

Correlational of adaptive reasoning and problem-solving level using AKMI task model in scientific context

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Abstract

This study is based on the literature finding that problem-solving ability and adaptive reasoning ability are interconnected but have not been widely studied empirically, using AKMI model questions at the MTs level. This research aims to describe and determine the relationship between these two abilities in solving AKMI model questions at the HOTS level with a scientific context for MTs students in Kediri City. This research uses a quantitative survey approach with a population of 160 students and a sample of 129 respondents from schools participating in the 2024 AKMI program. The research instrument consists of two AKMI-model questions at the HOTS level with a scientific context, which were developed based on indicators of problem-solving ability and adaptive reasoning using PLSV material. The instrument has undergone expert validation, with Aiken's V indices of 0.8913 and 0.875, and shows high reliability based on a Cronbach's Alpha test result of 0.821. The data obtained were analyzed descriptively and inferentially using the Spearman Correlation Test. The results of the descriptive analysis showed that students' problem-solving abilities were divided into three categories: 22 students were in the low category, 79 students were in the medium category, and 28 students were in the high category. Meanwhile, the results of the Spearman correlation test showed a positive relationship between adaptive reasoning ability and problem-solving ability. This finding indicates the importance of learning strategies that can accommodate both abilities.

Keywords: Adaptive Reasoning Skills, AKMI, HOTS, Problem-Solving Skills, Scientific

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INTRODUCTION

In order to achieve the goals of mathematics learning, students need to master five basic standards: problem-solving ability, reasoning, communication, connections, and representation (NCTM, 2000). Among the five standards, reasoning ability is an important aspect that students must possess. Previous research by (Adhami et al., 1999; Tika et al., 2025) believe that reasoning ability is a fundamental but often underestimated part of the curriculum. As stated by (Heryani et al., 2024; Syafrizal et al., 2020) also emphasized the importance of reasoning in

understanding and exploring mathematical ideas and applying them in the form of mathematical expressions.

Mathematical reasoning is a high-level cognitive process that includes the ability to think logically and systematically in order to evaluate, interpret, and connect information to arrive at valid conclusions (Adhami et al., 1999; Alawiyah et al., 2025; Haerullah & Hasan, 2022; Kauffman, 2004; NCTM, 2000; Rodin, 2020). In practice, mathematical reasoning is divided into deductive and inductive reasoning (Hakima et al., 2019; Hulu et al., 2024). Kilpatrick et al. (2001) introduced a type of reasoning that encompasses both, namely adaptive reasoning.

In line with curriculum development, adaptive reasoning ability has become an important competency in the Merdeka Curriculum. BSKAP Decision Document No. 32/H/KR/2024 emphasizes the importance of using mathematical patterns and properties to make generalizations, construct proofs, and explain mathematical ideas (Kemendikbudristek, 2022). This statement is supported by (Hartati & Gozali, 2025; Newton & Sword, 2018), who refer to adaptive reasoning as the "glue" in mathematics because it serves to justify mathematical statements. Adaptive reasoning encompasses the ability to think logically and reflectively in understanding, explaining, justifying, and evaluating mathematical concepts both formally and informally (Haerullah & Hasan, 2022; Hartati & Gozali, 2025; Kilpatrick et al., 2001; Leatham, 2014; Rodin, 2020).

The urgency of adaptive reasoning becomes increasingly clear when linked to other mathematical abilities, particularly problem-solving skills. Kilpatrick et al. (2001) stated that adaptive reasoning is closely intertwined with problem-solving abilities. This is also shown in several studies that emphasize the importance of adaptive reasoning in helping learners solve mathematical problems (Andestia et al., 2024; Choiriyah, 2012; Falaq et al., 2023; Riyanto et al., 2024) found a significant relationship between adaptive reasoning and mathematical problem-solving.

Problem-solving ability is defined as the ability to identify, analyze, and implement effective solutions through a structured and systematic thinking process (Az-Zahra & Surya, 2025; Haerullah & Hasan, 2022; Lutfiya et al., 2021; Nursalim et al., 2022; Polya, 1987; Puspita et al., 2022; Rodin, 2020; Savransky, 2000). The BSKAP document Kemendikbudristek (2024) guides students to understand problems, design and implement solutions, and evaluate the results, in accordance with Polya's (1987) problem-solving stages. Rizvi (2024) also emphasizes that this ability is important because it helps learners in future decision-making, conflict management, innovation, and productivity.

However, based on a literature study, the connection between adaptive reasoning and problem-solving is still widely studied in junior high school students. There is not much research that specifically addresses the relationship between the two at the Madrasah Tsanawiyah (MTs) level, even though MTs students have the same opportunities to participate in competency assessments like AKMI (Agustin et al., 2023; Supriyati et al., 2020). Previous research related to AKMI has focused on the development of AKMI-based instruments (Nurwahid, 2024; Ramadhia, 2022), the readiness of teachers and madrasahs in implementing AKMI (Binadari, 2024; Oktaviani, 2023; Rasmini et al., 2023; Wardhani et al., 2022), and the utilization of AKMI results for curriculum development and teacher competency improvement (Mulyana et al., 2024; Ningrum et al., 2024). In contrast, this research is novel because it examines students' adaptive reasoning and problem-solving abilities through an instrument made up of AKMI HOTS-level questions set in a scientific context, which has not been explored in prior studies.

The AKMI instrument itself consists of three aspects: content, context, and cognitive level. Based on context, AKMI questions are divided into personal, scientific, and sociocultural. Meanwhile, based on cognitive level, AKMI questions are divided into three: understanding (L1: C1-C2), application (L2: C3-C4), and reasoning (L3: C5-C6) (Haeruman & Eka, 2021). Questions with cognitive level L3 are known as AKMI HOTS (Higher Order Thinking Skills) questions according to the revised taxonomy by Anderson & Krathwohl (2001).

Furthermore, AKMI HOTS questions with a scientific context are questions designed to measure high-level thinking skills by applying a scientific context. This question requires students to analyze (C4), evaluate (C5), and create (C6) based on their understanding of science and technology concepts (Amalia, 2022; Anderson & Krathwohl, 2001; Wijaya & Effendi, 2021). As for scientific context questions, these are questions that group problems based on the application of mathematics in the universe, covering issues and topics from science and technology such as weather, ecology, medical science, space science, genetics, and measurement. Problems related to mathematics are called intra-mathematical, while those related to other disciplines are called extra-mathematical (Fachrudin, 2022). The use of scientific context is adapted to the development of the global world, which demands mastery of scientific issues (Reksoatmodjo, 2010; Verawati & Sarjan, 2023; Wijaya & Effendi, 2021).

Several previous studies have examined students' adaptive reasoning and problem-solving abilities. Jariyah (2021) found variations in adaptive reasoning abilities based on mathematical proficiency levels among eighth-grade students at SMPN 03 Kalidawir.

Furthermore, Andriyani et al. (2020) demonstrated that elementary school students' adaptive reasoning abilities develop through conceptual understanding and problem-solving experiences. Choiriyah (2012) research also revealed a significant influence between adaptive reasoning ability and problem-solving ability in NU 1 Gresik junior high school students. In line with this, Indriyani et al. (2017) found a positive relationship between adaptive reasoning ability and mathematical ability in students at SMPN 03 Pontianak. Unlike those studies, this research is novel because it empirically examines the relationship between adaptive reasoning ability and problem-solving using AKMI HOTS-level scientific context questions on MTs students in Kediri City, which has not been studied before.

Based on this urgency, it is important to conduct research that examines the relationship between adaptive reasoning ability and problem-solving ability using AKMI model questions at the HOTS level with a scientific context. Therefore, this study aims to describe and analyze the relationship between the adaptive reasoning abilities of MTs students based on their problem-solving skills.

METHOD

This study employs a quantitative correlational approach with a cross-sectional survey design to analyze the relationship between adaptive reasoning and problem-solving ability. This research was conducted in the second semester of the 2024/2025 academic year at 3 Islamic Junior High Schools (MTs) in Kediri City that were subjects in the 2024 AKMI. Data collection was carried out using a test instrument in the form of AKMI model questions at the HOTS level with a scientific context.

The research instrument consists of two AKMI-style questions at the HOTS (Higher Order Thinking Skills) level in essay format on the topic of linear inequalities in one variable. Both questions are contextualized within scientific situations, namely the process of converting waste into methane gas and the caloric needs of children based on their age. These questions are designed at the C5 cognitive level (Evaluating) according to Bloom's Taxonomy, which aligns with the AKMI's focus on problem-solving and reasoning abilities. To assess student mastery, the rubric used includes indicators from both variables being studied. In detail, the rubric for assessing problem-solving ability has the following criteria: students must be able to write down known and asked information, create a mathematical model in the form of a linear inequality with one variable, write down the steps of the solution, perform correct calculations, recheck their answers, and draw conclusions. Meanwhile, to measure students' adaptive

reasoning ability, the assessment criteria include the ability to write down the inequality model from the problem information, provide various possible solutions, verify the correctness of a conjecture or argument, provide supporting reasons or evidence, and draw appropriate conclusions. Regarding the scoring system, the minimum score for both variables is 0, with a maximum score of 76 for problem-solving ability and 74 for adaptive reasoning ability.

The instrument has undergone a series of tests, including Aiken's V validity test assisted by Microsoft Excel software, Cronbach's alpha reliability test assisted by IBM SPSS Statistics 24 software, and item readability test on three eighth-grade students. The validity criteria for the Aikens' V instrument used are as follows Retnawati (2016):

Table 1. Validity Criteria for Aiken's V Test

Count Index	Category
$V \leq 0,4$	Less
$0,4 \leq V < 0,8$	Currently
$V > 0,8$	Very valid

Meanwhile, the reliability criteria used are if the reliability coefficient value is >0.6 , then the instrument is reliable (Rizkia et al., 2023).

Using the formula above, the validity test was conducted for each criterion and for all criteria of each question. For the first question, the validity test conducted for each criterion yielded Aiken's V coefficient in the range of 0.75 to 1, with a medium to very valid category. The overall item coefficient was 0.8913, which is very valid. For the second question, the validity test conducted for each criterion yielded Aiken's V coefficient in the range of 0.75 to 1, with a medium to very valid category. The overall item coefficient was 0.875, which is very valid. As for the reliability test, it obtained a Cronbach's alpha value of 0.821, and it can be concluded that the instrument is reliable.

In this study, sample selection was conducted using a saturated sampling technique, resulting in a sample of 129 students. The saturated sample in this study was obtained from school data participating in the 2024 AKMI program in Kediri City. The selection of schools participating in the 2024 AKMI program was based on the suitability of the abilities measured in the program with the research variables, namely students' reasoning and problem-solving abilities. Based on this data, three schools were selected as research samples. The number of students used as a sample was determined based on data from each school's AKMI results report. The AKMI program not only serves to measure students' numeracy literacy skills but also has a follow-up in the form of implementing innovative learning in the classroom, aiming to improve adaptive reasoning and problem-solving abilities. With this sample selection, it is

hoped that the follow-up has been implemented in the educational units that are the subjects of the research. Therefore, this study aims to determine students' adaptive reasoning and problem-solving abilities and to analyze the relationship between these two skills.

Before data analysis was conducted, assumption tests were first performed, including normality tests using skewness and kurtosis values, linearity tests, and homogeneity tests using Levene's test. These three assumption tests were conducted with the assistance of IBM SPSS Statistics 24 software. As for the criteria used in the normality test, if the skewness value is <3.0 and the kurtosis is <8.0 , then the data is normally distributed (Kline, 2011). The criteria used for the linearity test are that if the significance value for deviation from linearity is > 0.05 , then the data is linear (Purnomo, 2017).

Meanwhile, the criteria used for the homogeneity test are that if the significance value is > 0.05 , then the data is homogeneous (Purnomo, 2017). After obtaining the data on problem-solving ability scores and adaptive reasoning ability, descriptive analysis was performed on each indicator and on all indicators. The formula used for descriptive analysis on each indicator.

$$\text{Percentage score} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100\%$$

In addition to each individual indicator, descriptive analysis results are also presented for all indicators combined, with criteria calculated using the following formula (Fatwikiningsih, 2024).

Table 2. Calculation of Criteria in Descriptive Analysis

Score	Category
$\text{Score} < \bar{x} - \sigma$	Low
$\bar{x} - \sigma \leq \text{Score} < \bar{x} + \sigma$	Medium
$\text{Score} \geq \bar{x} + \sigma$	High

To determine the relationship between adaptive reasoning ability and problem-solving ability, the Spearman rank correlation test was used. The testing criteria were if the significance value obtained was $0.000 < 0.05$, meaning the two variables were correlated (Shaliza et al., 2025). The categorization of the strength of the relationship used is as follows (Priyono, 2021):

Table 3. Spearman Rank Test Criteria

Correlation Coefficient	Strength of Relationship
0.00 – 0.19	Very low
0.20 – 0.39	Low
0.40 – 0.59	Moderate
0.60 – 0.79	Strong
0.80 – 1.00	Very Strong

RESULTS AND DISCUSSION

Based on the explanation of the research steps in the previous section, this research was conducted once at each school. The first step is to validate the research instrument, the second step is to test the readability of the questions, the third step is to revise based on the validation results and readability test results, the fourth step is research in the first school, the fifth step is research in the second school, the sixth step is research in the third school, and then the data obtained is analyzed. Based on the data analysis conducted, the research findings can be explained as follows:

1. The problem-solving abilities of MTs students in Kediri City in solving AKMI model questions at the HOTS level with a scientific context

Based on a descriptive analysis of each indicator of problem-solving ability for MTs students in Kediri City, the results obtained are that the average achievement for the problem understanding indicator is 57%, planning solutions is 58%, solving problems is 48%, and looking back is 36%. This indicates that the second indicator has the highest achievement, while the fourth indicator has the lowest achievement.

Overall, based on Table 4, a total of 22% or 28 students were in the high problem-solving ability category, 61% or 79 students were in the medium category, and 17% or 22 students were in the low category. Students in the high category generally met all four problem-solving indicators completely. Students in the medium category met all four indicators, although not optimally, while students in the low category were not yet able to meet all the indicators.

Table 4. Descriptive Analysis of Overall Problem-Solving Ability Indicators

Category	Interval	Frequency	Percentage
Low	Score < 18.3	22	17%
Medium	$18.3 \leq \text{Score} < 66.7$	79	61%
High	Score ≥ 66.7	28	22%
Total		129	100%

Based on the first indicator, most students with low problem-solving abilities have been able to understand the problem, although still at a low level. This finding aligns with the research of Hanggara et al. (2022), Maisyaroh Agsya et al. (2019), and Mawardi et al. (2022), which states that students with low abilities can still understand problems. However, this differs from the findings of Amaliah et al. (2021), Permata & Sandri (2020), and Rusdi et al. (2021), which show that students in the low category are unable to understand

problems. This difference indicates an improvement in indicator fulfillment from 2019 to 2022.

For the second indicator, most students were not yet able to plan their solutions well. This is supported by the findings of Astuti et al. (2024) and Novitasari & Wilujeng (2018), which show that students with low abilities are not yet able to design problem-solving strategies. This indicates that there has been no significant increase from 2018 to 2024. For the third indicator, most students were able to solve problems, although still at a low level. This is consistent with Mawardi et al. (2022), but differs from La'ia et al. (2022), who found that students had difficulty solving problems. This indicates differences in the characteristics of the subjects or the context of the questions. For the fourth indicator, most students were not yet able to re-examine the solutions they obtained. This result aligns with the research of Isnaini et al. (2021) and (Wardani et al. 2022), which shows that students with low abilities have not yet been able to meet this indicator. There is no evidence of a significant increase in this indicator from 2021 to 2022.

Students with moderate problem-solving abilities are generally able to meet all four indicators at a moderate level. This is supported by the research of Ningrum et al. (2024), which states that subjects with moderate ability are able to carry out Polya's three problem-solving steps. Unlike the findings of Elma & Munandar (2023), Maisyaroh Agsya et al. (2019), Purba & Warmi (2022), and Siregar et al. (2021), who found that intermediate-level students only met two indicators. This difference indicates an improvement in ability from 2019 to 2024.

As for students with high problem-solving abilities, they have optimally met all problem-solving indicators. This result is consistent with the research of Hasanah et al. (2024), Krisilawanti et al. (2024), and Ningrum et al. (2024), which states that high-achieving students can perform all of Polya's steps.

2. Adaptive reasoning ability based on the problem-solving skills of MTs students in Kediri City in solving AKMI model questions at the HOTS level with a scientific context.

After assessing the students' problem-solving abilities, a descriptive analysis was conducted on the adaptive reasoning ability scores based on the grouping of problem-solving ability categories. Students with low problem-solving abilities showed varying average scores on each adaptive reasoning indicator. Indicator 1 (finding patterns or mathematical phenomena) had the highest achievement rate of 10%, while indicator 2

(formulating conjectures) had the lowest achievement rate of 0%. The other indicators each had achievement rates of 9% (indicator 3), 5% (indicator 4), and 1% (indicator 5).

The results of the overall analysis of students' adaptive reasoning abilities in the low problem-solving category are presented in Table 5. A total of 82% of students (18 individuals) were classified as low, and 18% (4 individuals) were classified as moderate. There are no students in the high category. This indicates that students with low problem-solving abilities have not yet been able to adequately meet all the indicators of adaptive reasoning skills.

Table 5. Adaptive Reasoning Ability Category Based on Low Problem-Solving Skills

Category	Interval	Frequency	Percentage
Low	Score < 9.4	18	82%
Medium	$9.4 \leq \text{Score} < 54.2$	4	18%
High	Score ≥ 54.2	0	0%
Total		22	100%

Low problem-solving skills affect students' low adaptive reasoning abilities (Agustin et al., 2023). This is reflected in students' low scores on the five indicators of adaptive reasoning. Regarding the indicator of finding patterns or mathematical phenomena, students with low problem-solving abilities showed fulfillment, although at a low level, as stated by Indriani et al. (2017). For the indicator of formulating conjectures, no students were able to propose initial conjectures, which aligns with the findings of Indriani et al. (2017) who noted that this indicator was at a very low level. Some students are beginning to be able to examine the validity of arguments, although not completely, which is also in line with the research findings of Indriani et al. (2017). Regarding the indicator of providing reasons and evidence, the majority of participants were not yet able to meet it, which reinforces the finding that logical reasoning about the truth of statements is still low Indriani et al. (2017). Finally, on the indicator of drawing conclusions, students have also not yet succeeded in meeting it. Sulistiawati et al. (2020) found that participants were unable to draw conclusions, which differs from Indriani et al. (2017) who showed better results, indicating a decline in achievement from 2017 to 2020.

Descriptive analysis of adaptive reasoning ability based on students with moderate problem-solving skills shows varied achievement. The first indicator (finding mathematical patterns or phenomena) had the highest achievement rate of 43%, while the second indicator (formulating conjectures) had the lowest achievement rate of 11%. The other indicators,

namely examining the validity of arguments, providing reasons or evidence, and drawing conclusions, each had achievement rates of 40%, 28%, and 20%, respectively.

The overall analysis results, as shown in Table 6, for 79 participants with an intermediate problem-solving category, indicate that 94% (74 participants) were in the intermediate adaptive reasoning ability category, 3% (2 participants) were in the high category, and 4% (3 participants) were in the low category. This means that most participants have not yet been able to fully meet all the indicators of adaptive reasoning ability. This finding is consistent with Yunita (2019), who stated that participants with moderate problem-solving abilities generally also have moderate adaptive reasoning abilities.

Table 6. Adaptive Reasoning Ability Category Based on Moderate Problem-Solving Ability

Category	Interval	Frequency	Percentage
Low	score < 9.4	3	4%
Medium	$9.4 \leq \text{score} < 54.2$	74	94%
High	score ≥ 54.2	2	3%
Total		79	100%

Based on the indicators, when finding mathematical patterns or phenomena, the students were already able to construct mathematical models, although not perfectly (Febrianti, 2023). For the indicator of formulating conjectures, only a small portion of the participants were able to do so logically (Jariyah, 2021). Regarding the indicator of checking the validity of arguments, participants demonstrated the ability to evaluate through calculations, although not comprehensively (Andriyani et al., 2020). Similarly, for the indicator of providing reasons or evidence, participants were able to explain the results of their calculations (Andriyani et al., 2020). Only a few participants were able to draw conclusions, although not completely (Febrianti, 2023).

Descriptive analysis shows that students with high problem-solving abilities also have high adaptive reasoning skills. The average achievement for each adaptive reasoning indicator is: indicator 1 (finding patterns or mathematical phenomena) at 99%, indicator 2 (formulating conjectures) at 17%, indicator 3 (examining the validity of arguments) at 98%, indicator 4 (providing reasons or evidence) at 76%, and indicator 5 (drawing conclusions) at 57%. The highest achievement is on the first indicator, while the lowest is on the second indicator.

Table 7. Adaptive Reasoning Ability Category Based on High Problem-Solving Skills

Category	Interval	Frequency	Percentage
Low	Score < 9.4	0	0%
Medium	$9.4 \leq \text{Score} < 54.2$	0	0%
High	Score ≥ 54.2	28	100%
Total		28	100%

As shown in Table 7, all students (100% or 28 students) with high problem-solving abilities were categorized as having high adaptive reasoning. This finding aligns with the research by Supriyati et al. (2020), which states that students with good problem-solving skills also demonstrate good adaptive reasoning abilities. The fulfillment of indicators by students is also supported by various studies. For the first indicator, students were able to construct mathematical models well (Andriyani et al., 2020). For the second indicator, most participants were able to make one to three logical conjectures (Jariyah, 2021). The third indicator was also well met because participants were able to verify the arguments they obtained (Andriyani et al., 2020). Furthermore, for the fourth indicator, participants were able to provide evidence and explanations for the conjectures they made (Andriyani et al., 2020). For the fifth indicator, participants were able to draw conclusions from the problem-solving process (Jariyah, 2021), although this differed from the findings of Indriani et al. (2017), who stated that not all participants were able to draw conclusions logically. This finding confirms the close link between problem-solving ability and adaptive reasoning.

3. The relationship between adaptive reasoning ability and problem-solving ability of MTs students in Kediri City in solving AKMI model questions at the HOTS level with a scientific context

The results of the normality test for adaptive reasoning ability scores showed a kurtosis value of $0.374 < 8.0$ and skewness of $-1.286 < 3.0$, while for problem-solving ability, the kurtosis value was $0.294 < 8.0$ and skewness was $-1.251 < 3.0$. Based on Kline's (2011) criteria, the data for both variables are normally distributed. Next, the linearity test showed a Deviation from Linearity value of $0.000 < 0.05$, which means the relationship between adaptive reasoning ability and problem-solving is not linear. Therefore, the non-parametric Spearman test was used to determine the relationship between the two.

The first Spearman test focused on determining the relationship between low problem-solving ability and students' adaptive reasoning ability, as shown in Table 8. Based on Table 8, the significance value of $0.004 < 0.05$ indicates a correlation between low problem-

solving ability and adaptive reasoning. A correlation coefficient of 0.584 indicates a moderate and positive relationship.

Table 8. Results of the Spearman Rank Test for Low Problem-Solving Ability and Adaptive Reasoning Ability

Correlations			KPM_low	KPA_KPM_low
Spearman's rho	KPM_low	Correlation Coefficient	1.000	.584 **
		Sig. (2-tailed)	.	.004
		N	22	22
	KPA_KPM_low	Correlation Coefficient	.584 **	1.000
		Sig. (2-tailed)	.004	.
		N	22	22

The second Spearman's rank test was conducted to determine the relationship between moderate problem-solving ability and adaptive reasoning ability. Based on Table 9, the Spearman's rank test shows a significance value of $0.000 < 0.05$, which means there is a correlation between moderate problem-solving ability and adaptive reasoning. The correlation coefficient value of 0.949 indicates a very strong and positive relationship between the two variables.

Table 9. Spearman's Rank Test Results for Problem-Solving Skills and Adaptive Reasoning Abilities

Correlations			KPM_Medium	KPA_KPM_Medium
Spearman's rho	KPM_Medium	Correlation Coefficient	1.000	.949 **
		Sig. (2-tailed)	.	.000
		N	79	79
	KPA_KPM_Medium	Correlation Coefficient	.949 **	1.000
		Sig. (2-tailed)	.000	.
		N	79	79

The third Spearman rank test was conducted to determine the relationship between high problem-solving ability and adaptive reasoning ability. Table 10 shows a significance value of $0.000 < 0.05$ and a correlation coefficient of 0.692, indicating a strong and positive correlation between high problem-solving ability and adaptive reasoning ability.

Table 10. Results of Spearman's Rank Test for High Problem-Solving Ability and Adaptive Reasoning Ability.

Correlations			KPM_High	KPA_KPM_High
Spearman's rho	KPM_High	Correlation Coefficient	1.000	.692 **
		Sig. (2-tailed)	.	.000
		N	28	28
	KPA_KPM_High	Correlation Coefficient	.692 **	1.000
		Sig. (2-tailed)	.000	.
		N	28	28

In addition to calculating the relationship at each level of problem-solving ability, the Spearman rank test was also performed on the overall scores of students' problem-solving ability and adaptive reasoning ability, as shown in Table 11.

Table 11. Overall Spearman's Rank Test Results for Problem-Solving Ability and Adaptive Reasoning Ability Scores

Correlations			Score_KPA	Score_KPM
Spearman's rho	Score_KPA	Correlation Coefficient	1.000	.978 **
		Sig. (2-tailed)	.	.000
		N	129	129
	Score_KPM	Correlation Coefficient	.978 **	1.000
		Sig. (2-tailed)	.000	.
		N	129	129

Based on Table 11, the significance value obtained is $0.000 < 0.05$ and the correlation coefficient is 0.978, indicating a very strong and positive relationship between problem-solving ability and adaptive reasoning ability. This means that the higher a student's problem-solving ability, the higher their adaptive reasoning ability, and vice versa.

This result is supported by Kilpatrick et al. (2001), who stated that good adaptive reasoning skills make it easier for students to learn and solve mathematical problems. Other research also shows that adaptive reasoning ability is important for solving mathematical problems (Andestia et al., 2024; Falaq et al., 2023; Riyanto et al., 2024). Yanti et al. (2024) emphasize that adaptive reasoning plays a role in ensuring the correctness of the problem-solving process. These two abilities are closely related, so the level of problem-solving ability will affect the level of adaptive reasoning ability of the students.

Therefore, factors that influence problem-solving ability also have the potential to affect adaptive reasoning. This finding is consistent with Choiriyah (2012), who found a significant influence between adaptive reasoning ability and students' mathematical problem-solving.

CONCLUSION

Students with low problem-solving abilities tend to exhibit low adaptive reasoning skills. Students with moderate problem-solving abilities also demonstrate moderate adaptive reasoning skills. Students with high problem-solving abilities show high adaptive reasoning skills. Therefore, it can be concluded that problem-solving ability is positively related or correlated with students' adaptive reasoning ability.

Teachers are expected to strengthen learning integration that trains students to think adaptively through reasoning and problem-solving-based questions. To support this, schools need to provide learning resources that support the development of both abilities. Students also need to get used to solving contextual problems based on reasoning and problem-solving, finding relevant learning resources in a scientific context, and actively participating in group discussions to improve adaptive and solution-oriented thinking skills. In line with this, researchers are further advised to develop question variations considering context, content, cognitive level, and question format to delve deeper into the abilities of MTs students. Further research can also focus on interventions to improve adaptive reasoning and problem-solving skills, considering student characteristics, the types of questions used, data analysis techniques, underlying theory, and the number and diversity of research subjects. This collaborative effort between teachers, schools, students, and researchers is expected to strengthen meaningful learning and foster the development of higher-order thinking skills in students.

This study has limitations because it only focuses on the adaptive reasoning and problem-solving abilities of MTs-level students participating in the 2024 AKMI program in Kediri City, thus not yet covering other educational levels. Additionally, the problem context used in this study is limited to the scientific context only and does not yet encompass other relevant contexts for measuring students' problem-solving and adaptive reasoning abilities.

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