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Development of a Learning Tool Using the Cooperative Integrated Reading and Composition (CIRC) Model Based on Thunkable

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Abstract

This study aims to develop a Thunkable-based cooperative, integrated reading and composition (CIRC) model for mathematics instructional development in Unimed's PGSD program. Classroom observations revealed that current teaching practices inadequately engage students in fostering reading interest and substantive discussions for mathematical understanding. The study seeks to enhance pedagogical practices by integrating reading diversification through a Thunkable-based instructional framework. The research's overarching objective is to craft a CIRC-guided learning apparatus, utilizing Thunkable for the mathematics instructional development course in Unimed's PGSD program. Following Sugiyono's four-D model, the study employs a Research and Development approach encompassing the Define, Design, Develop, and Disseminate stages. Anticipated outcomes include obligatory deliverables like a comprehensive report, indexed proceedings publication, research proposal copyright, and publication in an accredited national journal. Supplementary outputs comprise an ISBN-endowed book, potential copyright or patent, and international journal publication. This research advances mathematics pedagogy within Unimed's PGSD program by integrating cooperative learning and technology-enhanced reading practices via Thunkable. Such an approach aligns with the progressive paradigm of educational development, fostering a conducive environment for comprehensive learning experiences and meaningful academic discourse.

Keywords

Cooperative Integrated Reading and Composition (CIRC) Model; Thunkable-based Instructional Framework; Mathematics Pedagogy Enhancement

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1. INTRODUCTION

The attainment of these skills often takes place after students have completed their collegiate coursework (Bettinger et al., 2013; Burrus et al., 2013). Educators should ideally enrich the everyday teaching process through various innovative approaches and models that consider the students' characteristics to produce well-rounded, resilient, and forward-ready higher education graduates (Kim, 2020). Instilling concepts in students should be undertaken using diverse methods and approaches. One strategy involves engaging students in group discussions to uncover answers and concepts for the issues at hand collaboratively through reading activities (Kazemi & Stipek, 2009). Regrettably, based on the observations conducted thus far, students' interest in reading remains notably low. This deficiency is evident from the limited number of students who engage in reading and discussions during their leisure time (Lee & Wong, 2017; Ryan & Viete, 2009).

Within UNIMED's Faculty of Education, as part of the Primary School Teacher Education Program, a course holds particular significance - the Mathematics Instructional Development course. Upon completing this course, students are expected to possess experience and skills in designing instructional processes, crafting necessary teaching aids, and facilitating engaging and appealing teaching methods suitable for elementary school students, in addition to a profound understanding of numerical and algebraic concepts (Ritzhaupt & Kumar, 2015). However, the actual classroom activities conducted during the coursework have yet to adequately address real-world problem-solving scenarios, such as the challenges faced by primary school mathematics educators (Asempapa & Sturgill, 2019). Presently, coursework focuses predominantly on discussions of numerical and algebraic material alone. Given this reality, this issue remains the central focus of the present study (Sheldon, 2020).

The pedagogical model, cooperative Integrated Reading, and Composition (CIRC), implemented through the Thunkable platform, embodies a collaborative learning approach (Asrifan & Raskova, 2021). This CIRC cooperative learning model was initially developed by Robert E. Slavin (Slavin, 1988). According to several studies, this cooperative learning model tends to yield more effective learning outcomes than other models due to its dual emphasis on motivational and cognitive perspectives (Järvelä & Järvenoja, 2011). As noted by Laurens et al., implementing the CIRC cooperative learning model can serve as an alternative method for teaching mathematics in classrooms, offering a refreshing change from conventional approaches (Laurens et al., 2017). This approach has demonstrated the ability to enhance student learning outcomes. Digital tools, as highlighted by Clark and Mayer (2016), positively impact student engagement. Thunkable, a user-friendly mobile app development platform, provides opportunities for interactive and customized learning experiences, aligning with the technology trend in education (Clark & Mayer, 2016). Thunkable's user-friendly interface allows educators and learners to create mobile apps without extensive programming knowledge (Hussey & Smith, 2019). Its visual drag-and-drop features make it versatile for developing interactive and engaging educational applications**.** Digital environments have transformed collaborative learning, as discussed by Dillenbourg (Dillenbourg, 1999). Computer-supported collaborative learning (CSCL) allows students to engage in cooperative activities. Integrating CIRC principles into a digital tool aligns with the goals of CSCL, enhancing collaborative reading and composition.

Given the paradigm shift and challenges the pandemic poses, using E-Books presents a viable solution for teaching the Mathematics Instructional Development course (Budiarto et al., 2022). We anticipate an enhancement in student learning outcomes by integrating E-Books with the Cooperative Integrated Reading and Composition (CIRC) cooperative learning model on the Thunkable platform. This improvement is expected to arise from more engaging reading activities and increased peer collaborative efforts.

Cooperative Learning

Suherman asserts that cooperative learning aligns with the inherently social nature of humans, who are inherently interdependent and share common goals and responsibilities (Suherman, 2016). By leveraging this reality, students are trained and accustomed to sharing knowledge, experiences, tasks, and responsibilities. They aid each other and practice interacting, communicating, and socializing, as cooperative learning mirrors the intricacies of communal life and promotes an awareness of individual strengths and weaknesses (Gay, 2002). Thus, cooperative learning is a group-based learning model where students collaboratively construct concepts and resolve problems.

Ibrahim expounds that cooperative learning manifests as group-based learning, where two or more individuals depend on each other to achieve a shared objective (Ibrahim et al., 2019). Students believe their goals will only be realized if their peers accomplish the same objectives. As a result, each group member assumes responsibility for the group's success. Students in cooperative situations are motivated to collaborate on collective tasks, necessitating coordinated efforts to complete assignments. Ibrahim outlines the key characteristics of the cooperative learning model as follows:

a. To facilitate students in comprehensively mastering the learning materials through cooperative learning.

b. Groups are formed from students with high, moderate, and low proficiency levels.

c. In cases where the class comprises students from diverse races, ethnicities, cultures, and genders, an effort is made to ensure each group represents a variety of races, ethnicities, cultures, and genders.

d. Emphasis is placed on valuing group work over individual efforts (Ibrahim et al., 2019).

The Cooperative Integrated Reading and Composition Instructional Model

The Cooperative Integrated Reading and Composition (CIRC) instructional model based on the Thunkable platform is a cooperative learning model. Robert E. Slavin initially developed this cooperative CIRC learning model. Based on several studies, this cooperative learning model has been shown to provide more extensive learning outcomes than other models. This is because cooperative learning is built upon two main theoretical perspectives: motivational and cognitive perspectives (Öztop et al., 2012). According to Slavin, the CIRC model was initially implemented in language lessons. In small groups, students are provided with a text or reading material. Then, they practice reading or reading together, understand the main ideas, revise, and write summaries or provide responses to the text. According to Slavin, CIRC has several key elements, including group or team, discourse presentation, activities related to discourse (paired reading, problem identification, keyword identification), peer review, direct teaching in discourse comprehension, and assessment (Slavin, 2008).

The CIRC model is a teaching technique that utilizes discourse or text where students are divided into pairs for reading and summarization tasks. One student takes on the role of speaker/presenter while the partner listens to the summarized results. This is done alternately, with the initial speaker exchanging roles as a listener (Latifa & Haryadi, 2022). Septian revealed that the CIRC model is designed to aid students in comprehensively developing their reading and writing skills (Septian, 2022). Furthermore, learning using the CIRC model emphasizes teamwork in mastering reading comprehension skills.

According to Rahmi and Marnola (2020), CIRC, short for Cooperative Integrated Reading and Composition, is a cooperative learning model that seamlessly integrates reading materials and assembles them into essential components (Rahmi & Marnola, 2020). In essence, the CIRC model represents a collaborative learning approach where groups of four students participate in a series of activities together. These activities encompass reading to one another, making predictions about narrative stories, generating summaries, composing responses to stories, practicing spelling, and expanding vocabulary (Anifah et al., 2023).

Wang et al. contend that the steps of the CIRC model can be applied across its implementation phases as follows:

a. The first phase is orientation. In this stage, the teacher shows appreciation for and assesses students' initial knowledge of the upcoming material. Additionally, the learning objectives are presented to the students.

b. The second phase is organization. The teacher divides students into groups, considering academic heterogeneity. Once grouped, the teacher provides reading materials relevant to the topic. The teacher also explains the group discussion mechanism and tasks to be completed during the learning process.

c. The third phase is concept introduction. A new concept is introduced, aligned with the group learning process. During this phase, students are assigned to read the provided materials. Each group member must identify core issues within the reading and critically analyze the content. Group members engage in argumentation to ensure the accuracy and substantiation of their criticisms.

d. The fourth phase is publication. Students communicate their findings and present them in front of the class. Other groups must provide feedback on the ongoing group discussion by critiquing the opinions and criticisms presented.

e. The fifth phase is reinforcement and reflection. In this stage, the teacher reinforces the material studied through explanations and real-life examples. Subsequently, students are allowed to reflect on and evaluate their learning outcomes (Wang et al., 2020).

Thunkable

Thunkable is an open-source Integrated Development Environment (IDE) or tool, similar to another example known as App Inventor. In times like these, Thunkable is the sole provider for creating applications across various mobile platforms, including Android and iOS, catering to the needs of programmers and mobile developers (Ayres et al., 2020). However, this tool operates on a block programming system. In essence, manual coding for Android application development is rendered unnecessary.

Thunkable is accessible for anyone to use free of charge, offering a convenient and efficient solution for crafting Android applications without the need for extensive time or complexity. No specific requirements are imposed for Thunkable registration; a Google Account is all that's required to access this tool.

Thunkable is a web-based application used to design smartphone applications for both Android and iOS operating systems. The design process for Android and iOS applications on Thunkable employs a visual programming concept, utilizing a drag-and-drop approach. The visual programming language employed is Scratch (Raharjo, 2019). The resulting applications provide audio and visual representations of various animals, presented through images and videos.

The research problem in this study revolves around assessing the impact of implementing a Learning Tool that incorporates the Cooperative Integrated Reading and Composition (CIRC) Instructional Model. Developed on the Thunkable platform, this tool is specifically applied within the context of the Mathematics Instructional Development course in the PGSD Program at Unimed. Three key research questions drive the study. Firstly, it aims to determine the validity of the Learning Tool employing the CIRC Instructional Model and Thunkable for Unimed's Mathematics Instructional Development course. Secondly, the research explores the practicality of using this Learning Tool within the same course. Lastly, the study seeks to evaluate the overall effectiveness of the Learning Tool in enhancing the learning experience in the Mathematics Instructional Development course within the PGSD Program at Unimed. These questions collectively guide the investigation into the feasibility and impact of integrating this innovative approach into the educational framework.

2. METHODS

This investigation was carried out within the Department of Primary School Teacher Education at Unimed's Faculty of Education, involving students in their second semester during the academic year 2022/2023. The research spanned nine months, from February to October 2023, and adopted a developmental approach, Research and Development, employing the 4D model. As delineated by

Sugiyono, the four-D model consists of four primary stages: 1) Define, 2) Design, 3) Develop, and 4) Disseminate. The developmental process in this study comprised the following phases (Sugiyono, 2013):

a. Definition Phase

In this stage, three distinct activities unfold, encompassing curriculum analysis, concept exploration, and student assessment:

1) Curriculum analysis entails scrutinizing the course's learning objectives through the lens of the National Qualifications Framework.
2) Concept exploration is undertaken to identify the fundamental concepts students should grasp in the Mathematics Instructional Development Course.
3) Student assessment is conducted to comprehend the various facets of the students, including age, motivation, diverse knowledge and educational backgrounds, academic aptitude, and social skills.

b. Design Phase

This phase aims to craft a Learning Tool employing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable specifically tailored for the Mathematics Instructional Development Course. Leveraging the insights gained from the earlier Concept Analysis Phase, instructional materials are meticulously crafted. These encompass the Semester Learning Plan (SLP), Lesson Plan (LP), Student Activity Sheet (SAS), and Assessment Instruments.

c. Development Phase

This phase is dedicated to crafting a Learning Tool that leverages the Cooperative Integrated Reading and Composition (CIRC) instructional model through the Thunkable platform, specifically tailored for the Mathematics Instructional Development course within the PGSD program based on Thunkable. The development stage comprehensively examines validation, practicality, and effectiveness. Validation entails subjecting the Learning Tool, integrated with the Cooperative Integrated Reading and Composition (CIRC) instructional model on the Thunkable platform, to expert evaluation, drawing on their respective areas of expertise. Concurrently, practicality implies that post-validation, adjustments are made, followed by classroom trials to assess its applicability in teaching. Practicality refers to the Learning Tool's degree of usability and feasibility, employing the Cooperative Integrated Reading and Composition (CIRC) instructional model via the Thunkable platform in the teaching process. Effectiveness pertains to evaluating the efficiency of the Learning Tool in utilizing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on the Thunkable platform, encompassing cognitive assessments of student outcomes.

d. Dissemination Phase

The Dissemination Phase seeks to advance the acceptance of the developed product among a broader spectrum of users, be they individuals, groups, or systems. This stage involves the widespread distribution of the product to reach a more extensive audience. Essentially, the developmental process can be succinctly captured through the flowchart diagram depicted below:

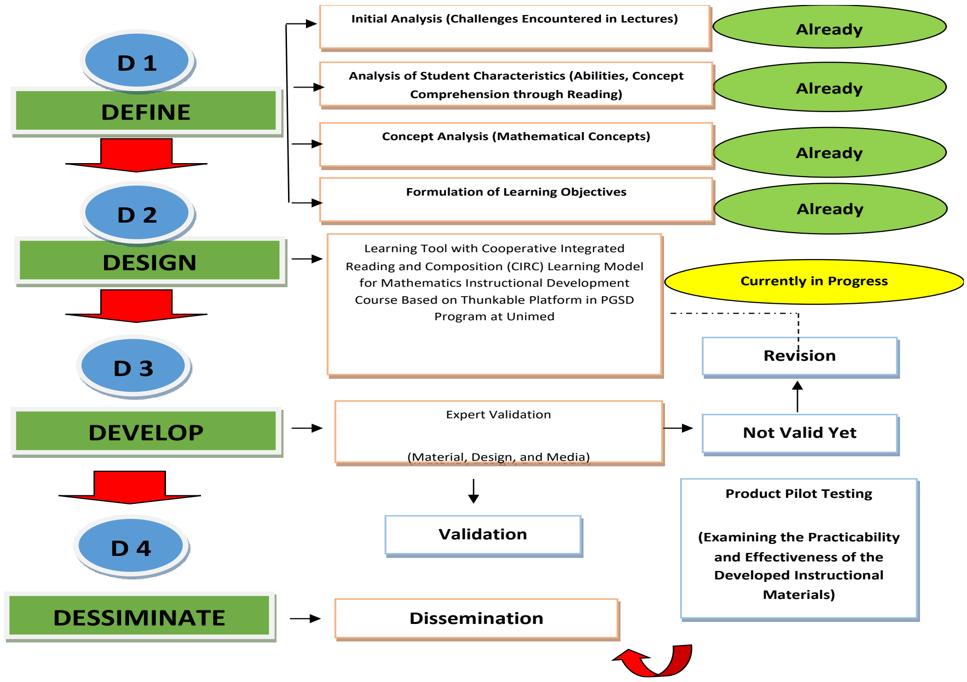

Figure 1. Procedure for Developing Instructional Materials Using the Cooperative Integrated Reading and Composition (CIRC) Learning Model Based on Thunkable for the Course "Mathematics Teaching Development" in the Thunkable-based PGSD Program at Unimed.

3. FINDINGS AND DISCUSSIONS

Initial Product Development Description

The initiation of this developmental research involves conducting a needs analysis through the dissemination of questionnaires. The results of this analysis strongly indicate the essentiality of a learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable within the learners' environment (Parandekar et al., 2019). This tool is designed to aid students in grasping the intricacies of mathematics education by incorporating stimuli derived from personal experiences.

Building upon the insights gleaned from the needs analysis, it is clear that there is a pronounced demand for a learning tool employing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable, not only from students but also from educators actively involved in the classroom learning process.

After acquiring data on the learning needs, the subsequent phase encompasses a series of processes to develop the learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable. This encompasses the intricate steps of designing and developing the learning tool. The resultant product of this developmental endeavor, the learning tool employing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable, encapsulates various elements, including the instructional material.

The material presented in the learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable entails the integration of mathematical calculations into everyday life. The content provided serves as supporting material containing core subjects comprehensively related to the development of mathematics education. The in-depth exploration of the material in this learning tool differs from the norm, as it presents engaging visuals and colors and ensures that each problem discussion within the material reflects local culture (Hora &

Holden, 2013). This approach makes the delivery of material flexible and easy to comprehend. Consequently, it is expected to encourage more questions, enabling participants to discover and share their creative ideas, strategies, and information while fostering an open space for sharing experiences related to mathematics education material.

Once the initial product of the learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) instructional model based on Thunkable is developed, the subsequent phase involves conducting Phase I evaluation, which entails validating the tool with experts in instructional content, instructional design, and tool design. The objective is to generate a product deemed suitable for utilization. The outcomes from each validator are then analyzed, and the product undergoes its first round of revisions.

Subsequently, Phase II evaluation ensues, encompassing the following steps: (1) individual testing, (2) analysis of individual testing results, (3) second round of revisions, (4) small-group testing, field testing (large-group), (5) analysis of field-testing outcomes, and (6) finalizing the product, followed by a feasibility assessment of the product.

Description of Product Testing Results Data

The findings stemming from the evaluation data in Phase I, validated by experts in instructional content, instructional design, and language, are elucidated as follows:

a. Results of Validation by Instructional Content Experts

The instructional content experts' validation concerning the Learning Tool's development utilizing the Cooperative Integrated Reading and Composition (CIRC) model based on Thunkable was administered by Mr. Mulyono, a lecturer at the Postgraduate Program of Universitas Negeri Medan. This assessment aimed to glean insights for refining and augmenting the quality of the Learning Tool utilizing the Cooperative Integrated Reading and Composition (CIRC) model based on Thunkable. The validation outcomes encompass evaluation scores addressing various facets of the mathematics learning materials, encompassing content appropriateness, presentation adequacy, feedback, recommendations for enhancement, and conclusions. These findings are detailed in the following table:

Table 1. Score of the Learning Tool using the Cooperative Integrated Reading and Composition (CIRC) model based on thinkable by the instructional content expert

Assessment Indicators		Item Assessment	Assessment			
			1	**2**	**3**	**4**
			K	**C**	**B**	**SB**
Relevance of Content	1.	Material comprehensiveness			√	
	2.	Material coverage			√	
	3.	Material depth			√	
Accuracy of Content	1.	Concept and definition accuracy				√
	2.	Data and facts accuracy				√
	3.	Example and case accuracy			√	
	4.	Image, diagram, and illustration accuracy				√
	5.	Terminology accuracy				√
Currency of Content	1.	Relevance of everyday life images, diagrams, and illustrations				√
	2.	Use of everyday life examples and cases			√	
Fostering Curiosity	1.	Promoting curiosity			√	
	2.	Encouraging questioning skills			√	
Total			85,42			
Validity Classification Valid			Valid			

From the data in the table above, it is apparent that the assessment results provided by the instructional material expert indicate an overall achievement score of 85.42 for content appropriateness and presentation suitability. This falls within the "Very Good" category, with the range falling between 85 and 100 in the achievement score level. The evaluation yielded valuable feedback, including suggestions such as specifying learning outcomes for each inclusion of material, providing methods or examples before presenting questions to ensure student comprehension of problem-solving techniques, restructuring the representation of units for length and weight in the activity involving formulas, refining the phrasing of each question, and adjusting them based on the discussion outcomes. In summary, the instructional material expert's assessment, comments, and recommendations collectively suggest that the Instructional material utilizing the Cooperative Integrated Reading and Composition (CIRC) learning model based on Thunkable is deemed suitable for field testing with certain revisions.

b. Data from the Validation of Instructional Design Expert

The expert validation for the instructional design of the material utilizing the Cooperative Integrated Reading and Composition (CIRC) model on Thunkable was overseen by Dr. Daulat Saragi, M. Hum, a faculty member in the Graduate Program at Universitas Negeri Medan. This comprehensive assessment covered diverse aspects, including visual appeal, appropriateness of design implementation, format compatibility, alignment with target characteristics, clarity of instructional components, lucidity of content presentation, and unity of assessments with the material's content:

Table 2. Assessment Score of the Instructional Material Utilizing the Cooperative Integrated Reading and Composition (CIRC) Model Based on Thunkable by the Instructional Design Expert

Assessment Indicators	Item of Assessment	Assessment			
		1	**2**	**3**	**4**
		K	**C**	**B**	**SB**
Clarity of the intended objectives	1. Appropriate font type				√
	2. Clear and well-organized text				√
	3. The text on the Material is legible.				√
Completeness of information	1. Sentences are well-structured				√
	2. Accuracy in choosing the text			√	
Sequence of presentation	1. Logical sequence of concepts				√
	2. Availability of example problems in each learning activity				√
Appealing qualities	1. Engaging content			√	
	2. Use of cover			√	
	3. Appealing color combinations				√
	4. Attractive visual design				√
Interaction (Stimulus and response)	1. Student Engagement				√
	2. Appropriateness of illustration images with the concept				√
Total		94,23			
Validity Classification Valid		Valid			

The assessment conducted by the instructional design expert, covering elements such as visual appeal, precise design implementation, format alignment, content harmonization with target characteristics, clarity of media instructions, lucidity of content presentation, and alignment of evaluations with the content, yields the following conclusion: The achieved score of 94.23 falls within the "Very Good" category, within the range of 85–100. The assessment results for the instructional design of the Learning Tool utilizing the Cooperative Integrated Reading and Composition (CIRC) model on Thunkable garnered specific feedback, including the need for title improvement on the cover and adjustments to the image positioning in sections containing images. Considering the assessment, comments, and recommendations by the instructional design expert, it is concluded that the Learning

Tool with the Cooperative Integrated Reading and Composition (CIRC) model based on Thunkable is suitable for field testing with some revisions.

c. Data from Expert Validation on Language Proficiency

Language validation by Dr. Wisman Hadi, S.Pd., M.Hum, a faculty member in the Graduate Program at Universitas Negeri Medan, was conducted to assess the development of the Learning Tool with the Cooperative Integrated Reading And Composition (CIRC) Model based on the Thunkable. The evaluation, encompassing all aspects outlined in the language expert's validation sheet, is detailed in the table below, derived from the assessment instruments provided to the language expert:

Table 3. Assessment Score of the Learning Tool with the Cooperative Integrated Reading and Composition (CIRC) Model Based on Thunkable by the Language Expert

Assessment Indicators	**Item of Assessment**	**Assessment**			
		1	**2**	**3**	**4**
		K	**C**	**B**	**SB**
Clarity	1. Precision of sentence structure				√
	2. Effectiveness of sentences				√
	3. Accuracy of terminology				√
Communicative	1. Comprehension of message or information			√	
Dialogic and Interactive	1. Ability to motivate students				√
Suitability with Student Development	1. Alignment with students' intellectual development				√
	2. Alignment with students' emotional development			√	
Suitability with Language Norms	1. Grammar accuracy				√
	2. Spelling accuracy				√
Average		94,44			
Validity Classification		VALID			

The analysis of the table above allows us to derive the following conclusion regarding the assessment results provided by the language design expert, who scrutinized the language application in developing the instructional tool using the Cooperative Integrated Reading And Composition (CIRC) model on Thunkable: the comprehensive achievement score from the language expert stands at 94.44, aligning within the score range of 85-100, denoted as "Excellent."

Based on the validation of the above outcomes, the design, language, and content integrated into the development of the instructional tool using the Cooperative Integrated Reading and Composition (CIRC) model on Thunkable have all successfully withstood scrutiny from experts in their respective domains. The validation was executed using scoring criteria ranging from the highest score of 4 to the lowest score of 1. Products scoring below 75 are deemed unfit for testing. Testing is permissible with revisions if the score falls within 75-85. Achieving a category score of 85-100 allows the product to proceed to testing. Notably, all three categories of the instructional tool—design, language, and content—have garnered exceptionally high scores, rendering them well-suited for testing.

Expert Analysis

Drawing on evaluations from various experts, encompassing instructional material, design, and language, each validator provided scores, achievement levels, comments, and recommendations for the completed initial product. These insights were subsequently scrutinized to gauge the viability of developing a learning tool based on the Cooperative Integrated Reading and Composition (CIRC) model using the Thunkable platform.

The instructional material expert appraised the CIRC model-based learning tool, yielding an impressive average percentage score of 85.42%, meriting the classification of "excellent." This outcome signifies the tool's capability to address the learning needs effectively. Both the language and design experts concurred that the overall expert assessments for developing the CIRC model-based learning tool warranted a classification of "Very Good." Consequently, the consensus is that the CIRC model-based learning tool is ready for field testing, albeit with some revisions.

Pilot Testing Phase I

A group of 25 participants took part in the initial trial. The primary objective of Trial I was to pinpoint any potential deficiencies in the product. The assessments and feedback collected during this trial were intended to offer constructive criticism and suggestions regarding the presentation of the developed learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) model on the Thunkable platform. This evaluation covered both the realms of media design and content presentation.

Analysis of Trial I Proficiency

a. Calculating Proficiency

The proficiency of Trial I can be calculated using the following formula:

$K = \frac{T}{T_1} x\ 100\%$

Where:

K = Proficiency

T = Total score obtained

T_1 = Maximum possible score

Criteria: 0% ≤ K < 70% Not proficient

70% ≤ K ≤ 100% Proficient

Based on the proficiency criteria of Trial I, learning outcomes are developed based on students' abilities. The percentages are classified into proficiency categories.

Table 4. Results of Proficiency Trial I

No	Name	Score (X)	K	Outcome
1	A1	65	65	BT
2	A2	75	75	T
3	A3	75	75	T
4	A4	60	60	BT
5	A5	80	80	T
6	A6	80	80	T
7	A7	85	85	T
8	A8	60	60	BT
9	A9	75	75	T
10	A10	65	65	BT
11	A11	80	80	T
12	A12	75	75	T
13	A13	60	60	BT
14	A14	65	65	BT
15	A15	50	50	BT
16	A16	90	90	T

No	Name	Score (X)	K	Outcome
17	A17	60	60	BT
18	A18	75	75	T
19	A19	60	60	BT
20	A20	75	75	T
21	A21	80	80	T
22	A22	80	80	T
23	A23	55	55	BT
24	A24	70	70	T
25	A25	70	70	T
Total		**1765**	**1765**	
Mean		**71**	**71**	
Standard Deviation		**10,137**	**10,137**	
Variance		**102,75**	**102,75**	

Based on the data of learning completeness from Trial I, which was assessed based on the student's abilities, it can be observed that out of 25 participants, ten individuals did not achieve the required level of completeness, "Not Sufficient." In contrast, 15 individuals have successfully reached the level of completeness "Sufficient."

b. Calculating Learning Mastery in Trial I

The students' learning mastery in Trial I can be calculated using the following formula:

$$PKK = \frac{Number\ of\ Students\ who\ Achieved\ Mastery}{Total\ Number\ of\ Research\ SubjectsBanyak\ subjek\ penelitian} x\ 100\%$$

$$PKK = \frac{15}{25} x\ 100\%$$

PKK = 60%

Analyzing the provided data shows that 60% of students have attained a mastery level of KB ≥ 70%. Following an examination of mastery in individual and class-wide learning processes, the pre-test and post-test results were computed using gain scores.

Table 5. Results of Pre-Test and Post-Test for Trial I

Pre-test			Post-test			Ket
Score (X)	**Frequency (F)**	**X*F**	**Score (X)**	**Frequency (F)**	**X*F**	
40	1	40	50	1	50	BT
45	3	135	55	1	55	BT
50	3	150	60	5	300	BT
55	2	110	65	3	195	BT
60	4	240	70	2	140	BT
65	3	195	75	6	450	T
70	3	210	80	5	400	T
75	5	375	85	1	85	T
80	1	80	90	1	90	T
Total		**1535**	**Total**		**1765**	
Mean		**61**	**Mean**		**71**	
Standard Deviation		**13,7**	**Standard Deviation**		**13,7**	

For a clearer understanding of the pre-test and post-test results, please refer to the figure below:

$$g = \frac{s_{Post} - s_{Pretest}}{Maximum\,Score - s_{Pretest}}$$

$$g = \frac{71 - 61}{100 - 61}$$

g = 0,26

Criteria:

0,70 < gs ≤ 1,00 High

0,30 < gs ≤ 0,70 Moderate

0,00 < gs ≤ 0,30 Low

A result of 0.26 was obtained based on the gain score, indicating that the gain score for Trial I with 25 participants falls into the "Low" category.

Analysis of the Effectiveness of the Learning Tool with Cooperative Integrated Reading And Composition (CIRC) Model Based on Thunkable

Assessing the Efficacy of the Learning Tool with Cooperative Integrated Reading and Composition (CIRC) Model Based on Thunkable entails examining 1) learning achievement or mastery and 2) student feedback regarding the effectiveness of developing the Learning Tool with Cooperative Integrated Reading and Composition (CIRC) Model Based on Thunkable. Achievement in this context is deemed accomplished when both indicators are satisfied.

Analysis of Student Learning Mastery in Trial II

The test results obtained by the researcher are analyzed to assess the learning mastery in Trial II.

a. Calculating Student Learning Mastery in Trial II

Student learning mastery in Trial II can be calculated using the following formula:

$K = \frac{T}{T_1} x\ 100\%$

Where:

K = Learning Mastery

T = Total score obtained

T_1 = Total possible score

Criteria:

0% ≤ K < 70% not proficient

70% ≤ KB ≤ 100% proficient

Based on the learning mastery criteria in Trial II, which is organized according to student abilities, it is classified into proficiency criteria as follows:

Table 6. Individual Proficiency Results of Trial II

No	Name	Score (X)	K	Outcome
1	A1	95	95	T
2	A2	95	95	T
3	A3	95	95	T
4	A4	90	90	T
5	A5	85	85	T
6	A6	95	95	T

No	Name	Score (X)	K	Outcome
7	A7	95	95	T
8	A8	95	95	T
9	A9	95	95	T
10	A10	95	95	T
11	A11	95	95	T
12	A12	80	80	T
13	A13	70	70	T
14	A14	95	95	T
15	A15	70	70	T
16	A16	75	75	T
17	A17	95	95	T
18	A18	65	65	BT
19	A19	95	95	T
20	A20	95	95	T
21	A21	95	95	T
22	A22	95	95	T
23	A23	95	95	T
24	A24	95	95	T
25	A25	100	100	T
Total		**2250**	**2250**	
Mean		**90**	**90**	
Standard Deviation		**9,79**	**9,79**	
Variance		**95,83**	**95,83**	

Based on the individual proficiency data according to students' abilities, it is known that there is one student who is "not proficient" and 24 students who are "proficient."

b. Calculating Proficiency Trial II

Proficiency of trial II can be calculated using the following formula:

PKK = $\frac{Number\ of\ Proficient}{Total\ Subjects} x$ 100%

PKK = $\frac{23}{25}$ x 100%

PKK = 96%

From the above classical proficiency data, 96% of students have demonstrated proficiency (K) at ≥ 70%. Following an analysis of individual and collective proficiency, the pre-test and post-test results are computed using the normalized gain score formula. This calculation serves to evaluate the score improvements and the effectiveness of the instructional tool developed based on the Cooperative Integrated Reading and Composition (CIRC) Cooperative Learning Model, both before and after its implementation:

Table 7. Results of Pre-Test and Post-Test for Trial II

Pre-test			Post-test			Ket
Score (X)	Frequency (F)	Score (X)	Frequency (F)	Score (X)	Frequency (F)	
45	1	45	65	1	65	BT
50	2	100	70	2	140	T
55	8	440	75	1	75	T
60	3	180	80	1	80	T
65	1	65	85	1	85	T
70	7	490	90	1	90	T
75	2	150	95	17	1615	T

Pre-test				Post-test		Ket
Score (X)	Frequency (F)	Score (X)	Frequency (F)	Score (X)	Frequency (F)	
80	1	80	100	1	100	T
Total		**1550**	**Total**		**2250**	
Mean		**62**	**Mean**		**90**	
Standard Deviation		**12.2**	**Standard Deviation**		**12.2**	

For a clearer understanding of the results of the pre-test and post-test in Trial II, please refer to the figure below:

$$g = \frac{S_{Post} - S_{Pretest}}{Maximum\,Score - S_{Pretest}}$$

$$g = \frac{90-62}{100-62}$$

$$g = 0{,}73$$

Criteria:

$0{,}70 < gs \leq 1{,}00$ High

$0{,}30 < gs \leq 0{,}70$ Moderate

$0{,}00 < gs \leq 0{,}30$ Low

Based on the obtained gain score of 0.73, the gain score in Trial II is classified as high.

c. Analysis of Feasibility Questionnaire

The survey conducted during the instructional process employing the learning tool developed based on the Cooperative Integrated Reading and Composition (CIRC) model through Thunkable has been effectively implemented. The outcomes derived from the questionnaire responses, involving a total of 25 student participants, after the application of the developed learning tool in the classroom, were computed using the following formula:

$$PRS = \frac{\Sigma A}{\Sigma B}$$

$$PRS = \frac{850}{1000} \times 100\%$$

$$PRS = 85\%$$

The average score for all aspects of the questionnaire items is 85%, falling under the criteria of good qualitative quality. Thus, it can be concluded that: 1) The learning tool based on the Cooperative Integrated Reading and Composition (CIRC) model with thunkable-based development is aligned with students' needs and researcher's expectations, 2) The learning tool based on the Cooperative Integrated Reading and Composition (CIRC) model with thunkable-based development has proven effective in the instructional process, particularly in mathematics lessons.

Discussion

This study falls within the category of development research aimed at determining the feasibility and effectiveness of a learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) model with a thinkable-based approach in mathematics education.

Feasibility of the Learning Tool Utilizing the Cooperative Integrated Reading and Composition (CIRC) Model with Thunkable-Based Approach

To assess the viability of the learning tool utilizing the Cooperative Integrated Reading and Composition (CIRC) model through a Thunkable-based approach, a validity test engaged subject matter experts, design experts, and language experts. Each expert contributed assessments for various indicators outlined in the instructional media validation sheet. They utilized a quantitative descriptive assessment questionnaire, expressing their evaluations through score distributions and rating scale categories.

The validity testing phase encompassed theoretical validity, involving experts proficient in their respective fields, grounded in theoretical and logical considerations. The validation process covered three primary aspects: content, design, and language. Throughout this phase, the researcher facilitated discussions with design, subject matter, and language experts, presenting the initial design of the Cooperative Integrated Reading and Composition (CIRC) model-based learning tool using Thunkable. Validation sheets were supplied to validators to elicit theoretical validation outcomes. Experts evaluated the material based on these sheets.

Subject matter experts' validation revealed a score of 84.09%, meeting valid criteria but with room for improvement, as suggested by the experts. Recommendations included refining language simplicity for enhanced comprehensibility. Following revisions, the validity percentage increased to 92.11%, signifying a highly valid status. Engaging in discussions with subject matter experts prompted revisions to the Cooperative Integrated Reading and Composition (CIRC) model-based learning tool, aligning with the input and suggestions of the validators.

In the evaluation by instructional design experts, assessments spanned content, presentation, linguistic aspects, appearance, and content, resulting in a rating of 78.57%, classifying it as a good category. Validators proposed enhancements such as improving the clarity of the cover image and enlarging image sizes for improved visibility. Post-revisions, the tool was deemed suitable for use.

Moreover, a feasibility test was conducted with Student Group I, yielding a percentage result of 81.67%. In the subsequent trial involving 25 participants in Student Group II, an impressive percentage of 88.42% was achieved, designating the tool as highly commendable and exceptionally suitable for implementation. Considering the evaluations by validators and the assessments of the learning tool's development utilizing the Cooperative Integrated Reading and Composition (CIRC) model with a Thunkable-based approach, alongside the counsel and insights from experts, the crafted learning tool is affirmed as valid and well-suited for educational purposes.

The Effectiveness of the Learning Tool Using the Cooperative Integrated Reading and Composition (CIRC) Model with Thunkable-based Approach

Evaluating the Learning Tool utilizing the Cooperative Integrated Reading and Composition (CIRC) Model with a Thunkable-based Approach assesses the degree of enhancement in students' learning outcomes. This is manifested through their pre-test and post-test scores for individual and class-wide mastery, considering the advancement in gain scores attained throughout the instructional process.

Effectiveness is measured by comparing pre-test and post-test results conducted at the beginning and conclusion of the instructional period. Examining the pre-test outcomes, involving three essay questions with a total of 15 sub-items (Table 4.18), reveals that students' initial learning performance is relatively low, averaging 71 with a standard deviation of 13.7. This assessment adheres to the established minimum proficiency criteria set at 70.

A post-test is administered upon completion of the instructional activities employing the Cooperative Integrated Reading and Composition (CIRC) Model with a Thunkable-based Approach. Post-test results indicate an average student performance of 71, with a standard deviation of 13.7. Meeting the reference minimum proficiency threshold of 70 for the mathematics subject, a significant improvement is evident, satisfying the criteria for minimal proficiency.

Analyzing the class-wide mastery data from the second trial (Trial II) in Table 4.18 reveals that the average classical learning mastery reaches 90, corresponding to a K≥ 96% attainment. When evaluating individual and class-wide learning outcomes, the pre-test and post-test results are utilized to calculate the gain score, indicating the improvement in the effectiveness of the Cooperative Integrated Reading and Composition (CIRC) Model with a Thunkable-based Approach. The computed gain score of 0.73 suggests a significant enhancement, indicating a high efficacy in student learning outcomes following the implementation of this approach.

Considering the research objectives focused on assessing the feasibility and effectiveness of the Learning Tool utilizing the Cooperative Integrated Reading and Composition (CIRC) Model with a Thunkable-based Approach, it can be concluded that it is both effective and suitable for widespread application. The data supports that the learning tool employing the cooperative, integrated reading and composition (CIRC) model with a thinkable-based approach successfully improves students' learning outcomes.

4. CONCLUSION

The research conclusions are drawn from systematically presented findings aligned with the established research objectives. Firstly, the Learning Tool, employing the Cooperative Integrated Reading and Composition (CIRC) Model with a Thunkable-based Approach, received commendable validation scores from subject matter experts (85.42%), design experts (94.23%), and language experts (94.44%). These scores categorize the tool as "very good," affirming its validity and suitability for implementation.

Secondly, the practicality of the Learning Tool is evident through increased student preference, with response rates reaching 88.1% in Trial I and a heightened 91.9% in Trial II. The consistent response rates exceeding 90% categorize the tool as "very good," recommending its use in mathematics instruction.

Lastly, the students' capabilities exhibited notable improvement, reflected in a 60% increase in Trial I and a 96% increase in Trial II. The gain scores, categorized as "low" in Trial I (0.26) and "high" in Trial II (0.73), highlight substantial improvement in learning outcomes. The tool's effectiveness is underscored by the notable gain score of 0.73, reflecting a "big" improvement in students' capabilities.

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