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Improving Creative Thinking Ability through Innovation of Textbook with Challenge based on STEM Context Learning assisted by Nearpod

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ABSTRACT

Kemampuan berpikir kreatif wajib dikuasai siswa guna menghadapi tantangan pembelajaran di abad 21. Namun, kemampuan berpikir kreatif siswa di salah satu SMP Negeri di Banyumas masih tergolong rendah (43,85). Tujuan dari penelitian ini adalah untuk mengembangkan buku ajar terintegrasi Challenge based on STEM Context Learning berbantuan Nearpod yang layak, mudah dipahami, efektif dalam meningkatkan kemampuan berpikir kreatif, dan memiliki respons positif dari peserta didik. Penelitian dan pengembangan model 4D telah terlaksana dengan sampel yang terdiri dari dua kelompok yaitu kelas VIII G sebagai kelompok eksperimen dan kelas VIII F sebagai kelompok kontrol. Data dikumpulkan melalui wawancara, angket, dan tes. Selanjutnya, data dianalisis secara deskriptif kualitatif dan kuantitatif. Hasil penelitian ini menunjukkan bahwa buku ajar terintegrasi Challenge based on STEM Context Learning berbantuan Nearpod mendapatkan rata-rata persentase kelayakan sebesar 93,67% dengan kriteria sangat layak, mendapatkan rata-rata persentase keterbacaan sebesar 95% dengan kriteria mudah dipahami, efektif meningkatkan kemampuan berpikir kreatif siswa, serta mendapatkan respons siswa sangat baik dengan rata-rata persentase sebesar 90,42%. Dengan demikian, buku ajar terintegrasi Challenge based on STEM Context Learning berbantuan Nearpod dapat digunakan sebagai salah satu sumber belajar yang mampu meningkatkan kemampuan berpikir kreatif siswa pada pembelajaran matematika khususnya materi SPLDV Kelas VIII.

Students must master creative thinking ability in order to face the challenges of learning in the 21st century. However, students' creative thinking abilities at a Public Junior High School in Banyumas are still relatively low (43.85). The aim of this research is to develop a textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod that is feasible, easy to understand, effective in improving creative thinking ability, and has a positive response from students. Research and development with the 4D model has been carried out with a sample consisting of two groups, namely class VIII G as the experimental group and class VIII F as the control group. Data was collected through interviews, questionnaires, and tests. Data was analyzed descriptively qualitatively and quantitatively. The results showed that the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod obtained a feasibility percentage of 93.67% with very feasible criteria, obtained a readability percentage of 95% with easy to understand criteria, effectively improving students creative thinking ability, and obtained very good student responses with percentage of 90.42%. Thus, the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod can be used as a learning resource that is able to improve students' creative thinking abilities in mathematics learning, especially for material on systems of linear equations in two variables.

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INTRODUCTION

The era of industrial revolution 4.0 means that technological developments are increasingly rapid, requiring human resources who can adapt to all the changes that occur. Producing quality human resources to encourage the nation's competitiveness can be done by preparing innovative learning and increasing the competency of graduates who have 21st century skills (Zubaidah, 2018). In line with this, one of the abilities that students must master in order to face the challenges of learning in the 21st century is the ability to think creatively (Dewi & Simanjuntak, 2019). Mathematics and the ability to think creatively are two things that are interrelated because mathematics develops based on creative thoughts (Pehkonen, 1997). Apart from that, students need creative thinking ability to solve non-routine problems. Students who have the ability to think creatively always have a high curiosity, desire to try, and generate new ideas or concepts in finding solutions that can later be used to solve non-routine problems in mathematics learning (Fairazatunnisa, Dwirahayu & Musyrifah, 2021).

Based on the results of a preliminary study at Public Junior High School in Banyumas, students' creative thinking abilities in solving mathematics problems are still relatively low. This is supported by the results of the initial creative thinking ability test which contains three indicators, namely fluency, flexibility and novelty which were tested in two class VIIIs. The average score obtained from the two classes was 43.85. The limited availability of mathematics learning resources at Public Junior High School in Banyumas makes students feel that they lack material references so that their interest in learning decreases. The mathematics teacher also said that the questions in textbooks and those given during learning still did not direct students to creative thinking ability.

One learning resource that can be developed as an effort to overcome this problem is textbooks. Textbooks can be interpreted as a collection of learning materials that are arranged systematically and aimed at specific learning targets and processes and direct students to achieve a competency (Magdalena et al., 2020). In developing textbooks, it is necessary to review feasibility, readability, effectiveness, and positive responses from students. This is a study in research so that it can solve problems related to students' low creative thinking abilities.

The textbook innovation that will be developed implements a learning model that supports students' creative thinking abilities, namely the Challenge Based Learning (CBL) model. This is in accordance with the statement that CBL is a learning model that can improve students' creative thinking abilities and self-confidence in solving problems (Nufus, Duskri & Bahrun, 2018). The syntax contained in CBL will provide opportunities for students to practice developing their creative thinking abilities through new ideas in solving challenges. Several previous studies related to the implementation of CBL on students' creative thinking abilities support this research, such as Ardiansyah, Junaedi, & Asikin (2018), Ardiansyah & Asikin (2020), Ardianyah & Junaedi (2020), and Ardiansyah, et al. (2022).

Another innovation implemented in this teaching material is STEM Context. STEM Context is a combination of STEM Education and Word Problems (Ardiansyah & Asikin, 2023). STEM Context can also be interpreted as a learning innovation which presents questions that are appropriate to students' experiences and related to the four disciplines, namely Science, Technology, Engineering and Mathematics. By providing problems that integrate STEM Context into teaching materials, students' creative thinking abilities can be honed optimally because students do not only focus on solving mathematical problems but can use other knowledge contained in STEM (Vistara et al., 2022). The implementation of STEM in textbooks will provide meaningful learning through learning experiences where students seem to be problem solvers for the challenges given during the learning process. Several

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studies show the positive impact of implementing STEM Context on creative thinking abilities, such as Pinasa, Siripun & Yuenyong (2018), Shukri, Ahmad & Daud (2020), and Khalil, et al., (2023).

The application of Information and Communication Technology (ICT) media in learning can have a good impact on memory because there is a process of involving students' emotions which stimulates students' brain nerves to easily remember the material (Wungguli & Yahya, 2020). The application of ICT in this textbook is the nearpod application, which is interactive learning media that can be accessed via electronic devices such as cell phones or PCs. Through several activities in the textbook that use the nearpod application, it is hoped that this can be an innovation that will have a positive impact on improving students' creative thinking abilities. The implementation of nearpod in learning has been noted to have a positive influence on creative thinking abilities as mentioned by Siswati, et al. (2023).

The main problem in this research is the imbalance between the importance of developing creative thinking abilities and the fact that students' creative thinking abilities are still low. There is a need to innovate on this problem by developing a textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod. Literature review shows positive things about the ability to think creatively regarding the development and implementation of these products. Thus, this research aims to develop a textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod that is feasible, easy to understand, effective in improving creative thinking ability, and has a positive response to students.

METHOD

Considering the aim of the research, research and development was carried out with a focus on producing products and testing the effectiveness of these products, this is in line with the opinion (Sugiyono, 2022). This research uses the 4D model developed by Thiagarajan, Semmel & Semmel (1974). The 4D model consists of four stages, namely: Define, Design, Develop, and Disseminate. The flow of the 4D stages can be seen in Figure 1.

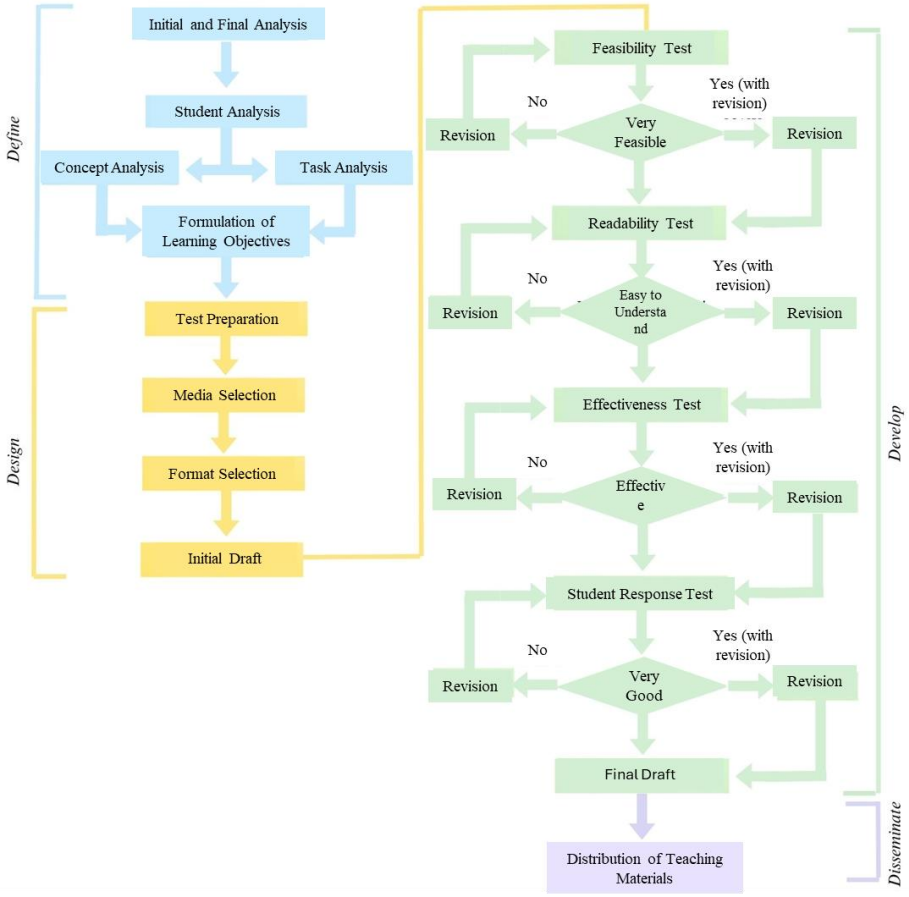

Figure 1. The 4D Stage Flow

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Research with a pretest-posttest control group design was carried out at a Public Junior High School in Banyumas Regency, Central Java from October 18th 2023 to November 9th 2023. As is known, the population of this study was 8th grade student at this school with samples taken randomly namely class VIII G as the experimental group and class VIII F as the control group. The research design can be seen in Table 1.

Table 1. Pretest-Posttest Control Group Design

Sample	Pretest	Intervention	Posttest
R	O_1	X_1	O_2
R	O_3	X_2	O_4

Information:
R = Random Sampling
X_1 = Implementation of product (experimental group)
X_2 = Implementation of collaborative learning (control group)
O_1 = Pretest for experimental group
O_2 = Posttest for experimental group
O_3 = Pretest for control group
O_4 = Posttest for control group

Data collection techniques in this research used interviews, questionnaires and tests. Interviews were conducted to obtain data regarding problems and analysis of the mathematics learning system at Public Junior High School in Banyumas through resource persons, namely the mathematics teacher and several students. The questionnaires used in the research were a feasibility test questionnaire (to obtain a suitable textbook), a readability test questionnaire (to obtain a textbook that was easy to understand), and a student response questionnaire (to obtain a textbook that had a positive response). The tests given are in the form of pretests and posttests to measure students' creative thinking abilities.

The data analysis technique in this research uses qualitative and quantitative descriptive techniques. Qualitative data analysis comes from the results of teacher and student interviews which are used as a reference in the process of developing teaching materials tailored to student needs. Quantitative data analysis is used to analyze data collected from assessing the suitability of textbooks, assessing the readability of textbooks, and assessing student responses. The score used refers to a Likert scale with details of score 1 (Very Not Good), score 2 (Not Good), score 3 (Good), and score 4 (Very Good) (Sugiyono, 2022). The guidelines for calculating the score percentage are as follows.

$$P = \frac{total\ score}{maximum\ score} \times 100\%$$

where P is the score percentage (Arifin, 2013).

The feasibility analysis of textbooks focuses on the achievement of content feasibility aspects, presentation feasibility aspects, language aspects, and product innovation aspects as mentioned by the BSNP (2006). The feasibility assessment is carried out by experts, namely mathematics or mathematics education lecturers and practitioners, namely mathematics teachers. The results of the assessment are then represented based on the categories proposed by Ardiansyah & Pratama (2021) as presented in Table 2. Based on these criteria, a product is said to be feasible if it obtains at least the Very Feasible criteria with a minimum percentage of 85%. Thus, if the product does not reach these criteria, it must be corrected and reassessed by experts and practitioners.

Next, an assessment of readability is carried out by students. The readability assessment aspect refers to Ardiansyah, Ferianto & Dinasari (2021). The results of the assessment are then represented in accordance with the readability criteria as stated by Ardiansyah & Pratama (2021) as presented in Table 3 Based on these results, a product is said to be easy to understand if it at least obtains easy to understand criteria or obtains a minimum score of 85%. If it does not meet these conditions, it must be corrected and reassessed.

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Table 2. Criteria for Textbook Feasibility Levels

Score Percentage	Criteria
$1\% < P \leq 50\%$	Not Feasible
$50\% < P \leq 70\%$	Quite Feasible
$70\% < P \leq 85\%$	Feasible
$85\% < P \leq 100\%$	Very Feasible

Table 3. Criteria for Textbook Readability Levels

Score Percentage	Criteria
$1\% < P \leq 50\%$	Elusive
$50\% < P \leq 70\%$	Hard to understand
$70\% < P \leq 85\%$	Quite easy to understand
$85\% < P \leq 100\%$	Easy to understand

The results of the feasibility and readability assessments are used as products that are ready to be implemented in the classroom. Next, an effectiveness test is carried out by considering students' achievement of completeness, a comparison test between the experimental and control groups, and an improvement test. The research hypotheses and statistical tests used in this research are presented in Table 4.

Table 4. Research Hypothesis and Statistical Test

Research Hypothesis	Statistical Test
Average Completion of Creative Thinking Ability (Min 78)	One Sample t-Test
Proportions Completion of Creative Thinking Ability (Min 75%)	One Sample z-Test
Improvement of Creative Thinking Ability	Paired Sample t-Test
Average Difference of Creative Thinking Ability	Independent Sample t-Test
Proportions Difference of Creative Thinking Ability	Independent Sample z-Test
Improvement Difference of Creative Thinking Ability	Independent Sample t-Test

In addition to effectiveness testing, after implementing the product, student responses are assessed. The criteria used in this student response refer to Sugianto et al. (2018) which is presented in Table 5. Based on these criteria, a product is said to have a positive response if it obtains at least very good criteria or at least obtains a percentage of 85%. If it does not meet these criteria, it must be corrected and reassessed.

Table 5. Criteria for Student Responses

Score Percentage	Criteria
$1\% < P \leq 50\%$	Very Not Good
$50\% < P \leq 70\%$	Not Good
$70\% < P \leq 85\%$	Good
$85\% < P \leq 100\%$	Very Good

This research developed a textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod for aimed at 8^{th} grade students in the Kurikulum Merdeka. The results of this research include the results of the textbook development process, the results of the feasibility test of the textbook, the results of the readability test of the textbook, the results of the effectiveness test of the textbook, and the results of the student response test to the textbook. The textbook was developed based on the 4D model stages, namely define, design, develop, and disseminate which are described as follows.

The define stage is the stage of front-end analysis and learner analysis to find out the information needed for the initial design of developing teaching materials. This stage begins with analyzing obstacles or problems to determine and define learning requirements (Iskandar & Raditya, 2017). Analysis of the problems at Public Junior High School in Banyumas was carried out with a preliminary study. Based on the existing problems, it is necessary to develop innovative teaching materials, namely textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod. The book discusses the

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material on Systems of Linear Equations in Two Variables and integrates indicators of creative thinking abilities.

Content analysis, task analysis, and specifying learning objectives are also activities at the define stage. The material that will be developed is two-variable linear equation systems for class VIII students. The results of review of the Kurikulum Merdeka revealed that the material was in accordance with the learning outcomes in phase D for junior high school students. Based on this analysis, the material was adapted to indicators of creative thinking abilities as a task analysis activity. The results of the matching will be used in developing learning objectives. The description of learning outcomes in learning objectives by taking into account the material and indicators of creative thinking abilities is presented in Table 6.

Table 6. Learning Objectives Developed in this Research

Learning Outcomes	Students can solve Systems of Linear Equations in Two Variables through several ways of solving problems.
Learning objectives	Through integrated learning with Challenge Based on STEM Context Learning assisted by Nearpod, it is hoped that students will be able to 1. analyze the concept of a system of linear equations in two variables correctly, and 2. think creatively in solving contextual problems related to systems of linear equations in two variables using graphic methods, substitution methods, elimination methods, and other methods.

The design stage is the stage for designing a textbook prototype after collecting information related to problems and learning objectives in the previous stage (Iskandar & Raditya, 2017). This stage consists of preparing the test, selecting media, selecting format, and initial draft. The tests are prepared by taking into account the learning objectives that have been developed and indicators of creative thinking abilities. The results of the test preparation are presented in Figure 2. Next, the textbook was developed taking into account the preparation of the book based on the BSNP (2006). The final result of this stage is the production of a prototype of the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod.

Instrument 1

Mr. Dandi plans to build a garden in front of his rectangular house. He needs the help of an architect to design the garden so that it is nicer and more organized. Before going to the renovation stage, the architect measured the land first. From the measurement results, the perimeter of the land is 44 m. If the width is 6 m shorter than the length, then find the length and width of the land to be made into a garden!

Instrument 2

Recycling is the process of reusing materials into more useful products. Some of the benefits of recycling are: reducing plastic waste and reducing environmental damage. A community last month collected 1,650 kg of used plastic bottles and straws for recycling. This month, the number of plastic bottles increased by 10% and straws increased by 20% compared to last month, both 210 kg more.

a) How much did each plastic bottle and straw weigh last month?
b) Find as many different solutions as possible that are different from the previous one!

Figure 2. Test Instruments in Textbooks

Figure 2 is an example of the test instruments available in textbooks. This instrument has been adapted to learning objectives, STEM Context, and indicators of creative thinking abilities. For instrument 1, students are asked to solve problems with the correct answer (achievement of fluency indicators), while for instrument 2, students are asked to determine as many different ways of solving as possible (achievement of flexible indicators) so that students can achieve good creative thinking ability. The appropriate STEM context is the context related to recycling activities as saving the environment which is closely related to the Scene context. Integrating STEM Context provides learning experiences for students to be able to solve contextual problems meaningfully thereby developing

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several students' mathematical abilities including the creative thinking ability (Arivina & Jailani, 2020; Arifin, Pujiastuti, & Sudiana, 2020; Ardiansyah & Asikin, 2023).

The next stage is the develop stage where the prototype that has been prepared is tested for feasibility, readability, effectiveness and student response. The feasibility assessment was carried out by several experts (lecturers in mathematics education) and practitioners (mathematics teachers at schools) to ensure that the product that had been developed was suitable for implementation. Readability assessments are carried out by students who have received the material to ensure that the product being developed is easy to understand. Effectiveness testing is carried out after product implementation to ensure that the results of product implementation reach predetermined effectiveness indicators. Assessment of student responses is carried out on students who gain learning experience with the product being developed to find out what students' responses and perspectives are after implementing the product. This integrated activity ensures that the product being developed is ready to be disseminated on a large scale.

The feasibility assessment was carried out by five lecturers in mathematics education (A) and six junior high school mathematics teachers (P). Table 8 shows a recapitulation of the results of the feasibility assessment of the textbook. Based on Table 5, the average feasibility percentage is 93.67% with very feasible criteria, meaning that the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod can be implemented in learning.

Table 8. Recapitulation of Feasibility Test Results

Penilai	**Feasibility Test Results (%)**				**Score**
	Contents	**Presentation**	**Linguistic**	**Learning Innovation**	
A01	96	95	100	100	97,13
A02	94	95	92,86	100	94,67
A03	98	100	94,64	100	97
A04	93	95	96,43	85,71	93,44
A05	87	86,67	94,64	82,14	88,11
P01	98	93,33	100	100	97,54
P02	96	95	92,86	92,86	94,67
P03	100	95	89,29	89,29	95
P04	92	95	91,07	92,86	92,62
P05	91	91,67	91,07	92,86	91,39
P06	86	90	94,64	85,71	88,9
Mean	93,72	93,78	94,31	92,85	93,67

These results show that developing textbooks that pay attention to the guidelines for preparing textbooks by the BSNP (2006) will provide certainty of product suitability. From the content feasibility aspect, it appears that the product received a final score of 93.72% which is categorized as Very Feasible. These results indicate that the product has achieved learning outcomes, learning objectives, as well as accuracy, breadth and depth of material content, definitions, principles, facts and data. The results of the presentation feasibility assessment showed that the final result was 93.87% categorized as Very Feasible. Certainty regarding product presentation starting from the attractiveness of the title page and the entire textbook, the completeness of the textbook starting from the Opening, Contents and Closing sections has been presented well. The assessment results for the linguistic aspect also showed the same results with a final score of 94.31% in the Very Feasible category. The product developed pays attention to aspects of writing in Indonesian, adapting the language for students, and writing good and correct mathematical sentences. The learning innovation aspect which consists of assessing innovation and achievement of creative thinking ability indicators also received assessment results in the Very Feasible category with a final score of 92.85%. These results show that the innovative product developed has adapted to the needs of mathematics learning problems, and achieved learning achievements in creative thinking abilities. In general, based on the results of this feasibility assessment, the product is ready to be implemented in the classroom.

After the feasibility assessment, a readability assessment was carried out by 32 students from 9th grade at a Public Junior High School in Banyumas. Figure 3 shows the results of the readability

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assessment of textbooks. Based on this image, information was obtained that all students gave a final readability assessment score of more than 85%. Furthermore, if calculated using descriptive statistics, an average readability assessment result of 95% is obtained with criteria that are easy to understand. Thus, students agreed to state that the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod was Easy to Understand.

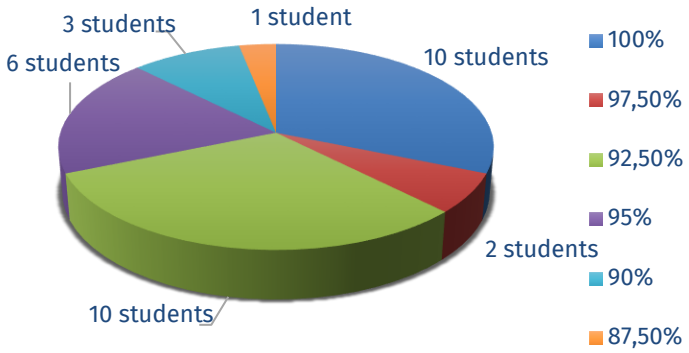

Figure 3. Readability Test Results

Readability assessment ensures that the product developed is easy to understand for students (Ardiansyah, Ferianto & Dinasari, 2021). Assessment of linguistic aspects, editing aspects such as fonts style & fonts size, line space, typography, and graphic aspects are points in this assessment. The attractiveness of the product was also assessed whether it was appropriate to the user's age, writing style, density of information, and systematic presentation were also assessed by students. By ensuring that the product meets these aspects, it is hoped that it will make it easier for students to study well.

Implementation activities are the next activity in the develop stage. This is in line with the statement that this development stage is the implementation stage of the product planning that was carried out at the previous stage and aims to produce a final draft (Iskandar & Raditya, 2017). Product implementation was carried out over 4 meetings in accordance with the learning objectives presented in Table 6. Before and after implementation, students took a pretest and posttest. Then, the test results are analyzed to ensure product implementation has been effective. The effectiveness indicators in this research consist of (1) average completion achievement, (2) proportion completion achievement, (3) increase in creative thinking ability, (4) average difference in creative thinking ability, (5) difference in proportion of creative thinking ability, and (6) different improvements in creative thinking ability.

Table 9. Statistical Test Results for Average Completion Achievement

n	μ	s	$\bar{x}$	dk	t_{stat}	t_{count}
36	78	5.96	84.60	35	1.69	6.64

Analysis of average completion achievement is carried out to ensure that the results of product implementation reach certain provisions called Minimum Completeness Criteria (KKM). Product implementation is expected to achieve an average posttest score of at least 78. One sample t test was carried out to test this hypothesis with the following conditions: $t_{count} > t_{stat}$. Table 9 presents the results of statistical calculations for the analysis of average completion achievement. Based on these results, the average of product implementation was 84.60. It is clear, that the average is more than the minimum expected score, namely 78. Furthermore, it is obtained $t_{count} = 6.64 > 1.69 = t_{stat}$, so it can be concluded that the average product implementation is significantly more than 78. Thus, it can be concluded that product implementation has achieved significant completion on average.

Table 10. Statistical Test Results for Achieving Complete Proportions

n	π	p	z_{stat}	z
36	75%	94%	1.65	2.69

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Proportion completion achievement analysis is carried out to ensure that the results of product implementation show the percentage of student success in achieving certain provisions. The expected proportion is 75% of students able to achieve certain requirements (minimum posttest result is 78). One sample z test was carried out to test this hypothesis with the conditions namely $z_{count} > z_{stat}$. Table 10 presents the results of statistical calculations for the analysis of proportion completion achievement. Based on these results, the percentage of students who met the requirements (minimum posttest result of 78) was 94%. It is clear, that the proportion obtained is more than the minimum expected percentage, namely 75%. Further, obtained $z_{count} = 2.69 > 1.65 = z_{stat}$, so it can be concluded that the percentage of students who meet certain conditions for product implementation is significantly more than 75%. Thus it can be concluded that product implementation has reached a significant proportion of completion.

Table 11. Statistical Test Results for Increasing Creative Thinking Ability

	$\bar{x}$	s	s_{tot}	t_{stat}	t_{count}
Pretest	37.62	63.97	6.18	1.67	35.25
Posttest	84.60	35.52			

Analysis of increasing creative thinking abilities is carried out to ensure that the results of product implementation can improve students' creative thinking abilities. The certainty of improvement is seen from the difference between posttest and pretest, where the posttest results must be more than the pretest. The paired sample t-test was carried out to test this hypothesis with the conditions namely $t_{count} > t_{stat}$. Table 11 presents the results of statistical calculations to improve creative thinking abilities. Based on these results, the pretest and posttest averages of product implementation were 37.62 and 84.60. It is clear, that the posttest average is more than the pretest average. Further, obtained $t_{count} = 32{,}25 > 1{,}67 = t_{stat}$, so it can be concluded that the posttest average is significantly more than the pretest average. Thus it can be concluded that product implementation is able to increase creative thinking abilities significantly.

Table 12. Statistical Test Results for Average Differences

	n	$\bar{x}$	s	s_{tot}	t_{stat}	t_{count}
Control Group	36	76,85	60,95	5,96	1,67	5,52
Experimental Group	36	84,60	35,52			

Mean difference analysis was carried out to ensure that the average results from product implementation (experimental group) were more than the average of the control group. A two-sample t test was carried out to test this hypothesis with conditions namely $t_{count} > t_{stat}$. Table 12 presents the results of statistical calculations for the average differences. Based on these results, the experimental group average was 84.60 while the control group average was 76.85. It is clear, that the average of the experimental group is more than the average of the control group. Further, obtained $t_{count} = 5{,}52 > 1{,}67 = t_{stat}$, so it can be concluded that the average creative thinking ability of students in the experimental group is significantly more than the average creative thinking ability of students in the control group.

Table 13. Statistical Test Results for Different Proportions

	n	x	p	z_{stat}	z_{count}
Control Group	36	17	47%	1,65	4,35
Experimental Group	36	34	94%		

Analysis of different proportions was carried out to ensure that the proportion of achieving the minimum score from the experimental group was more than the proportion achieving the minimum score of the control group. The minimum expected score is 78. A two-sample z test was carried out to test this hypothesis with conditions namely $z_{count} > z_{stat}$. Table 13 presents the results of statistical

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calculations for different proportions. Based on these results, it was obtained that the proportion achieving the minimum score for the experimental group was 94%, while the proportion achieving the minimum score for the control group was 47%. It is clear, that the proportion of achieving the minimum score of the experimental group is more than the proportion of achieving the minimum score of the control group. Further, obtained $z_{count} = 4{,}35 > 1{,}65 = z_{stat}$, so it can be concluded that the proportion achieving the minimum score for creative thinking ability in the experimental group is significantly more than the proportion achieving the minimum score for creative thinking ability in the control group.

Table 14. Statistical Test Results for Difference in Improvement

	n	$\bar{x}$	s	s_{tot}	t_{stat}	t_{count}
Control Group	36	0,67	0,0149	0,0014	1,67	255,58
Experimental Group	36	0,76	0,0073			

Analysis of differences in the increase in creative thinking abilities was carried out to ensure that the increase in the creative thinking abilities of the experimental group was more than the increase in the creative thinking abilities of the control group. Increasing of creative thinking abilities can be seen from the results of the N-Gain score. A two-sample t test was carried out to test this hypothesis with conditions namely $t_{count} > t_{stat}$. Table 14 presents the results of statistical calculations for differences in increasing of creative thinking abilities. Based on these results, the increase of creative thinking ability of the experimental group was 0.76, while the increase of creative thinking ability of the control group was 0.67. It is clear, that the increase of creative thinking ability of the experimental group was more than the increase of creative thinking ability of the control group. Further, obtained $t_{count} = 255{,}58 > 1{,}67 = t_{stat}$, so it can be concluded that the increase of creative thinking ability of the experimental group was significantly more than the increase of creative thinking ability of the control group.

The innovation of the Challenge based on STEM Context Learning model assisted by Nearpod is integrated in the development of teaching materials. This learning model is an innovation that integrates STEM Context in the Challenge based Learning model which is also combined with the application of Nearpod as a supporting learning media. The challenge context used in the Challenge based Learning model is integrated with STEM so as to provide meaningful learning. In simple terms, the implementation of this model includes providing a Big Idea that is integrated with STEM Context, asking essential questions based on that idea, delivering challenges that are integrated with STEM Context, providing guiding resources, guiding questions, and guiding activities that are integrated with STEM Context (specifically guiding activities will be linked in the Nearpod application), developing solutions to the task, presenting solution results, evaluating solutions, and self-reflection. Further information can be seen in Figure 4. This innovation will provide an invaluable learning experience for students.

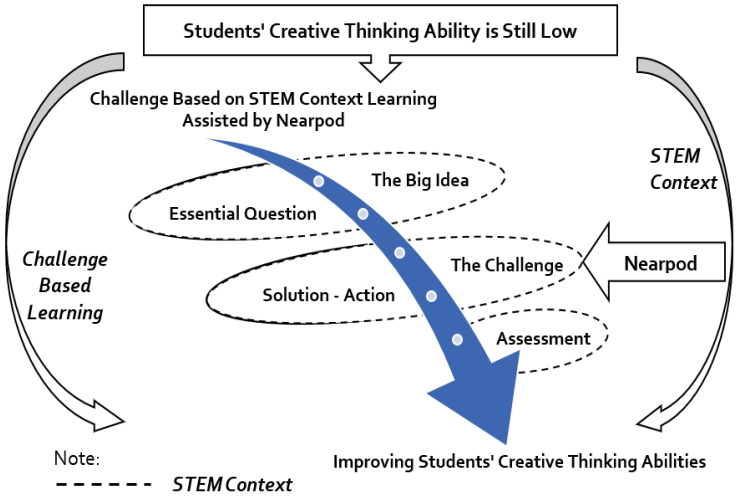

Figure 4. The Framework of Challenge based on STEM Context Learning Model assisted by Nearpod

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Figure 5. Learning Activities with Textbook Products

Creative thinking abilities can be developed through the implementation of textbook products. The Challenge based Learning model is the main focus in developing this product considering that this model provides collaborative learning opportunities for students to be able to develop creative ideas related to the challenges given (Ardiansyah, Junaedi & Asikin, 2018). Students are also given the freedom to be able to create their results as seen in Figure 4 which presents the creations of the challenges they completed. The conception provides validation that the implementation of products integrated with the CBL model can improve students' creative thinking abilities.

STEM Context integration also provides meaningful learning experiences for students. The contextual problem context built from the STEM Context will provide students with the opportunity to directly act as problem solvers in the challenges or evaluations given (Ardiansyah & Asikin, 2023). As presented in Figure 2, the problems given to students are not just ordinary problems, but problems that students have creative ideas to solve. The meaningfulness of learning is also presented by STEM Context where the context given is in accordance with what they have experienced and this concept is what they will use to develop ideas (new knowledge) in solving problems (Polman, Hornstra & Volman, 2021; Koskinen & Pitkäniemi, 2022).

Implementation of the Nearpod application provides interest in self-learning for students (Chairunnas, et al., 2022). It can be seen in Figure 4 that students are enthusiastic about using this media to complete the Guiding Activities that are being developed. In Guiding Activities, students are asked to carry out activities according to the guidance provided through the Neardpod application. There are several questions that can be solved together as a guide in achieving the expected learning objectives. Obviously, the questions developed have been adapted to indicators of creative thinking so that it is hoped that they can provide a good learning experience for students.

The results of product implementation show that students with the product intervention developed were able to achieve several achievements such as (1) average completion achievement, (2) proportion completion achievement, (3) increase in creative thinking ability, (4) average difference in creative thinking ability, (5) difference in proportion of creative thinking ability, and (6) different improvements in creative thinking ability. Thus, the implementation of the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod is effective in improving creative thinking abilities. This finding is not just a meaningless finding if there is no good preparation in product development and implementing learning using the product.

After learning using textbooks, students' responses are assessed. The student response questionnaire was filled in by 36 students from the experimental group. Figure 6 shows the results of student responses to the textbooks being developed. Based on these results, information was obtained that all students gave their final response score to the textbook more than 85%. Furthermore, if calculated using descriptive statistics, an average readability assessment result of 90.42% was obtained with Very Good criteria. Thus, students agreed to express a Very Good response to the implementation of the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod.

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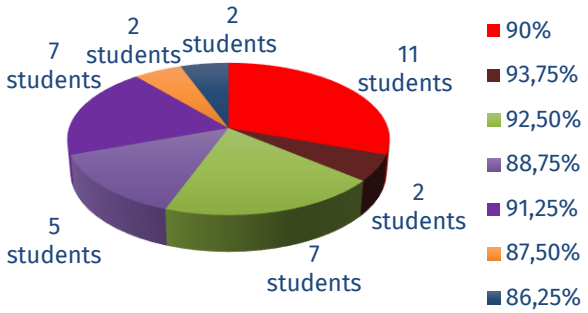

Figure 6. Results of Student Responses

Assessment of student responses ensures that the products developed are appropriate to student needs (Asikin, Nurhidayat & Ardiansyah, 2021). Assessment of aspects of the product's attractiveness, aspects of convenience, aspects of meeting needs, and aspects of adapting to student characteristics are assessed in this questionnaire. Students also convey their perceptions of the content developed in the teaching materials regarding its suitability for achieving learning success, learning motivation, curiosity and developing creative thinking abilities. By ensuring that the product meets these aspects, it is hoped that the product developed will be in accordance with student learning needs. So that it can be disseminated.

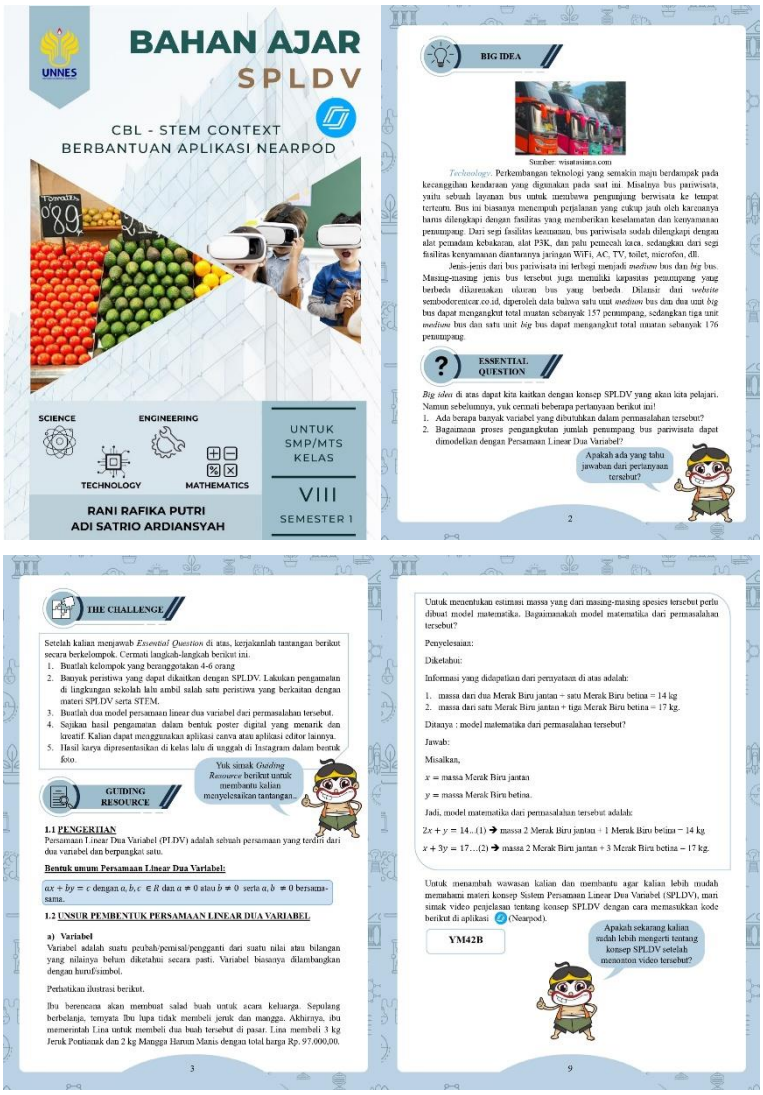

Figure 7. Textbook Display

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The final stage in 4D is disseminate. At this stage, improvements are made based on suggestions from the results of assessments of feasibility, readability, product implementation in class, and assessment of student responses. This activity is carried out before dissemination so that the product to be disseminated is the best product from this development activity. The textbook display is presented in Figure 6. Next, the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod is also submitted as Intellectual Property Rights (HKI). Apart from that, the textbooks that integrated Challenge based on STEM Context Learning assisted by Nearpod were distributed to mathematics teachers as research partners and several other schools through mathematics teacher groups in that area. By distributing it, textbook can be used as an innovative learning resource in junior high schools and as a reference for teachers when they want to create similar textbooks. The results of the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod are presented in Figure 7.

As stated in the background section, students' creative thinking abilities in Indonesia are still relatively low, so innovative textbook innovation is needed to solve this problem. The innovation of the textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod has been developed taking into account the provisions as stated by the BSNP (2006). It appears that the development results have achieved product feasibility with Very Feasible criteria. Furthermore, the product developed also ensures ease of use by paying attention to several aspects presented by Ardiansyah, Junaedi, & Wafirah (2023). It also appears that the results of product development also achieve product readability with the Easy to Understand criteria. Assurance of suitability and readability is something that is studied in this research as a form of our responsibility to develop products that are ready to be implemented in the classroom.

Implementation in the classroom also shows effective results, seen from its success in achieving predetermined indicators. It is not difficult to achieve this considering that a literature review of previous research has proven success in achieving creative thinking abilities. The effectiveness and improvement of creative thinking abilities through the implementation of the Challenge based Learning model has been conveyed by Junita (2016); Yang, et al. (2018); Khusrin (2019); Naim, Ibnu & Santoso (2020); Fairazatunnisa, Dwirahayu & Musyrifah (2021). STEM Context integration also provides truth for achieving effectiveness and increasing creative thinking abilities (Vidákovich, 2021; Oschepkov, et al., 2022; Wilis, 2023). Furthermore, the integration of STEM Context in Challenge based Learning has also been recorded as being effective in improving creative thinking abilities (Simarmata & Ardiansyah, 2024). The Nearpod application is also noted to be effective in improving creative thinking abilities (Rahayu, 2023). By reviewing the literature review and the successful implementation of the product, further implementation in the classroom needs to be done.

CONCLUSION

Developing mathematical abilities is the main focus in mathematics learning in the 21st century, such as the creative thinking ability. Learning innovation is a solution to achieve this, including solving problems related to low creative thinking abilities. The textbook that integrated Challenge based on STEM Context Learning assisted by Nearpod has been developed with good results. The research findings noted that the textbook product achieved Very Appropriate criteria with a score of 93.67%, achieved Easy to Understand criteria with a score of 95%, achieved effectiveness in improving creative thinking abilities, and obtained a Very Good response from students with a score of 90.42%. Thus, product development was declared successful.

Given these findings, large-scale implementation should be carried out in other mathematics classes. Mathematics teachers can use textbook products to implement in mathematics learning in the classroom to improve students' creative thinking abilities. Furthermore, considering the limitations of research related to material and mathematical abilities, it is necessary to develop other innovative textbooks by integrating Challenge based on STEM Context Learning assisted by Nearpod for other materials and the study of other mathematical abilities.

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