which has the goal of developing teaching materials that can help students in learning online and offline with the title taken "Development of Teaching Materials for Sequence and Sequence Materials Using the Problem-Solving Approach Assisted by the Canva Video Application to Improve Ability of Mathematical Communication and Learning Independence for Vocational High School Students."

METHOD

This study aims to develop a product in the form of innovative teaching materials that can assist students in learning in class and to improve mathematical communication skills and learning independence in student learning in the material of Sequences and Series for class X students. The method used in this research is the Research and Development method (Research and Development). (R&D) or research and development. That is a method that aims to make a particular product and test the effectiveness of the product. Where in this study the product developed was in the form of teaching materials. This is of course consistent with what Borg and Gall, (1983) stated that the research and development method is a process for developing and validating an educational product. The stages or phases of developing teaching materials taken in this study are the Plomp model with five phases as follows: preliminary investigation phase, design phase, realization/construction phase, test

phase, evaluation and revision (test, evaluation and revision), and implementation (Plomp, 1997).

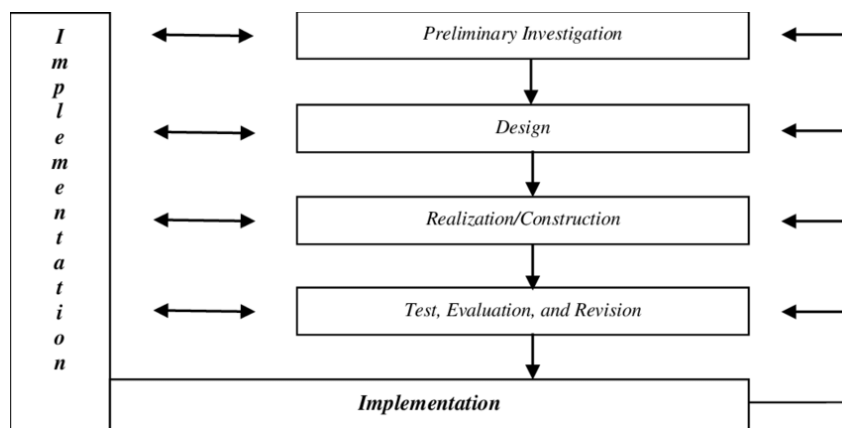


Figure 1. Flowchart of RnD Method (Mulyana & Gunadi, 2018)

The research instrument used was a teaching material validation test instrument, a student mathematical communication ability test instrument and a non-test instrument for student learning independence. The teaching materials validation test instrument was given to two experts, namely materials experts and ICT experts with the aim of testing the validity of the developed teaching materials. As for the students' mathematical communication ability test instrument and the non-student learning independence test instrument, they were tested on Al-IHSAN Batujajar Vocational High School students with a total of 60 students divided into 30 students of class X multimedia (MM) as the Experiment class and 30 students of class X device engineering. software (RPL) as Control class.

RESULTS AND DISCUSSION

Results

The process of developing this teaching material aims to develop teaching materials on Sequences and Series material using the Problem-Solving approach assisted by the Canva video application with 5 phases of developing the Plomp model. In the first stage of development the initial implementation phase. Researchers collect various kinds of information related to the teaching materials to be developed, starting from literature studies to interviews. The purpose of this activity is to collect various kinds of information related to teaching materials that will be developed and to analyze the needs that exist in each learning activity.

After the researcher formulates the information previously obtained then enters the design stage. At this stage the researcher begins to design the initial design of the teaching materials, begins to determine the targets of the teaching materials, development goals, establishes development procedures and so on. After obtaining a design that is felt to be in accordance with the needs, then in this phase the product will be developed in the form of a design that is felt to be in accordance with the needs, then in this phase the product will be developed. By involving 2 experts in their fields, namely ICT experts and material experts. And the following are the results of the validity test of the teaching materials being developed:

Table 1. Teaching Material Validation Results

Validators	Validation Results
ICT Expert	87,41 %
Material Expert	87,63 %

From the results of the validation test from the experts, the average percentage value given by ICT experts was 87.41%. Whereas the validation results from material experts have an average percentage value of 87.63% with the same interpretation which is very feasible. So, it can be concluded that the teaching materials developed can be tested in the next phase, namely the test, evaluation, and revision phases. In this phase, the teaching material products developed are tested to assess the legibility of the developed teaching materials, the feasibility of the design, and the effectiveness of the teaching materials through two stages of testing, namely limited trials, and extensive trials. And we can see the results of the testing of teaching materials as follows:

Table 2. Readability of Teaching Materials

Trials	Average Percentage
Limit Test	73,00%
Extensive Test	74,66%

Teaching materials that have been tested, whether limited trials or extensive trials, will be analyzed and evaluated to correct weaknesses that are felt to still exist in the teaching materials, so that appropriate and feasible teaching materials are obtained for implementation. After going through the test, evaluation and revision stages, the final product is obtained which is feasible to be applied in learning or implemented.

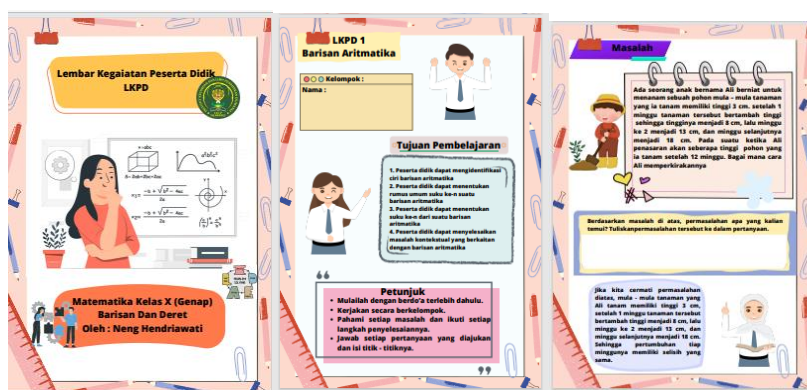


Figure 2. Instructional Material Design

At this implementation stage, teaching materials began to be tested on students in learning activities in class. After the implementation of the teaching materials is completed and it is felt that there is still something that needs to be improved because weaknesses are found in the teaching materials being developed, the teaching materials enter the final revision stage first before being socialized more broadly. And if it is deemed appropriate and there are no more things that need to be corrected, teaching materials for sequences and series using the Problem-Solving approach assisted by the Canva video application can be socialized more broadly. It can be through MGMP activities, seminars, journal publications and so on.

Mathematical Communication Skills

The results of the research related to students' mathematical communication abilities were obtained from the results of the pre-test, post-test and Gain analysis which were given to class X students at Al-IHSAN Batujajar Vocational School which were divided into two classes, namely the experimental class and the control class. In the experimental class, learning took place using teaching material products that were developed, namely using Teaching Materials on Sequences and Series Materials Using the Canva Video Application Assisted Problem Solving Approach while for the control class using ordinary learning.

The purpose of this test is to find out how the improvement and the differences in students' mathematical communication abilities after learning in both classes. And the following are the results of calculating descriptive data with the help of Microsoft Excel and IBM SPSS Statistics 25 which can be briefly seen in table 3.

Table 3. Descriptive Statistical Data Mathematical Communication Ability Test

Variable	Statistic	Experiment class			control class		
		Pretest	Posttest	N-gain	Pretest	Posttest	N-gain
Mathematical Communication Ability	N	30			30		
	Mean	2,63	18,43	0,42	2,90	14,23	0,31
	St. Dev	1,129	6,694	0,174	1,561	4,717	0,121
	%	7%	45%		7%	36%	

Students' initial mathematical communication skills when viewed from the average value of the experimental and control class pretests are still relatively low, namely for the experimental class 2.63 and the control class 2.90. Thus, there is no significant difference in the mathematical communication abilities of the two classes. As for the results of the post-test test after learning in the two classes with different treatments, it was found that the average value of the two classes increased, namely the experimental class was 18.48 and the control class was 14.23. With the most significant increase in the experimental class compared to the control class.

Likewise with the results of the N-Gain test that the mathematical communication skills of the experimental class students experienced a significant increase compared to the experimental class. So, it can be concluded that the mathematical communication abilities of experimental class students whose learning used Teaching Materials on Sequences and Series Materials Using the Canva Video Application Assisted Problem Solving Approach were better and had a more significant increase compared to the control class whose learning used ordinary learning.

Student Learning Independence

Learning independence is one of the non-test aspects tested in this study. The data was obtained from the results of filling out a non-test of learning independence given to the experimental class and control class with the aim of knowing student learning independence in learning mathematics. As well as to find out how is there an increase in student learning independence in learning. The following is the data from the results of the student learning independence questionnaire data analysis which can be seen in table 4:

Table 4. Student Learning Independence Scale Results

Class	N	Statistics	
Experiment class	30	Mean	83,90
		St Dev	9,125
Control class	30	Mean	80,77
		St Dev	7,417

If we look at table 4, it is found that student learning independence in the experimental class is better than the control class. Where for the experimental class learning takes place using the Problem-Solving Approach Assisted by the Canva Video Application, while the control class uses an ordinary learning approach. We can see this in the average value and standard

deviation of the experimental class which is higher than the control class. Namely, 9.125 for the experimental class and 80.77 for the control class.

Discussions

The development of this teaching material uses the five phases of the Plomp model development, namely the preliminary investigation phase, the design phase, the realization/construction phase, the test phase, evaluation and revision, and implementation (Plomp, 1997). In the early stages of development, researchers collected various kinds of information both through literature studies, interviews, and others beforehand. With the aim of analyzing potentials and problems as well as needs prior to development. In line with what Kamal, (2020) said, the development of teaching materials is based on a needs analysis based on the potential problems that exist.

After carrying out an analysis of the potential and problems as well as needs, the initial design of the teaching materials that will be developed begins. By first determining the goals of development, targets or participants of product development, development procedures and so on. The initial design made is a rough design that must first go through the stages of refinement through validation, evaluation, and revision activities. The purpose of this activity is to test the feasibility of the teaching materials to be made. As stated by Masithah, Jufri & Ramdani, (2022) that the purpose of validating teaching materials is to produce teaching materials that are valid and also feasible to find out the weaknesses and deficiencies of the teaching materials being developed.

Through the validation stage of teaching materials, the effectiveness and suitability of the content will be assessed. Besides that, the purpose of this activity is to test the feasibility of the teaching materials made. The validation test on this teaching material involved two experts, namely ICT experts and materials experts, each of whom gave their assessment of the teaching materials made. From the results of the validation test given by ICT experts, the average value was 87.41, while the validation results from material experts were 87.63 with the same interpretation, which is very feasible.

After being tested for validity and revised based on input and findings from experts, the teaching materials are then tested on field trials, where the field trials, themselves aim to test the legibility, feasibility and effectiveness of the teaching materials developed during learning based on facts found in the field. The next stage is field trials conducted in the test, evaluation, and revision phases. In this stage the teaching materials developed will be tested in the field in learning activities. As stated by Kamal, (2020) that field trials are activities for applying teaching materials made in learning activities in class. And in this field trial activity is divided into two stages, namely limited trials, and extensive trials.

Based on the results of the analysis carried out on the limited and broad test data obtained from filling out the questionnaire, it was found that the teaching materials developed had a good level of effectiveness. This is shown from the percentage value of the results of the questionnaire data analysis, namely 73% for the limited test and 74.66% for the wide test. Teaching materials that have been tested in the field are then evaluated and revised again if it is felt that there are still things that need to be improved so that the teaching materials made get better results.

Finally, in this implementation phase, the developed teaching materials begin to be applied in actual learning and socialized to a wider scope. Where in this phase the teaching materials that are implemented are finished teaching materials that are feasible to use. The socialization of teaching materials can be done through local MGMP activities, group MGMPs, seminars, journal publications and so on.

Mathematical Communication Skills

In learning mathematics, communication skills are one of the most important abilities to master. This is in line with the statement of Ariawan & Nufus, (2017) which stated that mathematical communication ability is very important. In addition, by mastering these communication skills, students will find it easier to solve problems. As stated by Ariawan & Nufus, (2017) that there is a significant relationship between problem solving abilities and students' mathematical communication abilities.

Therefore, an analysis was carried out on the data from the pre-test, post-test, and N-Gain test results to determine the increase and achievement of students' mathematical communication skills between the experimental class and the control class. The pretest itself was carried out before the two classes were given different treatment where the learning experimental class took place using teaching materials on sequences and series material using a problem-solving approach assisted by the Canva video application while the control class used ordinary learning which was often carried out by the class teacher.

From the results of statistical tests on pre-test data, it was found that there was no significant difference in the students' mathematical communication skills between the experimental class and the control class. This can be seen from the standard deviation values of the two classes where the experimental class is 1.129 and the control class is 1.561. After that each class was given learning using different treatments for 7 days the learning experiment class took place using teaching materials on row and series material using a problem-solving approach assisted by the Canva video application while the control class used ordinary learning to find out the effectiveness of teaching materials made in improving abilities students' mathematical communication.

After the learning took place, students from both classes were given a post-test to find out the improvement and achievement of students' mathematical communication skills from both classes. And from the results of the statistical test analysis of the post-test data, it was found that the mathematical communication abilities of the experimental class students whose learning used the problem-solving approach assisted by the Canva video application experienced an increase and better achievement compared to the experimental class. This can be seen in table 3, the standard deviation values for the post-test and pre-test results for the experimental class experienced a much better increase compared to the control class. That is, 6.694 for the posttest and 0.174 for the N-Gain in the experimental class while the control class is 4.717 for the posttest and 0.121 for the N-Gain.

Thus, we can conclude that the improvement and achievement of communication skills in the experimental class is better than the control class. This is in line with the results of research conducted by Hodiyanto, (2017) dan Oktaviani, Praja, & Asnawati (2019), which addressed the same thing. That communication skills experience a significant increase when learning takes place using a problem-solving approach.

Student Learning Independence

Student learning independence is an attitude that students are aware of in participating in learning without any coercion from the surrounding environment. As stated by Mashuri, (2016) which explains that student learning independence is a reflection of a creative attitude, responsibility and learning initiative and the desire to gain a new experience. Of course, this independent learning has good benefits for students. Therefore, efforts are made to increase learning independence through classroom learning by involving various learning approaches and learning models.

And in this study the learning approach used was a problem-solving approach assisted by the Canva video application which was applied to the experimental class while the control class used ordinary learning. To measure student learning independence is done by filling out a non-learning independence questionnaire which will later be analyzed through statistical tests given to the two.

From the results of the questionnaire analysis related to learning independence, it was found that the learning independence of the experimental class students experienced a more significant increase compared to the control. Thus, it can be concluded that the learning independence of students whose learning uses the problem-solving approach assisted by the Canva video application is better than ordinary learning. This is supported by the research results of Mulyana, Supyan & Zhanty, (2019) dan Panjaitan, Mansyur, & Syahputra (2023) which point to the same thing that students who get learning practice through a problem solving approach experience a more significant increase in learning independence.

CONCLUSION

Based on the results of the previous research and discussion, we can conclude that the teaching materials developed show very valid results based on the assessment of ICT experts and material experts and based on student responses, the teaching materials are feasible to use and receive very practical criteria. Besides that, based on the analysis of the post-test data that was carried out, the increase in communication skills and independence towards student learning in the experimental class was more significant than the control class. Where the experimental class learning takes place using mathematics teaching materials based on a problem solving approach assisted by the Canva video application while the control class uses ordinary learning.

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