



The contribution of higher-order thinking skills to the mathematics learning achievement of grade VIII students at SMP IT Al-Hijrah

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Abstrak

Penelitian ini bertujuan untuk mengetahui kontribusi keterampilan berpikir tingkat tinggi terhadap prestasi belajar matematika siswa kelas VIII di SMP IT Al-Hijrah. Keterampilan berpikir Tingkat tinggi yang dianalisis mencakup kemampuan penalaran matematis, pemecahan masalah, kemampuan analitis, berpikir kritis, serta berpikir kreatif. Latar belakang penelitian ini didasari oleh pentingnya pengembangan keterampilan berpikir tingkat tinggi dalam proses pembelajaran matematika untuk meningkatkan kemampuan berpikir siswa secara mendalam dan aplikatif dalam menyelesaikan masalah serta untuk meningkatkan prestasi belajar matematika siswa di sekolah. Metode penelitian menggunakan pendekatan kuantitatif dengan desain *ex post facto*. Populasi penelitian seluruh siswa kelas VIII tahun ajaran 2024/2025, dengan sampel sebanyak 60 siswa yang diambil dari seluruh kelas VIII. Data dikumpulkan melalui instrumen tes yang telah diuji validitas dan reliabilitasnya. Analisis data dilakukan menggunakan regresi linier berganda untuk mengetahui kontribusi masing-masing aspek keterampilan berpikir tingkat tinggi terhadap prestasi belajar matematika. Hasil penelitian menunjukkan bahwa keterampilan penalaran matematis berkontribusi sebesar 22%, pemecahan masalah sebesar 16%, kemampuan analitis sebesar 19,6%, berpikir kritis sebesar 21,2%, dan berpikir kreatif sebesar 15,3% terhadap prestasi belajar matematika. Hasil penelitian menunjukkan bahwa semua komponen keterampilan berpikir tingkat tinggi memiliki kontribusi yang signifikan terhadap pencapaian belajar siswa. Kesimpulan penelitian adalah terdapat hubungan positif dan signifikan antara keterampilan berpikir tingkat tinggi dengan prestasi belajar matematika siswa kelas VIII SMP IT Al-Hijrah. Berdasarkan hasil penelitian ini, disarankan kepada guru untuk lebih mengintegrasikan pengembangan keterampilan berpikir tingkat tinggi dalam proses pembelajaran matematika. Guru dapat menggunakan pendekatan pembelajaran yang menekankan pada penalaran, pemecahan masalah, analisis, berpikir kritis, dan berpikir kreatif, baik melalui penggunaan soal-soal berbasis konteks maupun model pembelajaran inovatif yang menumbuhkan kemampuan berpikir mendalam dan aplikatif. Selain itu, pihak sekolah diharapkan dapat memberikan pelatihan berkelanjutan kepada guru untuk meningkatkan kompetensi pedagogik dalam menerapkan pembelajaran berbasis keterampilan berpikir tingkat tinggi, guna mendukung peningkatan prestasi belajar matematika siswa secara optimal.

Kata Kunci: Keterampilan Berpikir Tingkat Tinggi, Penalaran Matematis, Analitis Matematis, Pemecahan Masalah Matematis, Berpikir Kritis Matematis, Berpikir Kreatif Matematis, Prestasi Belajar Matematika.

Abstract

This research aims to determine the contribution of higher-order thinking skills to the mathematics learning achievement of eighth-grade students at SMP IT Al-Hijrah. The higher-order thinking skills analyzed include mathematical reasoning, problem-solving, analytical ability, critical thinking, and creative thinking. This research is based on the importance of developing higher-order thinking skills in the mathematics learning process to enhance students' ability to think deeply and apply their knowledge in problem-solving, as well as to improve students' mathematics learning achievement in school.. The research method used a quantitative approach with an ex post facto design. The research population was all eighth-grade students in the 2024/2025 academic year, with a sample of 60 students taken from all eighth-grade classes. Data was collected through test instruments that had been tested for validity and reliability. Data analysis was performed using multiple linear regression to determine the contribution of each aspect of higher-order thinking skills to mathematics learning achievement. The results showed that mathematical reasoning skills contributed 22%, problem-solving 16%, analytical ability 19.6%, critical thinking 21.2%, and creative thinking 15.3% to mathematics learning achievement. The findings indicate that all components of higher-order thinking skills have a significant contribution to student learning achievement. The conclusion of the study is that there is a positive and significant relationship between higher-order thinking skills and the mathematics learning achievement of eighth-grade students at SMP IT Al-Hijrah. Based on the results of this study, it is recommended for teachers to more fully integrate the development of higher-order thinking skills in the mathematics learning process. Teachers can use teaching approaches that emphasize reasoning, problem-solving, analysis, critical thinking, and creative thinking, both through the use of contextual-based questions and innovative learning models that foster deep and applied thinking skills. Furthermore, schools are expected to provide ongoing training for teachers to enhance pedagogical competencies in implementing higher-order thinking skills-based learning, in order to optimally support the improvement of students' mathematics learning achievements.

Keywords: *Higher Order Thinking Skills, Mathematical Reasoning, Mathematical Analytical, Mathematical Problem Solving, Mathematical Critical Thinking, Mathematical Creative Thinking, Mathematics Learning Achievement*

Introduction

With the rapid development of science and technology, there is a growing need for human resources with high levels of intellectuality, including logical, systematic, critical, thorough, and creative reasoning skills in order to express ideas in problem-solving. This aligns with one of the objectives of mathematics learning in schools, namely to train students to think and reason in drawing conclusions, to develop problem-solving abilities, and to enhance skills in conveying information or communicating ideas orally, in writing, through images, graphs, maps, diagrams, and other forms (Depdiknas in Irawati, 2018).

Learning achievement can also serve as a benchmark for learning success, indicating the extent to which students have mastered the material delivered by teachers. Moreover, there are factors that may influence student learning outcomes or achievements, one of which is higher-order thinking skills (HOTS), which have

a significant effect on students' academic performance. If students are able to achieve and master HOTS, they can be considered to have good learning outcomes (Setyame, 2019).

The results of research conducted by Ainiyah (2017) show that both the process and outcomes of learning can be observed. In the learning process, students with strong mathematical critical thinking skills display active participation in solving problems during discussions, actively ask questions, and are able to provide appropriate arguments in response to teachers' questions. In terms of learning outcomes, students with strong mathematical critical thinking skills are able to answer test questions in the form of problem-solving tasks. Furthermore, the relationship between mathematical critical thinking ability and student achievement has been shown to have a positive influence, with a correlation coefficient of $r = 0.4642$ (Facriani et al., 2020).

Through creative thinking skills, students are able to generate new ideas for solving mathematical problems using sequential yet

different approaches, as well as providing unique answers compared to others. Students are therefore expected to meet the indicators of creative thinking ability in order to solve problems effectively and to improve mathematics learning achievement (Hidayah et al., 2021).

Based on the results of observations and previous studies described above, it is evident that higher-order thinking skills (including reasoning ability, analytical ability, problem-solving ability, critical thinking ability, and creative thinking ability) play a crucial role in influencing students' mathematics learning achievement.

Research Questions

Based on the research background above, the research questions of this study are formulated as follows:

To what extent do higher-order thinking skills (namely mathematical reasoning ability, mathematical analytical ability, mathematical problem-solving ability, mathematical critical thinking ability, and mathematical creative thinking ability) contribute individually to the mathematics learning achievement of Grade VIII students at SMP IT Al-Hijrah?

To what extent do higher-order thinking skills (namely mathematical reasoning ability, mathematical analytical ability, mathematical problem-solving ability, mathematical critical thinking ability, and mathematical creative thinking ability) contribute simultaneously to the mathematics learning achievement of Grade VIII students at SMP IT Al-Hijrah?

Research Objectives

The objectives of this study are:

To determine the extent of the individual contribution of higher-order thinking skills (namely mathematical reasoning ability, mathematical analytical ability, mathematical problem-solving ability, mathematical critical thinking ability, and mathematical creative thinking ability) to the mathematics learning achievement of Grade VIII students at SMP IT Al-Hijrah.

To determine the extent of the simultaneous contribution of higher-order thinking skills (namely mathematical reasoning ability, mathematical analytical ability, mathematical problem-solving ability, mathematical critical thinking ability, and mathematical creative thinking ability) to the mathematics learning achievement of Grade VIII students at SMP IT Al-Hijrah.

Method

This study reveals the existing data without applying treatment or manipulation to the variables or the research sample; therefore, it is classified as an ex-post facto study. According to Sugiyono (Riduwan, 2020), ex-post facto research is a type of study conducted to investigate events that have already occurred and then look back to identify the factors that may have caused those events. In this research, there are two types of variables, namely the independent variable and the dependent variable. The data collection techniques used in this study consist of tests and documentation. Several tests employed in this research include a test of mathematical reasoning ability, a test of mathematical problem-solving ability, a test of mathematical analytical ability, a test of critical thinking ability, a test instrument for creative thinking ability, and a test of students' mathematics learning achievement.

Meanwhile, the documentation method is a data collection technique carried out by examining images, records, and existing documents.

Result and Discussion

The descriptive analysis of the research data shows that most students demonstrated relatively high mathematical reasoning ability. This indicates that the majority of students were able to draw conclusions from given information and apply their knowledge in solving mathematical problems encountered during the test.

The results of the multiple linear regression analysis revealed that mathematical reasoning ability contributed 20.58% (effective contribution) and 24.39% (relative contribution) to students' mathematics learning achievement. This finding suggests that reasoning ability is an important cognitive factor that significantly influences how well students perform in mathematics.

The analysis also found that mathematical problem-solving ability had a significant contribution to learning achievement, with an effective contribution of 14.99% and a relative contribution of 17.76%. This result reflects that students who are able to analyze and execute steps in problem-solving tasks tend to achieve better outcomes in mathematics.

Mathematical analytical ability was shown to provide an effective contribution of 17.71% and a relative contribution of 20.98%. This suggests that the capacity to break down problems into smaller, logical components enhances students' capacity to understand and solve mathematics questions, leading to improved achievement.

Critical thinking ability also played an important role, with an effective contribution of 16.70% and a relative contribution of 14.40%. Students who could evaluate arguments, identify errors in reasoning, and propose alternative solutions tended to demonstrate stronger performance in mathematics assessments.

Creative thinking ability was shown to contribute 14.40% effectively and 17.07% relatively to mathematics achievement. This reflects the importance of originality and flexibility in approaching mathematical problems, which often require more than one pathway to a solution.

Collectively, the regression analysis indicated that all higher-order thinking skills—reasoning, problem-solving, analytical, critical, and creative thinking—contributed significantly to mathematics achievement. The simultaneous contribution was found to be 94.1%, indicating that these skills together are strong predictors of students' success in mathematics learning.

Despite the large influence of higher-order thinking skills, about 5.9% of the variance in mathematics learning achievement was influenced by other factors not included in the model, such as prior mathematical knowledge, motivation, teaching strategies, and environmental conditions.

Discussion

The findings confirm that mathematical reasoning ability has the highest individual contribution to mathematics learning achievement. This highlights the central role of reasoning in mathematics, where logical deduction and systematic application of knowledge are essential to solving problems effectively.

Problem-solving ability, although contributing less than reasoning, still plays a significant role. This emphasizes that mathematics learning should not be limited to memorization but should foster students' ability to apply knowledge in new and complex situations.

Analytical ability was also found to be a strong contributor. This finding supports the view that students who can deconstruct problems into smaller, manageable parts are better equipped to identify appropriate strategies and solutions, thus improving their overall performance.

Critical thinking was another key factor influencing student achievement. This ability enables learners to evaluate different approaches, recognize misconceptions, and construct sound arguments. The findings reinforce the notion that critical thinking is indispensable in mathematics, where accuracy and logical reasoning are paramount.

Creative thinking contributed significantly to mathematics achievement, indicating that flexibility and originality are also required in mathematical problem-solving. Students who are able to generate multiple strategies or unique solutions demonstrate deeper understanding and adaptability in tackling mathematical tasks.

The simultaneous contribution of higher-order thinking skills, reaching 94.1%, demonstrates that these skills are not only individually important but also collectively powerful in determining mathematics achievement. This suggests that a holistic approach in nurturing all aspects of HOTS will yield greater educational benefits.

However, the remaining 5.9% variance explained by external factors indicates that non-cognitive

variables also play a role. Factors such as motivation, classroom environment, prior learning experiences, and teaching methods should not be overlooked in efforts to improve student performance.

Overall, the study provides strong evidence that higher-order thinking skills significantly enhance students' mathematics learning achievement. Teachers should therefore adopt instructional strategies that integrate reasoning, problem-solving, analytical tasks, critical discussions, and creative activities to maximize learning outcomes in mathematics classrooms.

Conclusion

Based on the analysis of the research data, several conclusions can be drawn regarding the contribution of mathematical reasoning, problem-solving ability, analytical ability, critical thinking, and creative thinking to students' mathematics learning achievement.

First, each aspect of higher-order thinking skills was found to contribute positively and significantly to students' mathematics achievement when examined individually. Among these, mathematical reasoning and critical thinking emerged as the strongest contributors, showing that students who are able to reason logically and evaluate problems critically tend to achieve better results.

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