IMPLEMENTATION OF THE MATH CHAT BOOK IN CLASS XI MATHEMATICS LEARNING

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ABSTRACT

This study aims to describe the implementation of *The Math Chat Book* in Mathematics learning for 11th grade students. *The Math Chat Book* is designed as a learning medium that facilitates mathematical interaction and reasoning through a structured dialogue format, including idea formulation, information clarification, argumentation of solution steps, and answer verification activities. Implementation is carried out through learning stages: introduction (providing context and examples of reasoning dialogues), core activities (group discussions with alternating roles and filling out *chat book sheets*), mini presentations and intergroup responses, and closing in the form of reflection and concept validation. The expected results of this implementation are increased student ability in explaining the reasons for using concepts/formulas, increasing accuracy through *checking activities* , and strengthening mathematical communication skills when conveying ideas logically. Thus, *The Math Chat Book* can be an alternative student-centered learning strategy to support the achievement of mathematical reasoning and communication competencies at the 11th grade high school level.

Keywords : *The Math Chat Book , Mathematics Learning, Grade XI, Mathematical Reasoning, Mathematical Communication.*

PENDAHULUAN

Mathematics is a subject that emphasizes mastery of concepts, procedures, reasoning, and communication skills. Through mathematics, students are expected to be able to understand patterns, solve problems, and explain ideas logically (1). However, in classroom learning practices, many students have difficulty expressing the reasons behind the steps they use to solve problems. In many cases, mathematics learning still tends to be teacher-centered, while students tend to copy formulas or imitate steps in examples. As a result, higher-level thinking skills such as reasoning and argumentation do not develop optimally. Students also tend to view mathematics as a collection of rules to be memorized, rather than as a thought process that can be explained.

This condition impacts the quality of learning outcomes. Students who can obtain the correct answer to arithmetic problems are often unable to coherently explain how the answer was obtained. When given a slightly different problem, many students become confused because they do not understand the basic reasoning that underlies their steps (2). One important competency that needs to be considered in mathematics learning is mathematical communication. Mathematical communication includes not only the ability to write answers, but also the ability to convey ideas, formulate arguments, and respond to the ideas of others scientifically. In interactive learning, students need to be given the opportunity to discuss and present their thoughts.

In addition to communication, mathematical reasoning skills are also a major focus. Mathematical reasoning helps students understand relationships between concepts, choose appropriate methods, and verify the accuracy of results (3). Without reasoning, students easily make conceptual or procedural errors, and find it difficult to correct these errors. In the context of grade 11, learning challenges increase because the material is more complex and requires a stronger conceptual understanding. Materials such as functions, equations/inequalities, trigonometry, statistics, and sequences and series require thinking skills that involve analysis and interpretation.

Therefore, a learning approach or media is needed that can encourage students to actively build arguments and conduct verification. This media should guide students to explain the reasons for using concepts or formulas, as well as provide space for students to critique each other and improve answers (4). One innovation that can be used is *The Math Chat Book* . This media is designed as a structured dialogue-style worksheet that facilitates interaction between students. Through a conversational format, students are directed to write down ideas systematically, clarify information, and provide reasons for solving steps.

In *The Math Chat Book* , students are not only asked to work on problems, but also to develop a reasoned thought process. Each dialogue section emphasizes the importance of reasoning components such as “why a particular step was chosen,” “how to check the answer,” and “what to do if an error is found” (2). The implementation of this media also encourages active student involvement in discussions. With clear roles in groups, students are accustomed to listening, responding, and strengthening opinions based on mathematical reasoning. This is in line with learning needs that emphasize participation and collaboration.

In addition, *The Math Chat Book* can bridge cognitive and communication skills. When students write dialogues, they indirectly practice their ability to construct mathematical sentences, use appropriate terminology, and present reasons coherently and measurably. This medium also provides an opportunity for teachers to monitor students' thought processes (3). Through dialogue entries, teachers can identify errors, whether they stem from conceptual misconceptions,

procedural errors, or a lack of verification activities. This way, teachers can provide more appropriate feedback.

In this study, the implementation of *The Math Chat Book* was applied to the mathematics learning of grade XI students through stages such as introduction (providing examples of reasoning dialogues), core activities (filling out *the chat book* in groups), mini-presentations, and reflection and correction of answers (4). These stages are designed so that students not only work on problems, but also build understanding through dialogue. This research is expected to have an impact on students' mathematical reasoning and communication skills. Through structured dialogue activities, students can become more accustomed to explaining the reasons for solving steps, checking answers, and increasing accuracy and confidence when learning mathematics.

Thus, the implementation of *The Math Chat Book* is seen as relevant to address the challenges of 11th-grade mathematics learning, which still emphasizes final results without adequately structuring the thinking process. This medium is expected to be an alternative learning strategy that encourages students to be active, think critically, and convey mathematical arguments logically.

METHOD

Types of research

This study uses **Classroom Action Research (CAR)** to improve the mathematics learning process for class XI through the application of *The Math Chat Book media (9)* . CAR was chosen because the research focuses on actions carried out directly in the classroom to overcome real problems, especially the low mathematical reasoning and communication skills of students when answering questions and explaining the reasons for the solution steps.

Research Setting and Subjects

The research was conducted in **class XI** at the school where the researcher is located, with the research subjects being students who are taking mathematics lessons in that class (1). The number of students follows the class conditions (determined based on school data), and the subjects were chosen because the class showed a need for improvement in discussion activities, argumentation, and students' ability to communicate mathematical ideas in a structured manner.

Time and Place of Research

The research took place during the current semester, according to the mathematics lesson schedule, with the timing adjusted to the needs and the school's academic calendar. The research took place in the classroom where the learning process was taking place to ensure that the activities were conducted in accordance with actual learning conditions.

Research Design

The CAR design used follows a cycle model that includes **planning (plan), action (act), observation (observe), and reflection (reflect)** . The research is planned in **two cycles** (can be adjusted), where each cycle includes the implementation of *The Math Chat Book* as well as an evaluation to determine the improvement of students' mathematical reasoning and communication skills and the quality of the learning process.

Research Procedure (Cycle I)

In **Cycle I** , the researcher prepared a plan in the form of learning tools (teaching modules/RPP), *The Math Chat Book sheets* , practice questions according to material XI, as well as observation instruments and assessment rubrics. Next, the action was carried out through group

learning with roles in mathematical dialogue, followed by mini presentations and reflections on the results of the answers, while observations were carried out to record student and teacher activities and collect the results of student work (5). After that, the researcher conducted a reflection to identify shortcomings, for example, students' limitations in writing reasons, lack of verification of answers, or suboptimal discussions between students.

Research Procedures (Cycle II)

In **Cycle II** , the researcher made improvements based on the results of the Cycle I reflection by adjusting the learning strategy, strengthening dialogue examples, arranging student roles, and improving the dialogue sheets so that the reasoning and communication indicators were more focused. The actions were then carried out again through the same stages (learning based on *The Math Chat Book* , group discussions, presentations, and reflections), while observations focused on improving the quality of the dialogue, the accuracy of the solution steps, and the ability to check answers. At the end of Cycle II, the researcher conducted a final reflection to determine whether the CAR success indicators had been achieved or whether follow-up was still needed.

Data Collection Techniques and Instruments

Data collection techniques used **observation, learning outcome tests, and documentation** . Observations were conducted using teacher and student activity observation sheets to see involvement, discussion quality, and the ability to formulate reasons in dialogues in *The Math Chat Book* ; tests were conducted at the end of the cycle to measure material achievement and reasoning/communication indicators; while documentation consisted of a collection of student *chat book results* and learning process notes to strengthen research findings (6).

Data Analysis Techniques

Data analysis was conducted **quantitatively and qualitatively** . Quantitative data came from test scores for each cycle to calculate class averages and completion percentages, and to see improvements from Cycle I to Cycle II, while qualitative data came from observations and entries in *The Math Chat Book* , which were analyzed through data reduction, presentation of findings, and drawing conclusions about changes in the quality of students' mathematical reasoning and communication.

Success Indicators

The research is declared successful if it meets the established success indicators, for example, an increase in the average value and percentage of learning completion at the end of the cycle, as well as an increase in the quality of students' mathematical reasoning and communication based on *The Math Chat Book assessment rubric* . In addition, student learning activities during the discussion are expected to be in the good category, marked by an increase in students' ability to formulate reasons for solving steps, verify/check answers, and be able to respond to friends' ideas argumentatively.

RESULTS AND DISCUSSION

Based on the draft Abstract, Introduction, and Classroom Action Research (CAR) Method that have been prepared, the following is a description of **the Research Results** in 10 paragraphs that present the development of learning from Cycle I to Cycle II in sequence:

The implementation of the action in Cycle I began with an introduction to *The Math Chat Book media* to 11th-grade students through the provision of examples of mathematical reasoning dialogues. At this initial stage, students appeared awkward and hesitant when asked to express

their thoughts in a structured conversation format. Most groups tended to simply write short mathematical calculations without providing conceptual justification for the chosen formula or solution steps.

This situation impacted the quality of group discussions during Cycle I, which were not optimal. Interaction between students was still limited to assigning tasks to solve problems, rather than clarifying ideas or providing mathematical arguments. The alternating roles in the *chat book* were not fully understood, resulting in a stiff and formal flow of conversation simply to fill out the worksheet.

Based on the analysis of test data from Cycle I, students' learning achievement was only in the moderate category, with the class average score not yet meeting the Minimum Completion Criteria (KKM). Students' written mathematical communication skills still showed fundamental weaknesses, particularly in constructing logical and coherent reasoning sentences. Furthermore, the verification or rechecking of answers *on* the *chat book sheet* was often overlooked by most students.

The reflection results at the end of Cycle I served as the basis for improvements to the action plan in Cycle II. Researchers adjusted the strategy by improving the dialogue format to make it more interactive, providing more focused instructions regarding group role allocation, and providing more in-depth dialogue *scaffolding on how to critique and verify mathematical solution steps.*

Entering Cycle II, the implementation of *The Math Chat Book* showed significant improvements and developments. Students began to become accustomed to using a conversational format to argue, ask questions, and clarify the steps for solving complex 11th-grade math problems. Group discussions became much more lively because each group member had a clear responsibility to respond to and validate their peers' thinking.

Students' mathematical reasoning skills in Cycle II showed significant improvement. They were no longer simply copying formulas but were able to explicitly explain the rationale for using mathematical concepts or theories that underpin their steps. The *chatbook sheet* showed that students' argumentation became more mature, logical, and systematically connected between the concepts being studied.

Answer checking *and* concept validation activities were also consistently strengthened in Cycle II. Before concluding the final results, students were accustomed to conducting retests or substituting scores to ensure the accuracy of the results. If procedural errors were discovered during the dialogue, group members were able to responsively identify the error and correct it through a supportive conversation.

This improvement in cognitive abilities aligns with the results of the learning test evaluation at the end of Cycle II, which showed a significant increase in the class average score. The students' classical learning completion percentage exceeded the success indicators established in the study. This improvement demonstrates that conceptual understanding developed through dialogic activities can improve the mathematics learning outcomes of 11th-grade students.

Students' mathematical communication skills, both verbally and in writing, showed positive development during mini-presentations and intergroup discussions. Students became more confident in conveying ideas, using mathematical terminology appropriately, and responding to questions or comments from other groups using valid scientific arguments and oriented toward logical thinking.

Overall, the results of this study concluded that the implementation of *The Math Chat Book* successfully facilitated the transformation of learning from teacher - *centered* to student - *centered*. This media has proven effective as a bridge to hone mathematical reasoning and communication, while also forming critical and careful thinking habits in 11th grade high school students in solving mathematical problems.

The following is **a discussion of research results** that reviews and confirms the findings from Cycle I to Cycle II based on the theory of reasoning, mathematical communication, and collaborative learning.

Discussion

The Math Chat Book media in 11th-grade mathematics learning has been proven to have a positive impact on shifting students' learning paradigms, from merely focusing on the final result (calculations) to focusing on the quality of mathematical thinking, reasoning, and communication processes. The discussion of this research finding is outlined based on the following key aspects:

1. **Improving Mathematical Reasoning Skills Through Dialogic Scaffolding**

   In Cycle I, students still had difficulty expressing the reasons behind problem-solving steps (7). This is in line with the general conditions described in the background, where students tend to memorize formulas without understanding their conceptual basis. However, the dialogue structure in *The Math Chat Book* functions as *scaffolding* (gradual assistance) that guides students to analyze their thought processes in an orderly manner. In Cycle II, dialogue prompts that ask for an explanation of "why this step was chosen" trigger students to connect relevant mathematical concepts, so that indicators of mathematical reasoning—such as constructing logical arguments and proposing conjectures—can develop optimally.

2. **Strengthening Oral and Written Mathematical Communication Skills**

   Mathematical communication is not only limited to writing number symbols, but also the ability to convey ideas scientifically. By completing a worksheet in conversation format (*chat book*), students indirectly practice written communication skills by adapting mathematical symbols and terminology into coherent sentences (6). Furthermore, the mini-presentation stage and intergroup responses facilitate oral communication. Students become more confident in legitimizing their thoughts and responding to objections from other groups with arguments based on mathematical evidence.

3. **Habitual Verification (*Checking*) and Procedural Accuracy**

   One of the main advantages of *The Math Chat Book* is the integration of the verification stage in a dialogue format. At the beginning of learning, *checking activities* are often skipped because students are accustomed to assuming the work is complete after finding the final numerical value. Through interactive roles in groups, peers act as *checkers* who verify the correctness of steps and the accuracy of calculations. This habit of correcting errors independently and collaboratively has been shown to reduce the level of misconceptions and procedural errors in the final test evaluation of Cycle II.

4. **Change in Learning Paradigm to *Student-Centered***

   The application of this media directly changes the class dynamics from *teacher-centered* to *student-centered* . The teacher no longer acts as the sole source of truth or a one-way provider of information, but rather as a facilitator and concept validator (8). Focused group discussions provide the widest possible space for students to construct their own knowledge through social interaction. A clear division of roles in each cycle also ensures

the active participation of all group members, so that no student is passive in the problem-solving process.

5. **Diagnostic Feedback for Teachers**
   For educators, *The Math Chat Book* serves as a highly effective diagnostic tool. Through written conversational records captured in worksheets, teachers can precisely monitor students' weaknesses or misconceptions—whether they lie in their understanding of initial definitions, basic algebra, or logical inference. This allows for more specific and responsive feedback *tailored* to the learning needs of 11th-grade students.

The following is **the Conclusion of the Research Results** which summarizes the overall findings and achievement of the objectives of this Classroom Action Research (CAR):

CONCLUSION

Based on the results of research and discussion regarding the implementation of *The Math Chat Book media* in mathematics learning for class XI students, several main conclusions can be drawn as follows:

1. **Improving Mathematical Reasoning Ability**
   The implementation of *The Math Chat Book* through a structured dialogue flow successfully improved students' mathematical reasoning skills. Students who previously focused solely on final results and instant formulas were now able to explain the conceptual reasoning behind their choice of solution steps, construct logical arguments, and systematically link between 11th-grade mathematics concepts.
2. **Improving Mathematical Communication Skills**
   The use of this media effectively trains students' mathematical communication skills, both written and oral. In writing, students learn to translate mathematical symbols and procedures into systematic sentences using *chatbook sheets* . Orally, communication skills develop rapidly as students confidently present ideas, clarify information, and respond to feedback from other groups.
3. **Growing Habits of Verification (*Checking*) and Accuracy**
   The interactive conversation format encourages the habit of verifying answers before drawing final conclusions. Collaboration between group members, who critique and validate steps, has been shown to reduce misconceptions and improve students' procedural accuracy and precision in solving math problems.
4. **Achievement of Student Learning Outcomes and Activities**
   gradual implementation of *The Math Chat Book from Cycle I to Cycle II has been proven to improve student learning outcomes and shift classroom dynamics to a student-centered one* . Active student participation in group discussions and mini-presentations was categorized as excellent, which is in line with the achievement of average class scores that exceeded the established success indicators.

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