A GROUNDED THEORY APPROACH TO THE CRITICAL THINKING TENDENCIES OF STUDENTS WITH DISABILITIES IN MATHEMATICS LESSONS

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Abstract

This study analyzes the critical thinking tendencies of students with physical disabilities in mathematics learning at SMA-LB Negeri 3 Yogyakarta using a Grounded Theory approach. A qualitative method was applied, with data collected through observations, interviews, and questionnaires. The results indicate that 80% of students exhibit positive critical thinking tendencies, while 20% face internal challenges such as shyness, lack of confidence, and difficulty in collaboration. The main factors influencing critical thinking tendencies include the role of teachers, student participation, and classroom conditions. Teachers who implement interactive learning strategies, such as discussions and cooperative learning, play a crucial role in motivating students. A comfortable learning environment and adequate facilities also support the development of students' critical thinking skills. This study concludes that interactive teaching strategies and a conducive learning atmosphere are key to fostering students' critical thinking tendencies.

Keywords: *Critical thinking, students with physical disabilities, mathematics, grounded theory, learning*

INTRODUCTION

Mathematics is a subject taught from elementary to secondary education, highlighting its crucial role in education. As a fundamental component of various disciplines, mathematics is not only relevant in academic contexts but also in everyday life, such as financial management, time planning, and logical problem-solving. One of the primary goals of mathematics education is to help students understand its relevance and benefits, motivating them to learn and apply mathematical concepts (Wardani, 2011).

However, in practice, many students struggle to grasp the concepts and real-life applications of mathematics. This issue arises from a teaching approach that emphasizes memorizing formulas rather than deep conceptual understanding (Mardapi, 2010). Consequently, students often avoid mathematics due to fear, frustration, or lack of confidence. Such attitudes hinder their ability to think

critically, a key competency that should be developed through mathematics education (Anku, 1996; Ruseffendi, 1991).

Critical thinking is an essential skill in mathematics education, especially in addressing global challenges in the era of the Fourth Industrial Revolution. According to Wahyudin (2011) and Sumarmo (2013), critical thinking tendencies involve the ability to analyze, evaluate, and consider information rationally and objectively. In the context of inclusive education, students with special needs also require special attention to develop these tendencies through approaches tailored to their specific needs.

Grounded Theory (GT) is a qualitative research method aimed at generating inductive theories based on systematically collected empirical data. This method, introduced by Glaser and Strauss in 1967, was developed as an alternative to dominant deductive approaches, emphasizing theory development based on field data (Rus et al., 2015; Karuntu et al., 2022). GT is widely applied across various disciplines, including vocational education, due to its flexibility and ability to identify behavioral patterns or emerging phenomena (Karuntu et al., 2022; Ahmad, 2015).

Vocational education faces challenges in aligning curricula with the rapidly evolving demands of industry, particularly in the context of the Fourth Industrial Revolution (Rus et al., 2015; Ahmad, 2015). Here, Grounded Theory plays a vital role by enabling the development of relevant theories based on direct insights from field practitioners (Rus et al., 2015; Lensjø, 2021). In vocational education, GT helps researchers understand the complexities of social interactions, work-based learning processes, and factors influencing learning effectiveness in real-world settings (Lensjø, 2021).

This study aims to analyze students' critical thinking tendencies using the Grounded Theory approach. Focusing on students with physical disabilities at SMA-LB Negeri 3 Yogyakarta, this research identifies the factors influencing critical thinking tendencies and provides recommendations for more inclusive and relevant teaching strategies.

METHODS

Research Design

This study employs a qualitative approach using the Grounded Theory (GT) method. This method aims to develop theory based on empirical data without relying on initial hypotheses. Grounded Theory was introduced by Glaser and Strauss in 1967 as an alternative to deductive approaches, emphasizing simultaneous data collection and analysis until theoretical saturation is reached (Rus et al., 2015; Karuntu et al., 2022).

GT was chosen because it is well-suited for addressing complex research questions, such as analyzing students' critical thinking tendencies. GT not only produces theories relevant to the context but also provides flexibility in exploring new phenomena in education, including in the context of students with special needs (Ahmad, 2015; Lensjø, 2021).

The steps in Grounded Theory include:

1. Open Coding – The initial process of identifying categories from raw data.
2. Axial Coding – Connecting the main categories with subcategories to identify relationship patterns.
3. Selective Coding – Focusing the analysis on core categories relevant to comprehensively explaining the research phenomenon (Karuntu et al., 2022).

In this study, the GT approach enables researchers to develop a deep understanding of the critical thinking tendencies of students with physical disabilities through empirical data collected from various data collection techniques.

Data Collection Techniques

Data was collected using non-test techniques, including questionnaires, observations, and in-depth interviews. These three techniques were applied simultaneously in a triangulation approach to ensure data validity (Creswell, 2010).

1. Questionnaire

   The questionnaire was used to measure students' attitudes toward mathematics and their critical thinking tendencies. The critical thinking tendency scale was developed based on indicators such as the ability to analyze, evaluate, and connect concepts to real-life applications (Sumarmo, 2013).
2. Observation

   Observations were conducted during the learning process to document teacher and student activities. Field notes, photos, and videos were used to support the observation findings.
3. In-Depth Interviews

   Interviews were conducted to explore the perspectives of students, teachers, and school principals regarding the factors influencing students' critical thinking tendencies. This approach aimed to obtain richer and more in-depth qualitative data.

Data collection was carried out in stages using a theoretical sampling approach, where additional data was gathered until no new information emerged, indicating that theoretical saturation had been reached (Ahmad, 2015).

Research Instruments

The researcher acted as the primary instrument in this study. This aligns with the principles of qualitative research, where the researcher not only collects but also directly interprets data to construct relevant theories (Moleong, 2011).

The main data sources included students, teachers, and school principals, while supporting data were obtained from documents, photos, audio recordings, and videos. The use of multiple sources aimed to enhance the credibility of the research findings through source triangulation.

Data Analysis

Data analysis was conducted continuously following the steps of Grounded Theory:

1. Simultaneous Data Collection and Analysis

   Data obtained was continuously analyzed through the constant comparative method. Each new data point was compared with existing categories to ensure consistency and relevance (Karuntu et al., 2022).
2. Inductive Coding
   a. Open Coding – Raw data was broken down into smaller units to identify initial categories.
   b. Axial Coding – Relationships between categories were explored to discover data patterns or structures.
   c. Selective Coding – The analysis was focused on core categories considered most relevant to the research objectives (Lensjø, 2021).
3. Theoretical Saturation

   Data analysis continued until no new information emerged, indicating that the theory had reached theoretical saturation (Ahmad, 2015).

Validity of Findings

The validity of the data was examined through source, technique, and time triangulation. This triangulation approach involved:

1. Source Triangulation – Comparing data from students, teachers, and school principals to identify similarities and differences in perspectives.
2. Technique Triangulation – Using various methods, such as questionnaires, observations, and interviews, to ensure data consistency.
3. Time Triangulation – Conducting data collection at different times to check the stability of the results (Sugiyono, 2010).

This approach ensures that the research findings are not only valid but also reliable for providing recommendations relevant to the educational context.

RESULTS

Observation Results of Learning Activites (ORLA)

Preliminary Activities

Observations indicate that mathematics lessons begin with a preliminary phase lasting approximately 15 minutes. The teacher starts the lesson with greetings, takes attendance, motivates students, and provides guidance on the material to be taught. This approach is relevant to the subject matter, effectively capturing students' attention. During this phase, students are observed listening attentively and following the teacher's instructions.

Main Activities

During the core phase, the teacher employs the expository method and actively engages students. Several students are invited to solve problems in front of the class to practice the concepts being taught. The teacher asks about five questions randomly, to which four students respond. Additionally, some students ask questions during the lesson, demonstrating active participation.

The teacher also assigns individual tasks to be submitted at the end of the lesson. When disruptions arise from one or two students, the teacher provides gentle warnings and, if necessary, firmer discipline. The classroom remains conducive to learning as the teacher maintains student attention by incorporating motivation, light humor, and a relaxed yet structured learning atmosphere.

Closing Activities

In the closing phase, which lasts approximately 10 minutes, the teacher reminds students to complete their assignments and encourages them to review the lesson at home. The teacher summarizes the material covered and assigns additional homework. This approach ensures that students have a clear understanding of the lesson taught.

Supporting Factors in Learning

Observations reveal several factors influencing the success of classroom learning:

1. Teacher's Role

   The teacher plays the most influential role in fostering students' critical thinking tendencies. By creating a relaxed yet structured learning environment, allowing students to ask questions, express ideas, and share opinions, the teacher encourages a stronger inclination toward critical thinking.

2. Student Characteristics

   Students show a strong interest in learning mathematics, as reflected in their active participation during lessons. This enthusiasm indicates a positive attitude toward critical thinking, a key indicator of successful learning outcomes.

3. Classroom Conditions

   A comfortable, clean classroom equipped with adequate teaching and learning facilities, such as electronic media, supports a conducive learning environment. This setting enables students to focus better on understanding the material and practicing their critical thinking skills.

Integration with Grounded Theory
Emphasis on Data Analysis

The observation results were analyzed using the Grounded Theory approach, where collected data was processed through the constant comparative method. The analysis identifies categories such as the teacher's role, student characteristics, and classroom conditions as key factors influencing the development of students' critical thinking tendencies.

Data Coding Process

1. Open Coding: Identifying initial categories from the data, such as teacher and student activities and classroom conditions that support learning.
2. Axial Coding: Connecting main categories, such as the teacher's role in creating a conducive atmosphere, with subcategories like student motivation and active interaction.
3. Selective Coding: Focusing the analysis on the core category, namely the impact of teaching methods and learning environments on the development of students' critical thinking tendencies.

Data-Driven Findings

Through the GT approach, it was found that the dominant factors influencing learning success are the teacher's teaching methods and the classroom environment. These findings support the development of a theory that a conducive learning atmosphere—facilitated by a competent teacher and adequate facilities—directly impacts the formation of students' critical thinking tendencies.

Tabel 1. Survey/Questionnaire Results Data

Students	Confidently Agree	Agree	Neutral	Disagree	Confidently Disagree	Summary	Conclusion
1	4	8	14	10	4	2.95	Negatif
2	5	9	14	9	3	3.1	Positif
3	7	20	9	4	0	3.75	Positif
4	12	21	5	1	1	4.05	Positif
5	7	23	9	1	0	3.9	Positif
6	6	9	3	15	7	2.8	Negatif
7	1	4	17	14	4	2.6	Negatif
8	1	22	8	9	0	3.375	Positif
9	3	9	22	5	1	3.2	Positif
10	2	9	11	17	1	2.85	Negatif
11	2	20	12	5	1	3.425	Positif
12	1	16	10	13	0	3.125	Positif
13	4	12	11	11	2	3.125	Positif

Students	Confidently Agree	Agree	Neutral	Disagree	Confidently Disagree	Summary	Conclusion
14	14	17	1	8	0	3.925	Positif
15	1	25	3	11	0	3.4	Positif
16	1	22	13	4	0	3.5	Positif
17	1	16	18	5	0	3.325	Positif
18	13	14	1	9	3	3.625	Positif
19	8	20	6	6	0	3.75	Positif
20	4	6	9	14	7	2.65	Negatif
21	8	19	10	0	3	3.725	Positif
22	2	26	0	9	3	3.375	Positif
23	0	26	11	3	0	3.575	Positif
24	3	16	15	6	0	3.4	Positif
25	3	21	12	4	0	3.575	Positif
Summary	4.52	16.4	9.8	7.72	1.6	3.5246	Positif
Students	**Confidently Agree**	**Agree**	**Neutral**	**Disagree**	**Confidently Disagree**	**Summary**	**Conclusion**

Based on the data above, 20 students (80%) exhibit a positive tendency toward critical thinking, indicating that the teaching and learning process is generally effective. However, 5 students (20%) show a negative tendency toward critical thinking. This issue can be addressed by implementing more critical-thinking-oriented teaching strategies.

DISCUSSION

This study reveals that students' critical thinking tendencies in mathematics learning are influenced by various factors, including the teacher's role, student participation, and classroom conditions. Interviews and observations indicate that teaching strategies and a conducive learning environment play crucial roles in encouraging students' active engagement. The analysis follows a Grounded Theory approach, consisting of three main stages: open coding, axial coding, and selective coding.

1. The Teacher's Role in Mathematics Learning

Teachers play a crucial role as facilitators who not only deliver material but also create a supportive and engaging learning atmosphere. Interviews with teachers reveal that one major challenge is students' lack of understanding of prerequisite concepts, particularly fundamental mathematical principles. To address this, teachers review previous materials to ensure students have the necessary foundational knowledge before progressing to more complex topics.

Moreover, teachers employ various teaching strategies, such as expository methods, discussions, and cooperative learning, to actively engage students. Among these strategies, the lecture method with an initial explanation is considered the most effective, as it provides students with a fundamental framework for understanding further material. This method also helps maintain a relaxed yet structured learning environment, incorporating light humor to sustain students' motivation throughout the lesson (Ahmad, 2015; Karuntu et al., 2022).

2. Student Participation and Attitudes

Students' participation and attitudes during lessons reflect a positive interest in mathematics. Many actively respond to questions, share ideas, and participate in class discussions. However, some students hesitate or feel shy about asking questions, particularly when they lack confidence in their understanding. This challenge suggests that critical thinking tendencies have not fully developed in some students, despite their motivation to learn. According to Lensjø (2021), active student participation in a supportive learning environment is a key indicator of critical thinking development.

3. Classroom Conditions and Environment

A comfortable, clean classroom equipped with adequate learning facilities, such as electronic media, contributes to creating a conducive learning atmosphere. Teachers foster an environment where students feel free to ask questions, express ideas, and engage in discussions. This situation highlights the importance of both physical and emotional environments in shaping students' critical thinking tendencies (Karuntu et al., 2022).

4. Challenges in Mathematics Learning

Some students face difficulties in understanding basic mathematical concepts, memorizing formulas, and performing complex calculations. These challenges are often compounded by shyness or reluctance to ask questions. However, teachers have successfully mitigated many of these issues by providing additional explanations, reviewing previous material, and incorporating humor to ease classroom tension. This approach aligns with the findings of Rus et al. (2015), which emphasize that emotional support from teachers can enhance students' learning motivation.

5. Analysis Based on Grounded Theory

The Grounded Theory approach was used to analyze interview and observation data, revealing significant relationships between teaching strategies, classroom conditions, and students' critical thinking tendencies.

a. Open coding identified key themes such as teacher roles, student participation, and learning challenges.
b. Axial coding showed a correlation between teachers creating a supportive environment and increased student participation.

c. Selective coding focused on the core theme: "The relationship between teaching strategies and students' critical thinking tendencies."

The resulting theory from this analysis suggests that interactive teaching strategies and a supportive learning atmosphere are key to fostering students' critical thinking tendencies. Teachers who use a personalized approach and encourage students to ask questions and express ideas positively impact students' critical attitudes toward mathematics.

6. Implications of Findings

These findings have several important implications for mathematics education:

a. Strengthening the Teacher's Role: Teachers should continue to develop a personal approach in teaching, incorporating humor, motivation, and a relaxed yet structured atmosphere.
b. Enhancing Student Readiness: Emphasizing prerequisite knowledge can help students feel more confident when learning advanced topics.
c. Maintaining a Supportive Learning Environment: A comfortable and interactive classroom setting should be sustained to ensure optimal student learning experiences.

7. Connection with Previous Studies

These findings align with studies by Ahmad (2015) and Lensjø (2021), which highlight that adaptive teaching strategies and supportive learning environments promote students' critical thinking skills. Additionally, the Grounded Theory approach offers flexibility in understanding complex phenomena such as interactions between students, teachers, and the learning environment.

CONCLUSION

This study demonstrates that adequate school facilities, a comfortable environment, and a conducive classroom atmosphere positively impact students' learning interest, particularly in developing critical thinking skills. Mathematics learning in the Tunadaksa (D) class runs optimally due to the teacher's ability to select engaging teaching methods, models, and strategies, ensuring students remain motivated.

Based on the survey results:

1. 80% of students exhibit positive critical thinking tendencies, demonstrating the ability to analyze, evaluate, and provide solutions to mathematical problems.
2. 20% of students still display negative critical thinking tendencies, mainly due to internal challenges such as shyness, lack of confidence, difficulty concentrating, and struggles with social interaction during group discussions.

Teachers play a significant role in facilitating learning that supports students' critical thinking development. By creating an engaging learning atmosphere, motivating students, and encouraging

collaboration, teachers help build students' confidence and cooperative attitudes, which positively impact their critical thinking tendencies. Additionally, interactive and student-centered teaching approaches are key factors in successful learning.

This study also reveals a consistent relationship between observations, surveys, and interviews, which collectively depict students' critical thinking tendencies in the disabled (D) class. Overall, students exhibit a positive inclination toward critical thinking, influenced by a combination of teaching strategies, school facilities, and a supportive learning environment.

IMPLICATIONS

This study provides several important implications for teachers, schools, and future research:

1. For teachers: The findings reinforce the importance of creating a supportive and interactive learning atmosphere to encourage critical thinking. Teachers should continue developing cooperative learning strategies, using engaging teaching media, and incorporating humor or motivation to sustain students' interest. Additionally, special attention should be given to students with internal challenges (e.g., shyness or low confidence) by providing personal encouragement to help them feel more comfortable participating actively in learning.
2. For schools: A comfortable, clean, and well-equipped learning environment has been proven to be a key supporting factor in creating a conducive learning atmosphere. Schools should strive to maintain and enhance the quality of learning infrastructure, ensuring that students can focus on learning and develop positive attitudes, particularly toward mathematics, which is often perceived as a challenging subject.
3. For future research: This study opens opportunities for further research on effective teaching strategies to address students' internal challenges, such as shyness or lack of confidence in asking questions. Additionally, future studies can explore the integration of technology in mathematics learning to further facilitate the development of students' critical thinking skills in a broader context.

Thus, this research not only provides insights into students' critical thinking tendencies but also offers strategic recommendations for developing more effective and inclusive mathematics learning in the future.

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