

DEVELOPING A CANVA-ASSISTED CIRCLE LEARNING MODEL TO IMPROVE STUDENTS' MATHEMATICAL REASONING AND RESILIENCE IN JUNIOR HIGH SCHOOL

Enny Putri Cahyani¹, Heris Hendriana², Asep Ikin Sugandi³

¹IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
ennycahyani731@guru.smp.belajar.id

²IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
herishen@ikipsiliwangi.ac.id

³IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia.
asepikinsugandi@ikipsiliwangi.ac.id

ARTICLE INFO

Article history:

Received Mar 08, 2026

Revised Apr 20, 2026

Accepted May 06, 2026

Keywords:

Mathematical Reasoning

Resilience

Circle Learning Model

Junior High School

Canva

ABSTRACT

The importance of reasoning skills and resilience is essential and must be cultivated to face the challenges of global development in the future. Minimum proficiency in reading, mathematics, and science is a problem currently facing Indonesia, as indicated by PISA and TIMSS, and this is also observed in the field by researchers during the learning process. Canva-assisted CIRC learning was selected to assess the extent of improvement in students' mathematical reasoning skills and resilience regarding similarity concepts. This study employed an R&D approach through the 4D stages, enabling the CIRC learning model supported by Canva to be designed and tailored for seventh-grade students in junior high school based on initial interviews, observations, and literature reviews. This resulted in the development of 6 essay-type test items assessing reasoning ability and 30 validated statements measuring resilience. The results of the study indicate a significant improvement in reasoning ability between students who received the treatment and those who did not, with a p-value of $0.000 < 0.05$. The improved mathematical reasoning ability also influenced student resilience, with a significance level of 0.01, indicating that students who learned using the CIRC learning model supported by the Canva application achieved significantly higher resilience than those who used conventional learning methods. The higher the level of student resilience, the greater their mathematical reasoning ability. It can therefore be concluded that students with high resilience can adapt to the problems they face at that moment, thereby improving their mathematical reasoning ability due to their own resilience in solving problems.

Copyright © 2023 IKIP Siliwangi.
All rights reserved.

Corresponding Author:

Enny Putri Cahyani,
Department of Mathematics Education,
Siliwangi Institute of Teacher Training and Education,
Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
Email: ennycahyani731@guru.smp.belajar.id

How to Cite:

Cahyani, E. P., Hendriana, H., & Sugandi, A. I. (2026). Developing a Canva-Assisted Circle Learning Model to Improve Students' Mathematical Reasoning and Resilience in Junior High School. *JIML*, 9(3), 540-560.

INTRODUCTION

Mathematical reasoning skills are among the most crucial hard skills in mathematics education and must be mastered by students to the fullest extent (Saleh et al., 2018 ; Thompson et al., 2017 ; Thuneberg et al., 2018) . This competency is fundamental because it requires students to formulate hypotheses, design and carry out proofs, and present logical and systematic arguments. Astriani & Al Dhana,(2024) emphasize that the ability to formulate statements, draw valid conclusions, and validate arguments are key indicators of effective mathematical

reasoning . In line with this, Sumarmo et al., (2019) state that mathematical reasoning skills enable students to understand patterns, make generalizations, construct logical arguments, and draw valid conclusions based on evidence. Furthermore, reasoning ability is one of the process standards formulated by the NCTM, which states that reasoning is the core of mathematical activities (Richardo & Kholifah, 2023) . There is a similar emphasis on the importance of reasoning ability in international assessments such as PISA, where mathematical reasoning in mathematical literacy refers to the ability to formulate, apply, and interpret mathematics in various contexts. In line with this, Sumarmo (Hendriana et al., 2017) explains that mathematics learning is aimed at providing opportunities for the development of reasoning skills, awareness of the benefits of mathematics, fostering self-confidence, and an objective and open attitude toward facing an ever-changing future.

However, the reality on the ground shows that reasoning skills in Indonesia remain low. According to the results of the 2018 PISA assessment (Ministry of Education, Culture, Research, and Technology, 2021), approximately 60–70% of students in Indonesia still fall below the minimum proficiency standards in science, mathematics, and reading. Furthermore, several studies conducted at , (Hajar et al., 2021) , (Marasabessy et al., 2021) and (Ariati & Juandi, 2022) indicate that students' mathematical reasoning skills remain very low. Many students struggle when faced with problems requiring argumentation, generalization, or simple proof . This aligns with the issues identified by researchers during observations and interviews with mathematics teachers and early-grade students. There is a tendency to rely on examples provided by the teacher, an inability to transfer concepts to new situations, and a lack of sufficient perseverance, leading many students to complain about new problems rather than attempting to solve them.

Low reasoning ability is often correlated with weak mathematical resilience in students. Many students experience mathematics anxiety, perceiving mathematics as a difficult and intimidating subject, and are quick to give up when faced with challenging problems. In line with these issues, some experts suggest that students' difficulties and aversion to learning mathematics may lead them to feel anxious and avoid activities requiring mathematical reasoning (Hendriana et al., 2017) . The concept of mathematical resilience emerged from educational psychology research emphasizing the importance of a growth mindset and the belief that abilities can develop through effort. Students with high mathematical resilience view mistakes as a starting point for progressing toward improvement, thereby fostering self-awareness. They recognize that errors are part of the learning process, are willing to try alternative strategies, and remain motivated even when facing initial failures. Without resilience, efforts to improve reasoning will be hindered because students tend to avoid complex tasks that are actually necessary for training their reasoning skills. Thus, the design of effective learning models must consider affective aspects and social-emotional skills such as resilience, academic self-confidence, and collaboration skills so that the expected cognitive changes (improved reasoning) can be sustained and have implications for actual performance in the classroom. Resilience, according to Adolphs & Damasio (Hendriana et al., 2017), is defined as: “Students with strong mathematical resilience possess the ability to adapt to their environment; can cope with uncertainty, problems, and challenges; seek creative solutions to challenges; are curious and learn from experience; possess self-control; are aware of their emotions; and have strong social networks and are willing to offer help.”

One cause frequently identified in modern literature is the close link between reading ability (academic reading literacy) and mathematical reasoning ability. Longitudinal studies and the latest PISA data analysis confirm that reading literacy is a strong predictor of mathematical performance, particularly on context-based problems (word problems) that require text interpretation and higher-order reasoning. The results of the OECD's “ analysis(2023) , show

that students with high reading literacy consistently score better in the mathematical reasoning domain compared to students with low literacy, even after controlling for socioeconomic factors. These findings indicate that the ability to understand text is not merely a supporting factor but a structural component of successful mathematical reasoning.

Furthermore, Daroczy et al. (, (2021)) confirm that linguistic complexity in math problems directly influences problem-solving performance. Another study by Peng et al. (2022), through a meta-analysis of various international studies, found a moderate to strong correlation between reading comprehension and mathematical problem solving. They concluded that reading comprehension acts as a cognitive mediator in the reasoning process because students must construct a mental representation of the text before they can apply relevant mathematical concepts. Without adequate text comprehension, the processes of generalization, logical inference, and proof cannot proceed optimally. This demonstrates that linguistic barriers—not merely conceptual ones—often serve as disruptive factors in the mathematical reasoning process.

Given these cognitive and affective challenges, a learning model that integrates the development of academic reading literacy, cooperative learning activities, and the use of interactive visual technology emerges as a promising solution. One relevant model is CIRC (Cooperative Integrated Reading and Composition). CIRC is designed to integrate reading, writing (composition), and cooperative work so that students not only process texts individually but also construct understanding together through discussion, argumentative writing, and peer feedback. Cooperative approaches like CIRC are grounded in social constructivism, influenced by the ideas of Lev Vygotsky, which emphasize the importance of social interaction in cognitive development (Wardani et al., 2023) . Group discussions and the problem-solving sequence in CIRC facilitate the negotiation of meaning and peer scaffolding, enabling students to develop reasoning through argumentative dialogue and strong resilience in facing the problems presented. This is done to improve students' reading and mathematical skills. Consequently, it will produce more resilient students who possess an open-minded perspective from various angles to determine intelligent solutions to problems.

A literature review since 2021 indicates that: (1) various systematic reviews confirm low levels of mathematical reasoning ability, necessitating structured interventions; (2) research on mathematical resilience in Indonesia remains limited to small-scale studies and is predominantly descriptive rather than interventional (Perestroika & Putri, 2025); (3) cooperative models such as CIRC effectively improve literacy and cognitive aspects, but their application to mathematical reasoning remains limited; and (4) the integration of Canva into mathematics learning is still developing, with most studies focusing on media and communication, while empirical evidence regarding improvements in reasoning and resilience remains scarce. These findings open research opportunities to systematically test the effectiveness of a CIRC model modified and enriched with Canva in improving students' mathematical reasoning and resilience through the reinforcement of contextual reading and the construction of mathematical arguments in cooperative learning.

In the digital age, technology integration is a key factor in supporting the effectiveness of learning models. Effective visualization can help students understand abstract representations, while activities involving the redesign of concepts or solutions in visual formats can deepen reasoning while enhancing learning engagement. The researchers sought to integrate digital mathematics learning using Canva. Canva has been used in previous research (Carceller et al., 2023), where it was proven effective in the learning process for dental students at the Universidad Europea de Valencia (UEV). Additionally, Canva was validated in the study by Einstein et al., (2022) which noted that this tool is easy to use and has been shown to enhance students' motivation in mathematics learning.

The novelty of this study lies in several aspects: first, the direct integration of CIRC (which traditionally focuses on general literacy) and Canva as a visual-interactive tool specifically designed to support mathematical communication and representation; second, the simultaneous focus on two interrelated yet rarely co-tested outcomes: mathematical reasoning ability (higher-order cognitive) and academic resilience (affective/emotional); third, a research approach that will test the mediating mechanism of reading literacy on the relationship between the intervention (CIRC and Canva) and improvements in reasoning, thereby not only measuring the total effect but also tracing the pathways of change. Methodologically, the use of a field experimental design with instruments measuring academic reading comprehension, argument-based mathematical reasoning tests, and an academic resilience scale contributes both practically and theoretically to the mathematics education literature. The findings are expected not only to add to the empirical evidence but also to yield a validated learning model that can be adapted in junior high schools

Based on the various issues and solutions raised by experts, the author intends to conduct a study titled “Developing a Canva-Assisted CIRC Learning Model to Improve Students' Mathematical Reasoning and Resilience in Junior High School.” This study aims to examine the process of developing the Canva-assisted CIRC model, the level of feasibility and effectiveness of using the Canva-assisted CIRC learning model in improving the mathematical reasoning skills and resilience of junior high school students in the learning process, as well as the improvement in the quality of learning at the research site in particular, or in Indonesia in general.

METHOD

In this study, a research and development (R&D) model was employed. The objective of developing this learning model is for the researcher to address various existing issues in the educational environment, particularly in mathematics instruction. In this development, the researcher created a learning model integrated with interactive learning media supported by Canva. This product was designed to enhance the mathematical reasoning skills and resilience of seventh-grade junior high school students. The subjects of this study were 36 seventh-grade junior high school students for the 2024/2025 academic year, of whom six were assigned to a small-group pilot test and 30 to a field test, as well as 60 seventh-grade students for the 2025/2026 academic year, comprising 30 students from the experimental class and 30 from the control class. The research model used was the 4D method. The steps of research and development using the 4D model are Define, Design, Development, and Dissemination (Sugiyono, 2024) .

The data analysis steps or techniques used in this study involved calculating the average percentage scores from the validation sheets of subject matter experts, media experts, and focus group tests to determine the level of feasibility and validity. The data was processed using Microsoft Excel 2016 as follows: :

$$P = \frac{\Sigma x}{\Sigma x_i} \times 100\%$$

Notes: P = Percentage, Σx = Total score per aspect, Σx_i = Ideal score

Next, the researchers determined the feasibility and practicality criteria using predetermined intervals based on (Accraf Rinjani et al., 2018) :

Table 1. Product feasibility and practicality criteria

Percentage	Criteria	Description
81%–100%	Very Good	Highly valid/no revisions needed
61%–80%	Good	Valid/no revisions needed
41%–60%	Fair	Less valid/needs revision
21%–40%	Insufficient	Invalid/needs revision
0%–20%	Very insufficient	Very invalid/needs revision

N-Gain is calculated to determine the improvement in students' mathematical reasoning ability. According to Hake (Dewi & Harahap, 2016), N-Gain is calculated using the following formula:

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

Notes: g = N-Gain, S_{pre} = pretest score, S_{post} = posttest score, S_{maks} = maximum score for the item.

Table 2. N-Gain Score Criteria

Criteria	Explanation
$g > 0.7$	High
$0.3 < g \leq 0.7$	Moderate
$g \leq 0.3$	Low

Table 2 represent the criteria of N-Gain score that used in this research. In addition, the data obtained after the product was revised were analyzed to determine the achievement levels and differences in mathematical reasoning ability and resilience between the experimental and control groups, as well as N-Gain, using normality tests, homogeneity tests, and t-tests processed using IBM SPSS Statistics 26.

RESULTS AND DISCUSSIONS

Results

In the Define stage, gathering information to support the research process was essential through observation, interviews, and questionnaire completion to identify the issues found at the targeted research site. Additionally, the researcher collected information regarding the needs of teachers, students, and materials aligned with the curriculum agreed upon at the school. The preliminary study was conducted by analyzing Learning Outcomes, Learning Objective Sequences, Learning Objectives, and indicators used in creating instructional materials and teaching modules that would serve as products in this planning stage. One method employed was a discussion with peers, professional teachers, and lecturers to analyze the results of the information collection conducted previously.

Table 3. Summary of findings from the preliminary study

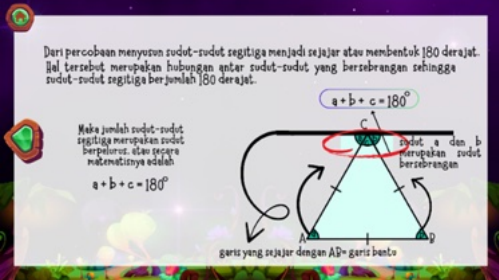
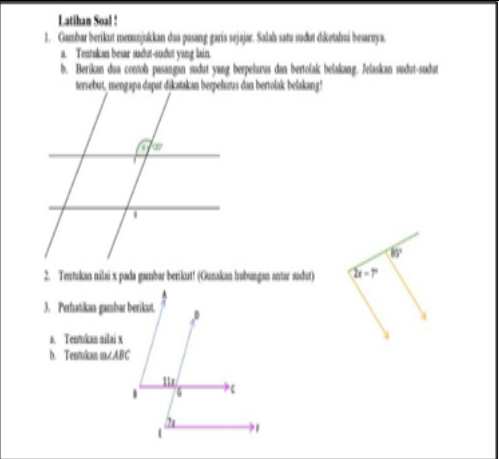
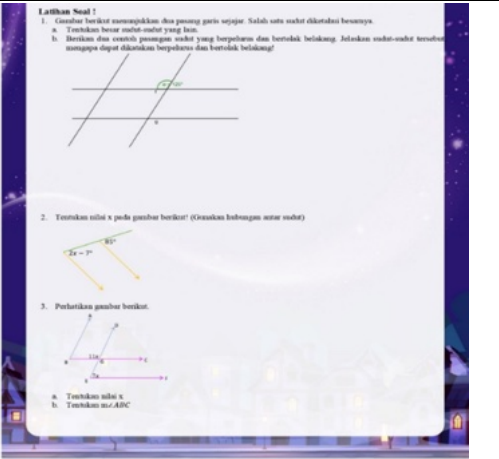
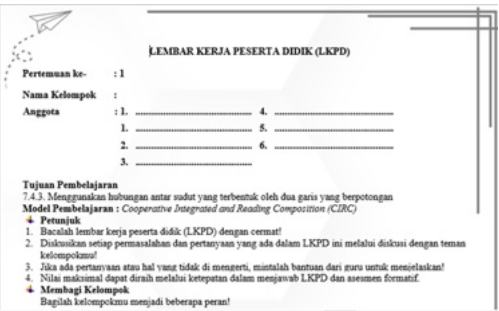
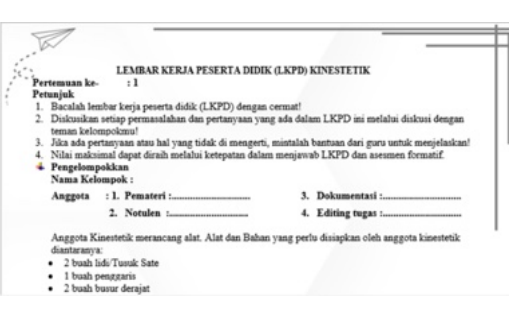
No	Actual Situation	Desired Situation	Cause
1	Teachers have not yet made effective use of technology	Technology can be utilized to the fullest to provide meaningful learning	Efforts to improve teachers' technological competencies remain minimal
2	Students' prerequisite knowledge is still weak	Students must understand the basic concepts of the previous material before moving on to the next	Students have varying levels of prior knowledge, so they are not given appropriate instruction

No	Actual Situation	Desired Situation	Cause
3	Students are still given routine problems with unclear instructions. Consequently, students' thinking remains at the LOTS level	Students are engaged in meaningful and in-depth activities and are expected to think at the HOTS level	Teachers lack varied methods or approaches in their teaching
4	Teachers' teaching methods are varied, but the instructional materials do not support meaningful learning	Teachers create small-group activities that make students feel confident, happy, and aware of the mathematics instruction provided	Teachers have limited time to design effective lessons
5	Resilience toward mathematics remains very weak	Students enjoy engaging mathematics lessons	Instructions that do not foster perseverance, causing students to be reluctant to ask questions
6	9th-grade teachers still need appropriate strategies for teaching geometry in the classroom	It is hoped that teachers can master technology and media to introduce geometry through Geogebra, etc.	Not all teachers can operate technology effectively
7	Teachers collaborate with guidance counselors to obtain data on students' initial abilities.	Teachers can utilize this data for group learning needs	

In the Design phase, the product developed in this study is a Cooperative Integrated Reading and Composition (CIRC) learning model supported by Canva. This learning model is linked to interactive learning media that must be designed in such a way as to suit the age of the students targeted by the research. The data collection instruments at this stage consist of instruments for reading skills, mathematical reasoning ability, mathematical resilience, teacher responses, and student responses. The product developed is a Canva-assisted CIRC learning model integrated with interactive learning media tailored to students' characteristics and learning styles. The resulting teaching materials include Interactive Learning Media (ILM), Worksheets, and a Canva-assisted teaching module on Similarity. The ILM contains concepts, proofs, and practice problems. The use of the Canva platform is based on the government's support for professional education accounts, as well as its ease of access and use by teachers and students.

Once the media had been developed into the desired design, the researcher proceeded to the product design validation stage with media experts and subject matter experts during the Development phase. After receiving validation and feedback from several experts, the researcher revised the product based on the feedback provided. During the Development phase, the data collection instruments used were a teacher response questionnaire and a student response questionnaire. Small-group trials and field trials were conducted with the following detailed activities: 1) Demonstrating the interactive learning media during instruction to gauge the responses of teachers and students to the initial product, which had been deemed suitable by media and subject matter experts. 2) Students provided feedback on the initial product design by completing the questionnaire. The following are the feedback and improvements made to the developed product.

Table 4. Improvements and feedback on the developed product

	Before	After
a	Simplify the display, which contained too many animations in the learning media	
		
b	Improving the contrast between text and background	
		
c	Expanding the answer column space on the assessment sheet	
		
	Half-page layout	Full-page view
d	Adding a column for writing members' names and their distribution on the worksheet in more detail	
		
e	Add the syntax/phases of the CIRC learning model to each session	

No slides displaying the syntax/phases of the CIRC learning model



The Dissemination stage is a research and development procedure involving the dissemination of the completed revised results so they can be utilized by other schools. Limited dissemination was conducted by providing an interactive learning web platform to the school where the research took place. Dissemination was implemented in classes VII-J and VII-K, each consisting of 6 sessions: 1 session for a pretest, 4 sessions for instruction, and 1 final session for a posttest. The learning activities were also differentiated by treatment. The experimental class, VII-J, was taught using the Canva-assisted CIRC learning model along with validated teaching materials, while the control class, VII-K, used deep learning instruction aligned with the latest curriculum at the time.

Validation was conducted by experts to assess the validity of the research instruments—specifically the developed instructional materials—in terms of relevance, accuracy, and quality of content, language appropriateness, presentation suitability, and graphic design. The validation results served as the basis for revising and refining the instructional materials. The validators’ overall assessment of the teaching materials using the Canva-assisted CIRC approach generally yielded the same conclusion: “Very Good” and suitable for use with minor revisions. The revised drafts from these expert validators were subsequently provided to teachers as pre-test validators.

Front-end validation was conducted with expert teachers and competent professionals familiar with the product in this study. The validation instruments used a questionnaire format to assess the content of the materials and an interview format to discuss the developed product in greater detail. The validation process involved presenting the initial product, having it evaluated by validators, conducting interviews, having the researchers make improvements, and having the validators re-evaluate it as part of the revision process. The results of the subject matter expert validation are presented in Table 5. The following is a summary of the feasibility results from the small-group pilot test involving 3 subject matter experts:

Table 5. Validation results from three subject matter experts regarding the product

No	Aspect	Response from Subject Matter Expert Validators			Average (%)	Notes
		1	2	3		
1	Content	85	85	75	82	Highly valid/no revisions needed
2	Language	80	88	83	83	Highly valid/no revisions needed
3	Presentation of learning materials	80	87	67	78	Valid/no revision needed
4	Consistency with the approach	80	90	70	80	Valid/no revision needed
5	Meets the criteria for conceptual discovery	90	90	80	87	Highly valid/no revision needed

No	Aspect	Response from Subject Matter Expert Validators			Average (%)	Notes
		1	2	3		
6	LKPD Display	80	90	87	86	Highly valid/no revisions needed
7	Completeness of LKPD content in accordance with the selected material	80	100	87	89	Highly valid/no revisions needed
8	Consistency with the approach in the LKPD	93	87	87	89	Highly valid/no revision needed
Average of all aspects		84	89	79	84	Highly valid/no revision needed (Very Good)

Based on **Table 5**, six aspects met the “Very Good” criteria. Therefore, the CIRC-modeled instructional materials created with Canva can be considered highly suitable, even though they received only a few suggestions for improvement. Additionally, there are validation results for the interactive learning media developed using Canva. One validator holds a valid certificate in the field of technology. Below are the validation results from the media expert.

Table 6. Media expert validation results for the product

No	Aspect	P (%)	Description
1	Media appeal	90	Highly valid/no revisions needed
2	Physical Appearance	90	Highly valid/no revision needed
3	Color and image combination in the media	80	Valid/no revisions needed
4	Media suitability for the environment	80	Valid/no revisions needed
5	Completeness of media components	80	Valid/no revision needed
6	Alignment of media with student characteristics	80	Valid/no revision needed
7	Instructions for using the media	80	Valid/no revision needed
8	Ease of use	80	Valid/no revision needed
Average		83	Highly Valid (Very Good)

Based on **Table 6**, two aspects of the product were deemed highly valid and suitable for use, while the other six aspects were suitable for use with minor revisions based on the feedback provided. After the product underwent improvements and met the criteria for suitability, the researcher concluded that the product was suitable for use and distribution to students in a small-group pilot test to assess the practicality of the developed product.

In the first small-group pilot test, 3 students were involved to determine the extent of their understanding and the readability of the Similarity material they had learned. Subsequently, in the second small-group pilot test, 6 students were involved. The following are the students' responses to the product provided:

Table 7. Readability and practicality results for the product (small-group trial)

No	Aspect	Responses from 3 students		Responses from 6 students	
		P (%)	Notes	P (%)	Description
1	Media appeal	73	Valid/No revisions needed	82	Highly valid/no revision needed
2	Physical Appearance	73	Valid/no revision needed	83	Highly valid/no revision needed
3	Combination of colors and images in the media	72	Valid/no revisions needed	81	Highly valid/no revisions needed
4	Media suitability for the environment	77	Valid/no revision needed	87	Highly valid/no revision needed
5	Completeness of media components	67	Valid/no revision needed	80	Valid/no revision needed
6	Media suitability for student characteristics	82	Valid/no revision needed	88	Highly valid/no revision needed
7	Media usage guidelines	80	Valid/no revisions needed	80	Valid/no revision needed
8	Ease of use of the media	85	Highly valid/no revision needed	88	Highly valid/no revisions needed
Average		76	Valid/no revision needed (Good)	84	Very valid/no revision needed (Very Good)

After revisions based on various inputs, there were significant differences. Out of the 8 aspects of product feasibility and readability, 6 aspects were rated as highly valid, while the other 2 were rated as feasible and valid. This indicates that the product can be distributed for the next phase of testing, namely the large-scale trial.

After obtaining the readability results from the small-group pilot test, the researcher conducted interviews with students to obtain detailed feedback on the identified shortcomings. In addition to the validators, the students also provided input to normalize the scale-slider function. Initially, the scale buttons did not function properly. Consequently, students had difficulty using them. Feedback from the students indicated that the zoom in/out functions on the learning media were not working properly.

After conducting an evaluation, final validation, and improvements to the product, the researcher then conducted a large-scale pilot test. The large-scale pilot test was conducted at the same school in Class VII-H for the 2024/2025 academic year, where students had not yet received material on similarity, with a total of 30 students. The large-scale trial was conducted to measure the readability, effectiveness, or suitability of the instructional materials developed by the researcher for a broader audience. One of the techniques the researcher used to obtain data from this trial involved administering the product and then conducting a questionnaire regarding the product using the CIRC learning model supported by Canva in its entirety.

The results of the large-scale pilot test were used as the basis for revising the interactive learning media in the subsequent stage. The revision stage involved testing the design and product feasibility of the pilot test results, which had undergone various revisions, resulting in a product that is highly suitable and effective in terms of alignment with the students' age group and its methodology. Revisions were based on the data and information collected during the field pilot test. In the research by Cahyani et al.,(2025) the Canva-assisted media was found to be suitable and effective for students with a visual learning style. The following are the results of the large-scale pilot test regarding the feasibility and practicality of the product:

Table 8. Student response scores regarding product practicality (extensive trial)

No	Aspect	P (%)	Description
1	Media appeal	89	Highly valid/no revisions needed
2	Physical Appearance	88	Highly valid/no revision needed
3	Combination of colors and images in the media	87	Very valid/no revision needed
4	Media suitability for the environment	87	Highly valid/no revision needed
5	Completeness of media components	88	Highly valid/no revision needed
6	The suitability of the medium for student characteristics	86	Highly valid/no revisions needed
7	Instructions for using the media	86	Highly valid/no revision needed
8	Ease of use of the media	88	Highly valid/no revision needed
Average		87	Very valid/no revisions needed (Very Good)

Based on **Table 8**, 87% of the developed products received a very good response to proceed to the next stage. This was followed by the dissemination stage, which was implemented in Grade VII-J (Experimental Class) and Grade VII-K (Control Class) in the 2025/2026 academic year.

The results of the analysis of mathematical reasoning skills in the experimental and control classes before and after the implementation of the developed product are presented.

Table 9. Results of statistical analysis of the product trial for the experimental and control classes

Mathematical Reasoning Ability								
Statistical Data	Experimental Class				Control Class			
	Pre-test	Post-test	n-Gain		Pre-test	Post-test	n-Gain	
$\bar{x}$	5.00	61.87	0.49	Moderate	3.97	45.97	0.36	Medium
%	4.17	51.56	-		3.31	38.31	-	
SMI					120			
S	3.96	17.45	0.15	-	3.49	14.74	0.14	-
N	30				30			

Based on **Table 9**, data were obtained with the measured variables being mathematical reasoning ability and resilience. These data served as a basis for further data analysis to determine their significance. The mean pretest score for mathematical reasoning ability was 5.00% for the experimental class and 3.97% for the control class. After instruction using teaching materials based on the CIRC approach supported by Canva was implemented, the mathematical reasoning ability of students in the experimental class reached 51.56% of the ideal maximum score, with an n-Gain of 0.49 (moderate), indicating a fairly significant improvement following the implementation of the CIRC learning model supported by Canva. This suggests that after receiving instruction on similarity, a difference was observed compared to before the material was introduced. The mathematical reasoning ability in the control class reached 45.97% of the ideal maximum score, with an n-Gain of 0.36 (moderate), indicating an improvement following the implementation of conventional instruction. Both groups showed changes; however, the class that received the Similarity lesson using the Canva-assisted CIRC learning model demonstrated higher-quality mathematical reasoning ability compared to conventional instruction (the deep learning approach). This is also evidenced by the differing standard deviations of the two classes. The experimental class had a larger standard deviation

than the control class, indicating that the mathematical reasoning skills of the experimental class were more varied.

This study will analyze the achievement of mathematical reasoning skills, with the research hypothesis to be tested being: "The mathematical reasoning skills of students using the Canva-assisted CIRC learning model are better than those using conventional instruction."

Before beginning instruction, the researcher administered a pre-test on mathematical reasoning regarding similarity, consisting of 6 questions given to both the experimental and control classes to determine students' initial abilities before the intervention. After the pretest was administered, the researcher conducted instruction using different treatments. The experimental class received CIRC learning supported by Canva, while the control class received conventional instruction following the general Merdeka curriculum. Posttest data were obtained by administering a mathematical reasoning test to students after the treatment was administered. The purpose of the posttest was to determine whether the mathematical reasoning skills of students in the experimental class were better than those in the control class.

To observe any improvement in mathematical reasoning ability before and after the intervention, the analysis continued by examining the N-Gain scores from the pretest and posttest. After the N-Gain data met the requirements for normality and homogeneity tests, a two-sample t-test was conducted, with the following hypotheses:

$H_0 : m_1 \leq m_2$ (there is no significant difference in students' reasoning ability between those whose learning used the Canva-assisted CIRC learning model and those who used conventional learning)

$H_1 : m_1 > m_2$ (there is a significant difference in students' reasoning ability between those whose learning uses the Canva-assisted CIRC learning model and those using conventional learning)

The testing criteria are as follows:

If the significance value is ≥ 0.05 , then H_0 is accepted

If the significance value is < 0.05 , then H_0 is rejected

The results of the N-Gain t-test are presented in the following table:

Table 10. Results of the t-test for students' mathematical reasoning ability

		t-test for Equality of Means		
		t	Df	Sig. (2-tailed)
N-Gain	Equal variances assumed	4.223	29	0.000

Based on the data in **Table 10**, it can be seen that the significance values for the class that received instruction using the Canva-assisted CIRC learning model and the class that received conventional instruction are less than 0.05; therefore, H_0 is rejected. It can thus be concluded that there is a significant increase in students' reasoning ability among those whose instruction used the Canva-assisted CIRC learning model compared to those who received conventional instruction.

The same procedure was followed to assess the significance of student resilience. The data obtained were ordinal data converted into interval data using the Method of Successive Intervals (MSI). The results of the statistical tests are presented below, along with the analysis of the Final Student Resilience Scores:

Table 11. Results of the statistical analysis of the product test for the experimental and control classes

Statistical Data	Final Scale Experimental Class	Final Scale Control Class
$\bar{x}$	94.63	90.27
S	7.37	5.47
N	30	30

Based on Table 11, the average final score for student resilience in the experimental class was 94.63, while the average final score in the control class was 90.27. The data indicate that the resilience of students in the experimental class was higher than that of the control class. This study analyzed resilience outcomes, with the research hypothesis to be tested being: Students' resilience using the CIRC learning model assisted by Canva is better than that of students using conventional learning. The first test on the resilience questionnaire data was a normality test, followed by a homogeneity test and a two-sample t-test. The hypotheses regarding student resilience are as follows:

H_0 : The mathematical *resilience* of junior high school students whose learning uses the *Cooperative Integrated Reading and Composition (CIRC)* learning model supported by *Canva* is no better than or equal to that of students using conventional learning. ($\mu_1 \leq \mu_2$)

H_1 : The mathematical *resilience* of junior high school students whose learning uses the *Cooperative Integrated and Reading Composition (CIRC)* learning model supported by *Canva* is better than or equal to that of students using conventional learning ($\mu_1 > \mu_2$)

The testing criteria are as follows:

If the significance value is ≥ 0.05 , then H_0 is accepted

If the significance value is < 0.05 , then H_0 is rejected

After the normality and homogeneity tests were met, the two-sample t-test was conducted. The following table shows the t-test results for students' final resilience scores.

Table 12. Results of the t-test for students' final resilience scores

		T	Df	Sig (2-Tailed)
Resilience Score	Based on Mean	2.476	29	0.019

Based on **Table 12**, it can be seen that the significance value (two-tailed) is < 0.05 , specifically $\frac{0.019}{2} = 0.0095 = 0.01$, which means that the H_0 is rejected. Thus, it can be concluded that the mathematical *resilience* of junior high school students whose learning utilizes the *Cooperative Integrated Reading and Composition (CIRC)* model assisted by *Canva* is better than or equal to that of students using conventional learning methods.

Discussions

During the Define stage, after interviews, validation of teaching materials, and classroom observations were conducted, several findings were obtained. Interview results indicated that mathematics teachers at the school had followed the government's latest policies and regulations in the learning process. However, the use of technology in mathematics instruction had not yet become a consistent practice. Major challenges included limited time to develop technology-based instructional materials and the uneven mastery of current technology among teachers. Discussions with the guidance counselor revealed that at the beginning of the semester, the school had mapped students' learning styles, allowing this data to be utilized to

optimize instruction. The researcher also discussed with a colleague who has over ten years of teaching experience and learned that teachers still face difficulties in teaching geometric transformations that require a high level of conceptual understanding.

Based on these findings, the researcher concluded that reinforcing foundational geometry concepts must begin early. Although GeoGebra has the potential to visualize geometric concepts, this study focused on the topic of Similarity by utilizing Canva as an engaging visual medium, aligning with the researcher's expertise in its design. This choice is supported by various studies showing that Canva effectively improves learning outcomes, creativity, and learning innovation (Saputra et al., 2022; Effendi et al., 2023; Ilham et al., 2023; Ardiyani et al., 2023; Ramos, 2024; Castillo-Cuesta et al., 2024).

In line with findings from the field, Mukuka et al.,(2023) argue that some teachers were not as supportive of students' mathematical reasoning as they believed they were. Additionally, Mukuka & Tatira, (2025) state that digital professional development remains a challenge. Therefore, during the planning phase, the researcher intends to create a product that can effectively visualize the material using Canva. The researcher did not use Geogebra; this is because Canva is more engaging and can be integrated with other interactive applications. Furthermore, the selected model is *Cooperative Integrated Reading and Composition (CIRC)* because students' literacy skills remain below average based on PISA 2018. Thus, the researcher chose this model to assess students' effectiveness in literacy during mathematics learning.

To foster high resilience in students, they were guided to follow an engaging learning sequence so that they actively experience the reading process to discover new concepts through activities designed to achieve the intended learning objectives. Thus, the researcher adopted the Cooperative Integrated Reading and Composition (CIRC) model to observe students' mathematical literacy processes and help them become accustomed to them. Several previous studies indicate that cooperative learning models have a positive impact on learning outcomes (Rahmi & Marnola, 2020) , (Agnia, 2024) . Below is the design and analysis of the CIRC model using Canva.

Table 12 . Analysis of the CIRC learning model

CIRC Model 1			CIRC Model 2			CIRC Model 3		
Core	CIRC	Activities	Core	Activities	of CIRC	Core	CIRC	Activities
According to Suyitno (Rahmi & Marnola, 2020) ,			According to Marlina,(2019) ,			According to Agnia, (2024)		
a. One member or a group reads,			a. The teacher provides instructions on the learning material,			a.the teacher begins by introducing a new concept to guide student exploration, whether sourced from the teacher or other media,		
b. Making predictions or interpreting the content of the reading, including writing down what is known, what is being asked, and representing the question with a variable,			b. Teachers divide students into homogeneous or heterogeneous groups,			b.Students, working in groups, are given the opportunity to share their prior knowledge, after which they are able to build upon it and combine it with group learning, with the expectation that discussions will arise from their observations,		
c. Collaboratively creating a summary or plan to solve the			c. Teachers provide students with instructions on reading and writing skills and guide them in synthesizing the results of their discussions into conclusions, essays, or other products.					
			d. Students explore knowledge from various sources, discuss it in groups, and present or					

problems presented in the reading material	apply the results of their group discussions.	c. Ultimately, students are able to present the results of their observations, after which the teacher and students can exchange suggestions and feedback based on the discussion
d. Writing down the problem-solving steps in order, and	e. Conducting assessments or quizzes	
e. Mutually revising and editing the work or solutions.	f. Awarding recognition to the group that demonstrates the best performance	

Therefore, the researcher incorporated technology, which is expected to capture students' attention and motivate them to learn mathematics in a more engaging way. The sequence of activities in the Cooperative Integrated Reading and Composition (CIRC) learning model, supported by Canva and designed by the researcher, consists of the following phases: a) grouping (heterogeneous groups based on initial diagnostic assessments); b) exploring knowledge through Canva; c) creating a plan of action; d) group discussion/presentation; e) assessment.

Based on the preliminary study conducted during the Define phase, the researcher proceeded to design learning media, worksheets, and learning modules that were tailored to the initial needs identified. In the Design phase, the researcher designed the media using Canva and Construct 2 to make them more interactive, while the worksheets and modules were designed using Canva and Microsoft Word 2016. Additionally, the researcher designed a differentiated learning module based on the data regarding students' learning styles. This was done to ensure students receive instruction tailored to their specific learning styles.

During the Development phase, trial-and-error adjustments to the media and other instructional materials were made based on feedback from teachers, academic advisors, and students. The validity of the developed product was deemed appropriate and effective after undergoing a series of extensive processes. Validity tests were conducted with experienced teachers and media experts, resulting in feedback and revisions to the developed product. Similarly, during small-scale and large-scale trials, the developed product still encountered technical challenges in the field; thus, the researchers documented these potential issues to anticipate them during the dissemination phase.

During the dissemination phase, the product was piloted in Grade 7-J and Grade 7-K during the 2025/2026 academic year, both of which had not yet covered the topic of similarity. Thorough preparation and a predetermined timeline constituted the final process to assess the effectiveness of the developed product in teaching the topic of similarity. Although their initial abilities were the same, their learning processes exhibited distinct characteristics. The Experimental Class (VII-J) was treated with the CIRC learning model assisted by Canva, while the Control Class (VII-K) received only a deep learning approach using lecture and discussion methods. Both groups showed improvement in mathematical reasoning skills. However, significantly, students in the Experimental Class demonstrated higher mathematical reasoning skills than those in the Control Class. In addition to the difference in instructional approaches, the Control Class was not provided with visually engaging media. It was limited to the teacher or students looking at the student textbook. Based on the above description, it can be concluded that the development process of the Canva-assisted CIRC cooperative learning model aligns with the stages designed in the 4-D framework and can enhance students' mathematical reasoning and resilience.

Based on the analysis conducted through the Define and Design stages, the developed product—the Canva-assisted CIRC learning model—is highly feasible and valid for use in enhancing students' mathematical reasoning skills and resilience. The product has been

validated by subject matter experts and media experts through a lengthy process of discussion and revision. The validation results from subject matter experts and media experts fall into the "highly valid" category, while the validation results from teachers and students regarding practicality fall into the "highly practical" category. Therefore, the resulting product is highly suitable for use and aligns with the needs of both teachers and students, as it incorporates procedural, conceptual, and factual elements that prioritize real-world problems.

The factors that place this LKPD in the "highly valid" and "highly practical" categories are as follows: The CIRC-based E-LKPD developed using Canva is classified as highly valid. This validity is demonstrated by the strong correlation between the content, learning activities, and the learning objectives to be achieved. This aligns with the findings of Firman et al. (2024), who state that a systematic relationship between objectives, content, and learning steps serves as the primary indicator in determining the "highly valid" category. Additionally, the reliability of the CIRC-based LKPD supported by Canva is high, making the results obtained reliable for evaluating student progress (Labuhanbatu, 2022).

The practicality of the E-LKPD is supported by an attractive and systematic visual design created with Canva. The clear layout and typography make it easier for students to understand instructions independently. This aligns with Rosmana et al. (2024), who state that visual modifications using Canva in worksheets make instructions more communicative and engaging, thereby encouraging student independence in completing tasks. Additionally, another factor contributing to the developed worksheets being categorized as highly practical is: the E-LKPD created can be used flexibly; students can access the E-LKPD anytime and anywhere as long as they are connected to the internet (Triasari et al., 2022).

Furthermore, the practicality of the Canva-assisted CIRC learning model is demonstrated not only by its ability to capture attention but also by the numerous elements that can be incorporated into the platform, which in turn makes it more practical for students to utilize. In this study, the visual elements designed through Canva at least enable students to visualize and draw images related to a problem. Previous research conducted by (Hapsari & Zulherman, 2021), (Septiyawati Putri et al., 2022), (Amri, 2023), and (Syafitri & Sujannah, 2024) indicate that Canva-assisted learning media/interactive learning media are effective in producing good learning outcomes.

Based on the data analysis results, it was found that the mathematical reasoning skills of students whose learning utilized the Canva-assisted CIRC learning model were better than those of students in conventional learning. This aligns with the views of , Latifah et al., (2024), Sugandi, et al. (2025), who state that innovative learning models and the use of Canva media can enhance mathematical reasoning skills. Ayuni et al. (2023) conducted a study using the CIRC learning model with 11th-grade high school students; Sugandi et al. (2022) used the Discovery Learning model with 8th-grade middle school students; and Latifah et al. (2024) used Canva-based digital comics with 7th-grade students.

The CIRC model is effective in improving mathematical reasoning skills because it integrates reading, discussion, and composition activities within cooperative learning. Mathematical reasoning requires the ability to interpret information, select strategies, construct justifications, and verify the validity of arguments. The structured activities in CIRC systematically train these cognitive processes.

First, the reading stage encourages students to deeply understand the problem, thereby minimizing misconceptions and helping to identify relevant information—both explicit and implicit—before the problem-solving process. Quasi-experimental findings indicate that integrating reading strategies into mathematics instruction contributes to improved problem-

solving and numeracy skills (Hamidi et al., 2022) , thereby reinforcing the role of reading as an interpretive foundation for reasoning.

Second, the discussion stage provides a space for social interaction to clarify concepts, negotiate meanings, and test hypotheses. Through structured discussions, students articulate reasons, critique assumptions, and revise strategies based on group feedback. Research from 2021–2023 reported significant improvements in problem-solving and numerical strategy indicators following the implementation of CIRC (Fitriana, 2023) . This aligns with social learning theory, which emphasizes that verbal interaction reinforces the internalization of thinking processes and the validation of mathematical arguments.

Third, the composition component requires students to write summaries, justifications, and presentations. This activity requires the logical and explicit organization of ideas, thereby strengthening the structure of deductive arguments. Research and Development studies indicate that students learning through CIRC produce more systematic written justifications compared to the control group (Ariyana & Suastika, 2022), suggesting an improvement in the quality of written reasoning as an indicator of mathematical reasoning. Collectively, various empirical findings indicate that CIRC contributes to skill improvement. In addition to CIRC-based learning influencing the effectiveness of enhancing mathematical reasoning skills, Canva also makes a positive contribution to improving mathematical reasoning skills, namely:

The use of Canva enhances the readability and quality of visual representations of mathematical content, thereby accelerating the interpretation of problems as the initial stage of mathematical reasoning. Santoso (2022) states that Canva-based e-modules featuring multimodal graphics, annotations, and step diagrams facilitate students' identification of relevant information in text-based problems and abstract concepts. Muhajir (2024) further emphasizes that Canva for Education strengthens graphical representations that support conceptual understanding. These findings indicate that the presentation of structured material reduces ambiguity and supports the selection of strategies and the drawing of inferences, which are components of mathematical reasoning ability (Santoso, 2022; Muhajir, 2024). Creating visual artifacts such as solution infographics, flowcharts, and argumentative posters through Canva encourages the systematic explicitation of steps and reasons, thereby improving the quality of written reasoning. Akbar (2024) and several development studies report that tasks based on visual artifacts produce more coherent and well-structured answers, which serve as indicators of the quality of mathematical justification. Thus, Canva artifacts function as cognitive representations that facilitate verification and reflection in the reasoning process (Akbar et al., 2024; Santoso, 2022).

In collaborative learning, Canva supports the creation of shared visual representations that accelerate the testing of group strategies and arguments. Studies on innovative models integrating Canva demonstrate improved quality of conceptual discussions as well as the collective formulation of problem-solving strategies. This process transforms individual solutions into socially validated arguments, thereby strengthening the internalization of mathematical reasoning (Rahayu et al., 2023; Oktania, 2024). s have previously conducted ; their findings indicate that teachers have successfully improved reading comprehension skills using the CIRC cooperative learning approach. Since reading ability positively correlates with reasoning ability, this research can enhance students' mathematical reasoning skills

Based on the data analysis results, it was found that the mathematical resilience of students who were taught using the CIRC learning model was better than that of students who received conventional instruction. This indicates that the Canva-assisted CIRC learning model is effective in improving mathematical resilience. This aligns with the findings of studies by ; Haryanti et al. (2023); Hutagalung et al. (2025); and Nuramalina et al. (2025), which state that the implementation of innovative learning models can enhance students' mathematical

resilience. The factors that make the CIRC learning model effective in enhancing student resilience are as follows:

First, the CIRC model prioritizes teamwork, thereby enhancing students' resilience. This aligns with the view of Hidayat & Arifin (2022), who state that collaboration in project development on Canva creates a social support system that is crucial for students to minimize fear of failure and enhance their resilience. Additionally, the stages in CIRC (reading the problem, identifying key ideas, and writing solutions) constitute systematic learning activities, thereby helping students remain calm when facing problems. This aligns with the findings of Cahyani et al. (2025), who demonstrated that a systematic learning structure helps students stay calm when confronting difficult problems. With this support. This aligns with the definition of mathematical resilience as the ability to persist in solving mathematical challenges despite initial obstacles (Nurkhodijah & Abadi, 2025 ; Maarif et al., 2023). Furthermore, Canva provides visual representations that facilitate learning, helping students see relationships between concepts and resolve misunderstandings in real-time. Studies show that the use of interactive learning media such as Canva increases students' learning motivation and their active engagement in the learning process (Santoso et al., 2022 ; Laras Asih & Dewi, 2026) . High motivation serves as a foundation for students to remain persistent and not give up easily, which is part of the construction of mathematical resilience

CONCLUSION

Based on the results and discussion outlined above, the following conclusions can be drawn: 1) The development of a Canva-assisted CIRC learning model to enhance students' mathematical reasoning skills and resilience aligns with the steps outlined in the established 4D model and is effective in improving students' mathematical reasoning skills and resilience. 2) The Canva-assisted CIRC learning model is suitable for use in classroom mathematics instruction, as it has a high level of validity and a high level of practicality. 3) The improvement in students' mathematical reasoning skills in learning using the Canva-assisted CIRC model is better than in conventional learning. 4) The mathematical resilience of students in learning using the Canva-assisted CIRC model is better than in conventional learning. This indicates that the Canva-assisted CIRC learning model is effective in enhancing students' mathematical reasoning skills and resilience.

By adapting the instructional approach to suit students' needs, mathematics learning should become meaningful and effective in enhancing mathematical reasoning skills, as students develop strong resilience to face challenges. With a strong fighting spirit and foundational reading and mathematical skills firmly established through the CIRC learning sequence, each individual will cultivate a resilient mindset. These findings open opportunities for further research so that the CIRC learning model can be applied and modified into a better version. Additionally, this will be influential because Canva's continuous updates will make it more advanced than previous versions; therefore, Canva can be utilized in other studies to create more varied forms of mathematics learning that are more enjoyable and meaningful.

ACKNOWLEDGMENTS

This article was completed thanks to the support of our loved ones, who assisted us throughout the research process, from the initial stages to the conclusion. First and foremost, we thank ourselves, as managing time effectively and remaining resilient in the face of all challenges is no easy task. Additionally, our beloved family who supported us in various ways. Furthermore, the preparation of this article would not have been possible without the assistance, support, and collaboration of various other parties. In particular, we would like to thank our colleagues and collaborative partners, who worked with us throughout the process of compiling this article. Through discussion, effective division of tasks, and mutual support, this article was successfully

completed. We hope this collaboration serves as a starting point for addressing the existing disparities in mathematics education in Indonesia so that future generations can be prepared for the future.

REFERENCES

- Accraf Rinjani, B. L., Suryati, & Khery, Y. (2018). Development of an Android-Based Interactive E-Module on the Nature of Science for Chemical Bonding and Intermolecular Forces to Foster Students' Science Literacy. *Hydrogen: Journal of Chemistry Education*, 6.
- Agnia, N. G. S. (2024). Reading Comprehension Skills for Various Text Types Based on HOTS in Elementary School: A Literature Review. *LITERASI: Scientific Journal of Language Education, Indonesian and Regional Literature*, 14 (2), 662–669. <https://doi.org/10.23969/literasi.v14i2.13102>
- Amri, Z. (2023). The use of the Canva application as a learning medium in the Fiqh learning process. *Journal of Learning Innovation and Technology*, 10 (1), 1. <https://doi.org/10.17977/um031v10i12023p001>
- Ariati, C., & Juandi, D. (2022). Mathematical Reasoning Skills: A Systematic Literature Review. *Jurnal Lemma*, 8 (2), 61–75. <https://doi.org/10.22202/jl.2022.v8i2.5745>
- Astriani, N., & Al Dhana, M. B. (2024). Students' Mathematical Reasoning Skills Through the Contextual Teaching and Learning Approach. *THEOREMS Journal (The Original Research of Mathematics)*, 8 (2), 263–271. <https://doi.org/https://doi.org/10.31949/th.v8i2.7>
- Ayuni, N. P., Laswadi, & Anggraini, R. S. (2024). Improving Students' Mathematical Reasoning Skills Through the Cooperative Integrated Reading and Composition (CIRC) Learning Model. *Journal of Mathematics Teacher Education*, 4.
- Cahyani, E. P., Hendriana, H., & Sugandi, A. I. (2025). *Development of Canva-Assisted Media Using the CIRC Learning Model for Visual Groups of Junior High School Students*. 10(1), 34–47.
- Daroczy, G., Wolska, M., Meurers, D., & Nuerk, H.-C. (2021). Word problems: A review of linguistic and numerical complexity and their relation to mathematical performance. *Educational Psychology Review*, 543–579. <https://doi.org/https://doi.org/10.1007/s10648-020-09574-8>
- Dewi, I., & Harahap, M. S. (2016). The Development of Geometry Teaching Materials Based on Constructivism to Improve Students' Mathematical Reasoning Ability through Cooperative Learning (Jigsaw) in Grade 8 at SMP Negeri 3 Padangsidempuan. *Journal of Education and Practice*, 7(29), 68–82.
- Enstein, J., Bulu, V. R., & Nahak, R. L. (2022). Development of Educational Game Learning Media on Exponents and Roots using Genially. *Jurnal Jendela Pendidikan*, 2 (01), 101–109. <https://doi.org/10.57008/jjp.v2i01.150>
- Fitriana, I. A. (2023). Cooperative Integrated Reading and Composition (CIRC) Learning: Implications for Mathematical Problem-Solving Skills. *Journal of Mathematics Education*.
- Fransiska, N., Nursit, I., & Khairunnisa, G. (2022). The Effectiveness of the Metaphorical Thinking Approach on Problem-Solving Skills and Mathematical Resilience in Quadrilaterals at SMP Islam Ma'arif 02 Malang. *Journal of Research, Education, and Teaching*, 17.

- Hajar, S. S., Sofyan, S., & Amalia, R. (2021). Analysis of Students' Mathematical Reasoning Abilities in Solving Open-Ended Problems from the Perspective of Emotional Intelligence. *Journal of Realistic Mathematics*, 2 (2), 32–36. <https://doi.org/10.33365/ji-mr.v2i2.1413>
- Hamidi, F., Soleymani, S., Dazy, S., & Meshkat, M. (2022). Teaching mathematics based on integrating reading strategies and working memory in elementary school. *Athens Journal of Sciences*.
- Hapsari, G. P. P., & Zulherman, Z. (2021). Development of Animated Video Media Based on the Canva Application to Hapsari, G. P. P., & Zulherman, Z. (2021). Development of Animated Video Media Based on the Canva Application to Improve Student Motivation and Learning Achievement. *Basicedu Journal*, 5(4), 2384–2394. Men. *Basicedu Journal*, 5(4), 2384–2394.
- Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). *Hard Skills and Soft Skills*. PT Refika Aditama.
- Laras Asih, E. S., & Dewi, N. R. (2026). THEORETICAL STUDY: A CANVA-BASED LEARNING WEBSITE USING THE PREPROSPEC MODEL SUPPORTED BY ICT-STEM TO ENHANCE SKILLS. *Journal of Mathematics Education*, 5, 406–418.
- Latifah1, A. T., Supratman, M., & Rahayu, D. (2024). Canva-Based Digital Comics to Improve Proportional Reasoning Skills of Junior High School Students. *Jurnal Pedagogik*, 7(1), 107–118.
- Marasabessy, R., Hasanah, A., & Juandi, D. (2021). Curved-Surface Geometric Shapes and Their Problems in Mathematics Education: A Literature Review. *Journal of Mathematics Education*, 4.
- Marlina, E. (2019). Enhancing Linguistic Intelligence in Mathematics Learning Through Cooperative Integrated Reading and Composition (CIRC). *METAMORFOSIS | Journal of Language, Indonesian Literature, and Their Teaching*, 12 (2), 12–16. <https://doi.org/10.55222/metamorfosis.v12i2.224>
- Mukuka, A., Balimuttajjo, S., & Mutarutinya, V. (2023). Teacher efforts toward the development of students' mathematical reasoning skills. *Heliyon*, 9 (4), e14789. <https://doi.org/10.1016/j.heliyon.2023.e14789>
- Mukuka, A., & Tatira, B. (2025). *A Review of the Implementation of Technology-Enhanced Heutagogy in Mathematics Teacher Education*.
- Nurkhodijah, S., & Abadi, A. (2025). The Relationship Between Mathematical Resilience and Students' Mathematical Thinking Skills. *Journal of Mathematics and Science Education*, 5 , 977–984. <https://doi.org/https://doi.org/10.53299/jagomipa.v5i3.1873>
- OECD. (2023). PISA 2022 Results: The state of learning and equity in education. *OECD Publishing*, 1 . <https://doi.org/https://doi.org/10.1787/53f23881-en>
- Rahmi, Y., & Marnola, I. (2020). Improving Students' Reading Comprehension Skills Through the Cooperative Integrated Reading and Composition (CIRC) Learning Model. *Jurnal Basicedu*, 4 (3), 662–672. <https://doi.org/10.31004/basicedu.v4i3.406>
- Richardo, E. Y., & Kholifah, S. (2023). Improving Mathematical Reasoning Skills and Learning Interest through the Wordwall Educational Game. *Journal of Educational Review and Research*, 6(2), 161–169.
- Rosyid, A., Nuraeni, Z., Apriati, A., Kuningan, S. M., Murtasiah, J., & No, S. (2018). *Analysis of the Improvement in Mathematical Reasoning Ability through the Application of the*

- Problem-Posing Learning Model Based on Students' Initial Mathematical Ability*. 3, 11–22.
- Saleh, M., Prahmana, R. C. I., Isa, M., & Murni. (2018). Improving the Reasoning Ability of Elementary School Students Through the Indonesian Realistic Mathematics Education. *Journal on Mathematics Education*, 9, 41–53. <https://doi.org/https://doi.org/10.22342/jme>
- Santoso, H. A., Istiqomah, N. R., & Santoso, D. (2022). Using Canva to Create Visual Materials in Mathematics Education. *Journal of Mathematical Pedagogy (JOMP)*, 3(2), 114–120. <https://doi.org/https://doi.org/10.26740/jomp.v3n2.p114-12>
- Saputra, A. G., Rahmawati, T., Andrew, B., & Amri, Y. (2022). Using the Canva Application for Elementary School Learning Media. *Sciencetchno: Journal of Science and Technology*, 1 (1), 46–57. <https://doi.org/10.55849/sciencetchno.v1i1.4>
- Septiyawati Putri, D. N., Islamiah, F., Andini, T., & Marini, A. (2022). Analysis of the Effect of Interactive Media-Based Learning on Elementary School Students' Learning Outcomes. *Elementary Education and Social Humanities*, 2(2), 367.
- Sugiyono. (2024). *Quantitative, Qualitative, and R&D Research Methods*. ALFABETA.
- Sumarmo, U., Hendriana, H., Ahmad, & Yuliani, A. (2019). *Mathematics Tests and Scales*.
- Syafitri, T. R., & Sujannah, W. D. (2024). The Effect of Genially on Students' Reading Skills. *Seattle PI Education Website*, 7 (2), 150–154. <http://education.seattlepi.com/effect-plagiarism-students-1195.html>
- Thompson, P. W., Hatfield, N. J., Yoon, H., Joshua, S., & Byerley, C. (2017). Covariational reasoning among U.S. and South Korean secondary mathematics teachers. *Journal of Mathematical Behavior*, 95–111. <https://doi.org/https://doi.org/10.1016/j.jmathb.2017.08.001>
- Thuneberg, H. M., Salmi, H. S., & Bogner, F. X. (2018). How Creativity, Autonomy, and Visual Reasoning Contribute to Cognitive Learning in a STEAM Hands-On Inquiry-Based Math Module. *Thinking Skills and Creativity*. <https://doi.org/https://doi.org/10.1016/j.tsc.2018.07.003>
- Triasari, I., Susanti, R., & Raharjo, M. (2022). *Electronic development of student worksheets (E-LKPD) in 11th-grade coordination*.
- Vidia, H., & Suswanto, H. (2017). Development of Web-Based Learning Media to Measure Student Learning Outcomes in the Basic Computer Networking Subject of the Computer and Networking Engineering Program. *Journal of Education: Theory, Research, and Development*, 2.
- Wardani, I. R., Putri Zuani, M. I., & Kholis, N. (2023). Lev Vygotsky's theory of cognitive development and its implications for learning. *Journal of Islamic Education*, 4.