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Through the Teacher's Lens: Perspectives on Integrating Higher-Order Thinking Skills into Mathematics Instruction

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ABSTRACT

The integration of Higher-Order Thinking Skills (HOTS) in mathematics instruction holds significant potential to deepen students' conceptual understanding and fostering analytical thinking. However, its implementation is often hindered by gaps in teacher competency, curricular limitations, and outdated assessment methodologies. This study aims to explore mathematics teachers' perspective on HOTS integration by examining four dimensions: understanding, perceived need, implementation challenges, and classroom practices. A descriptive survey design was employed, involving 186 junior and senior high school teachers selected through stratified random sampling. Data were collected via a structured questionnaire and analyzed using descriptive and inferential statistics, including Pearson correlation. Findings reveals a noticeable gap between teachers' conceptual understanding of HOTS and its practical application in the classroom. While teachers acknowledge the importance of HOTS and frequently incorporate problem-solving and analytical activities, practical application is inconsistent due to time constraints, insufficient training, and limitation of resources. Differences were observed across teaching levels and school types: private and senior high school teachers, showing stronger understanding and more frequent HOTS integration. Weak correlation among understanding, perceived need, and practice indicate that awareness alone does not ensure effective implementation. These findings underscore the need for systematic support, targeted professional development, and policy reforms to bridge the gap between theory and practice. The study contributes to educational practice by highlighting actionable areas for institutional support and inform policy development aimed at enhancing the integration of HOTS in mathematics education.

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A. INTRODUCTION

In today's rapidly changing educational landscape, the importance of developing Higher-Order Thinking Skills (HOTS) has become increasingly evident. Mathematics, traditionally associated with procedural and rote learning, is now being re-envisioned as a subject where conceptual understanding and critical problem-solving are essential. Grounded in Bloom's Taxonomy, HOTS encourages a progression from basic recall of facts to complex cognitive processes such as analysis, evaluation, and creativity. This shift comes amid widespread curricular reforms intended to equip students with skills that are crucial for navigating an uncertain and innovative future. Bloom's Taxonomy has been extensively utilized as a cognitive framework in structuring HOTS-based activities, offering a structured progression from lower-order thinking skills (LOTS) to HOTS (Abosalem, 2016; Stayanchi, 2018; Zaidi et al., 2018). The

hierarchical nature of the taxonomy facilitates progressive cognitive engagement, guiding students from basic recall to complex problem-solving and analytical reasoning.

The integration of HOTS into mathematics instruction has been widely recognized as an essential approach for deepening conceptual understanding and fostering analytical reasoning. Empirical research suggests that engaging students in higher-order cognitive tasks not only strengthens subject comprehension (Chaojing, 2023; McNamara et al., 2015; Sutarni et al., 2024), but also enhances transferable skills necessary for lifelong learning (Carroll & Harris, 2020; Falloon, 2020; Richland & Begolli, 2016; Richland & Simms, 2015; Tajudin & Chinnappan, 2016). However, despite the theoretical advantages of HOTS-driven instruction, its effective implementation is impeded by multiple barriers, including teacher competency gaps (Abdullah et al., 2017; Kosasih et al., 2022), curriculum rigidity (Zohar & Cohen, 2016), assessment limitations (Abdullah et al., 2017; Jansen & Möller, 2022; Retnawati et al., 2018), and the challenges of digital transformation (Widana, 2020).

A growing body of research underscores that teacher competency is a critical factor in the successful implementation of HOTS in mathematics education (Abdullah et al., 2017; Azid et al., 2022; Chun & Abdullah, 2019). While curricular policies increasingly emphasize HOTS-based learning, many educators lack the pedagogical knowledge (Abdullah et al., 2017; Singh & Marappan, 2020; Tyas et al., 2019), training (Jailani et al., 2017; Yoke et al., 2015), and instructional techniques (Apino & Retnawati, 2017; Pratama & Retnawati, 2018b; Tanujaya et al., 2017; Yen & Halili, 2015) necessary to facilitate higher-order cognitive engagement. Retnawati et al. further explore these challenges through a phenomenological analysis, revealing that prospective mathematics teachers often struggle with designing HOTS-oriented mathematical problems (Retnawati et al., 2023). This difficulty stems from both a lack of training in crafting open-ended, inquiry-based tasks and curriculum structures that emphasize procedural learning over conceptual understanding.

One of the most persistent challenges is curriculum rigidity, where standardized syllabi prioritize content coverage over cognitive depth. Traditional curricula often limit educators' ability to incorporate exploratory learning methodologies, constraining their capacity to integrate HOTS-driven problem-solving activities (Gallagher & Savage, 2023; Marco-Bujosa et al., 2017). Furthermore, assessment practices remain misaligned with HOTS principles. Current studies argue that standardized testing models emphasize recall-based evaluation, making it difficult to measure students' analytical reasoning and critical thinking skills (Kania & Kusumah, 2025; Talamás-Carvajal et al., 2024). Additionally, the role of digital transformation in HOTS implementation is also a critical concern. While technology-enhanced learning environments, including smart classrooms and adaptive learning platforms, have the potential to enhance HOTS-based instruction (Nykyporets et al., 2023; Tangkui & Keong, 2020), their effectiveness is dependent on infrastructure availability and teacher preparedness.

Despite the recognized importance of HOTS and the theoretical backing of frameworks such as Bloom's Taxonomy, a significant discrepancy exists between policy aspirations and classroom realities. This gap is influenced by various factors, including systemic barriers, curriculum design, and educational policies that do not align with classroom practices. The mathematics curriculum heavily emphasizes LOTS, with 81.2% of the syllabus dedicated to the lower three levels of Bloom's hierarchy. This leaves minimal room for HOTS, highlighting the

need for curriculum models that prioritize transversal skills and informed citizenship (Atta et al., 2024). Educational policies often fail to connect with classroom realities, leading to unreasonable expectations and a disconnect between policy and practice. This gap is exacerbated by the lack of alignment between policy aspirations and the lived experiences of educators and students (Du Plessis, 2020). Teachers are expected to translate the complex requirements of HOTS into their daily instructional practices, yet many faces considerable obstacles. These include a lack of clear guidance, insufficient training, and the challenge of aligning innovative teaching practices with standard curriculum mandates. Without a clear understanding of these challenges, the true impact of HOTS-oriented reforms on mathematics education remains uncertain (Judijanto et al., 2024; Wijayasari et al., 2020; Zana et al., 2024).

While existing literature offers valuable insights into the benefits of HOTS and the potential of Bloom's Taxonomy as an educational framework, there is a notable gap in research regarding teachers' perspectives on this integration. Specifically, there is limited empirical evidence on how mathematics teachers understand HOTS, perceive the need for its integration, experience the challenges involved, and actualize HOTS practices in their instruction. Filling this gap is crucial for developing targeted strategies that support teachers and ultimately enhance student learning outcomes. This study aims to explore mathematics teachers' on HOTS integration by examining four dimensions: understanding, perceived need, implementation challenges, and classroom practices. The findings of this study promise to contribute significantly to the field of mathematics education. By illuminating the teacher's perspective, this research will inform the development of more practical, teacher-centered support systems and professional development programs. Furthermore, it will provide educational policymakers with robust evidence to refine curricular frameworks and resource allocation strategies. Ultimately, understanding and addressing the challenges teachers face in integrating HOTS will foster a more dynamic and effective learning environment, ensuring that students develop the critical skills necessary for success in the 21st century.

B. METHODS

This study employed a descriptive survey research design to investigate mathematics teachers' perspectives on integrating HOTS into mathematics instruction. Grounded in Bloom's Taxonomy, the study examined four key dimensions of teachers' perspectives: understanding of HOTS, the perceived need for integration, the challenges encountered, and current classroom practices. A quantitative, cross-sectional approach was chosen to obtain a comprehensive snapshot of these perspectives, enabling the identification of patterns and relationships within the data. A total of 186 mathematics teachers from junior and senior high schools participated in the study. The demographic data collected focused on three areas: teaching experience, school type (public or private), and grade level taught. This information was essential for understanding how background factors may influence teachers' perspectives on HOTS integration.

A stratified random sampling method was employed to ensure balanced representation across the three key demographic categories; (1) teachers were stratified based on years of teaching experience, (2) participants from both public and private schools, and (3) teachers from junior high and senior high schools were included, addressing potential differences in

curricular demands and classroom practices. Data were gathered via a structured questionnaire developed specifically for this study. The questionnaire was distributed both electronically through a secure online survey platform and in paper format to accommodate varied access to technology. The questionnaire comprised a (1) 32 closed-ended items deploy a 4 Likert-scale questions to quantitatively assess the four dimensions of teachers' perspectives, and (2) demographic items that capturing teaching experience, school type, and grade level taught. To ensure the credibility of the instrument, the validity was established through content validity. Content validity was evaluated through a panel of five experts in the fields of mathematics education. The experts reviewed each of the 32 items in the questionnaire to assess their relevance, clarity, and alignment with the research objectives. Based on their feedback, minor revisions were made to ensure the items clearly reflected the four dimensions of teachers' perspectives. The content validity index (CVI) for the instrument was calculated, with an average CVI score of 0.92, indicating a high level of content validity. This suggests that the items were deemed highly relevant and appropriate for measuring the intended constructs. Reliability was determined using Cronbach's alpha coefficient, which was found to be 0.85 for the entire scale, indicating good internal consistency. Individual dimensions also demonstrated acceptable reliability, with Cronbach's alpha values ranging from 0.75 to 0.89, confirming the stability and reliability of the questionnaire. All participants provided informed consent, and confidentiality was maintained throughout the data collection process.

The collected data were analyzed using both descriptive and inferential statistical techniques. The data analysis was performed in two stages. First, descriptive statistics were used to summarize the overall responses and demographic characteristics, including frequency distributions, percentages, means, and standard deviations. In the second stage, Pearson's correlation was applied to examine the relationships among the four dimensions of teachers' perspectives. Specifically, Pearson's correlation coefficient was calculated to determine the strength and direction of the linear relationships between the different dimensions of teachers' perspectives. A positive correlation would suggest that as one increases, another also increases, while a negative correlation would indicate an inverse relationship. Statistical significance was set at $p < 0.05$ for all correlation analyses, and the results were interpreted to explore how the dimensions of teachers' perspectives were interrelated.

C. RESULT AND DISCUSSION

1. Demographic Profile of Participants

Table 1 summarizes the demographic characteristics of the participants, including their teaching experience, the grade levels they teach, and school type. This overview provides insights into the participants' backgrounds, which may influence their perspectives and readiness for integrating HOTS in mathematics learning.

Table 1. The Demografic of Participants

Variable		Frequency (%)
Teaching Experience	1-5 years	8,06%
	6-10 years	10,75%
	11-15 years	19,35%
	16-20 years	45,70%
	21+ years	16,13%
Grade Levels Taught	Junior High School	51,61%
	Senior High School	48,39%
School Type	Private School	31,18%
	Public School	68,82%

2. The Mathematics Teachers' Perspectives among Four Dimensions

The study examined responses from 186 mathematics teachers to evaluate their perspectives on integrating HOTS into mathematics learning. The quantitative analysis focused on four dimensions: Understanding HOTS, the Need for HOTS, Challenges in HOTS integration, and the Practice of integrating HOTS. Table 2 discussing the mean score and standard deviation of the teachers' perspective on integrating HOTS in mathematics learning.

Table 2. The Mean score and standard deviation of the Teachers Perspective

Dimensions	Understanding HOTS	Need HOTS	Challenges HOTS	Practice HOTS
Mean Score	3,16	3,15	3,19	3,09
Standard Deviation	0,92	0,91	0,19	0,96

The findings revealed moderate consensus among teachers across the dimensions. For "Understanding HOTS," the mean score was 3.16 (SD = 0.92), indicating a solid grasp of the concept, particularly as framed by Bloom's Taxonomy. The "Need for HOTS" dimension had a similar mean of 3.15 (SD = 0.91), reflecting strong recognition of its importance in mathematics curricula. Teachers reported slightly higher scores for "Challenges in HOTS" (M = 3.19, SD = 0.90), underscoring persistent obstacles in implementation. In contrast, the "Practice of HOTS" dimension showed a slightly lower mean of 3.09 (SD = 0.96), suggesting a gap between theoretical understanding and practical application in classroom settings. The findings align with studies that indicate a discrepancy between teachers' knowledge and their ability to effectively integrate HOTS into their instructional practices (Abdullah et al., 2017; Tajudin & Chinnappan, 2016).

The findings underscore a dual reality in mathematics education, while teachers are well-informed and value HOTS, significant challenges, such as curricular constraints and resource limitations, impede seamless integration into classroom practices. These findings are supported by studies indicating that limitations in curriculum and resources serve as barriers for teachers in implementing HOTS in their teaching (Gupta & Mishra, 2021; Zhaffar et al., 2021). Addressing these barriers through targeted professional development and resource allocation is essential to align pedagogical practices with the intended outcomes of HOTS integration.

a. The Mathematics Teachers' Perspectives based on Their Teaching Experiences

Table 3. The Mean and standard deviation by Teaching Experience Group

Teaching Experience	Understanding HOTS		Need HOTS		Challenges HOTS		Practice HOTS	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
1-5 years	3,14	0,93	2,82	0,97	3,1	0,96	3,15	0,93
6-10 years	3,09	0,91	3,21	0,89	3,24	0,96	3,14	0,97
11-15 years	3,13	0,95	3,11	0,94	3,27	0,85	3,08	0,95
16-20 years	3,19	0,91	3,18	0,9	3,19	0,9	3,08	0,95
21+ years	3,18	0,9	3,22	0,85	3,11	0,93	3,09	0,97

The analysis reveals distinct trends in teachers' perceptions and practices related to HOTS across different experience levels. Mid-career teachers (6–10 years) report the highest scores for the perceived need for HOTS (mean = 3.21, SD = 0.89) and associated challenges (mean = 3.24, SD = 0.96), highlighting their active engagement with professional development and curriculum initiatives amid systemic barriers. In contrast, veteran teachers (21+ years) exhibit a more nuanced view, with the highest scores for understanding HOTS (mean = 3.18, SD = 0.90) and a consistent recognition of its importance (mean = 3.22, SD = 0.85). However, their lower scores in applying HOTS (challenges mean = 3.11, SD = 0.93; practice mean = 3.09, SD = 0.97) suggest difficulties in translating their comprehensive conceptual understanding into practical classroom applications.

Interestingly, the mean scores for Practice HOTS are relatively consistent across all experience groups, with minor variations (ranging from 3.08 to 3.15) and similar standard deviations (0.93-0.97). This consistency implies that the practical application of HOTS is influenced by factors beyond teaching experience, such as institutional support, access to resources, or professional development opportunities. Teachers with 11-15 years of experience report the highest mean score for Challenges HOTS (3.27, SD = 0.85), with the lowest standard deviation among all groups for this dimension, further emphasizing that challenges in HOTS integration are not confined to a specific experience level but are a pervasive and consistently recognized issue across the teaching profession.

In summary, the findings highlight the nuanced relationship between teaching experience and the dimensions of HOTS. While understanding and perceived need for HOTS vary with experience, the challenges and practical application of HOTS remain consistent issues across groups, as evidenced by both mean scores and standard deviations. These findings align with numerous studies that examine the link between teaching experience and various dimensions of HOTS, consistently finding a significant relationship (Graham et al., 2020; Hino et al., 2020; Pratama & Retnawati, 2018a; Retnawati et al., 2018, 2023; Widana et al., 2019). The standard deviations, generally ranging from 0.85 to 0.97 across all dimensions, indicate moderate variability in responses within each experience group. These results underscore the importance of targeted interventions, such as tailored professional development programs and

systemic reforms, to support teachers at all experience levels in effectively integrating HOTS into their teaching practices.

b. The Mathematics Teachers' Perspectives based on The Grade Level

Table 4. The Mean Score by Grade Level

Grade Level	Understanding HOTS		Need HOTS		Challenges HOTS		Practice HOTS	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Junior High School	3,12	0,92	3,13	0,91	3,25	0,87	3,08	0,98
Senior High School	3,21	0,91	3,17	0,91	3,13	0,93	3,10	0,93

The analysis of mean scores by grade level provides valuable insights into how teachers' perceptions and practices of HOTS differ between junior high school and senior high school. The findings reveal notable variations across the four dimensions of integrating HOTS into mathematics learning: Understanding, Need, Challenges, and Practice. Teachers at the senior high school level exhibit higher mean scores for Understanding HOTS (3.21) compared to their junior high school counterparts (3.12). The standard deviations for Understanding HOTS are relatively similar—0.91 for senior high school and 0.92 for junior high school—suggesting comparable variability in responses despite the higher mean among senior high educators. This difference indicates that, on average, senior high school teachers have a stronger conceptual grasp of HOTS, likely due to the more advanced cognitive demands of their curriculum and the need to prepare students for higher education. Similarly, senior high school teachers report slightly higher mean scores for Need HOTS (3.17 versus 3.13). With both groups showing a standard deviation of 0.91, it is clear that while the perceived need is generally high, the consistency of responses is very similar across grade levels. This slight edge in mean for senior high educators may reflect an increased emphasis on critical thinking and problem-solving skills in senior-level curricula.

In contrast, junior high school teachers report higher mean scores for Challenges HOTS (3.25 compared to 3.13 among senior high teachers). Here, the standard deviation is lower for junior high teachers (0.87) than for senior high teachers (0.93), suggesting that while junior high teachers uniformly experience these challenges, there is a bit more variation among senior high teachers. This finding implies that junior high school educators face more significant and consistent barriers in implementing HOTS, potentially due to factors such as developmental readiness of students, limited resources, or fewer targeted professional development opportunities. Additionally, the mean scores for Practice HOTS are marginally higher among senior high school teachers (3.10) than junior high school teachers (3.08). The standard deviations, 0.93 for senior high and 0.98 for junior high, indicate slightly more variability in the practices of junior high school teachers compared to their senior high counterparts.

Overall, these findings underscore important differences in how HOTS is perceived and practiced across grade levels. Senior high school teachers demonstrate a stronger understanding and a greater perceived need for HOTS, with consistent levels of variability in these measures. Conversely, junior high school teachers not only face more

challenges in implementing HOTS but also exhibit slightly greater variability in their practices. These results highlight the importance of providing targeted support and resources to junior high school teachers to address the barriers they face, while reinforcing professional development programs designed to enhance the practical application of HOTS across all grade levels. These findings are consistent with studies showing variations in the perception and implementation of HOTS across different grade levels (Abdullah et al., 2017; Mitani, 2021; Sa'dijah et al., 2021; Shukla & Dungsungnoen, 2016).

c. The Mathematics Teachers' Perspectives based on School Type

Table 5. The Mean Score and Standard Deviation by School Type

School Type	Understanding HOTS		Need HOTS		Challenges HOTS		Practice HOTS	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Private School	3,38	0,83	3,26	0,94	3,24	0,83	3,22	0,97
Public School	3,06	0,93	3,09	0,90	3,17	0,89	3,03	0,94

The analysis reveals significant differences in teachers' perceptions and implementation of HOTS between private and public schools. Across all four dimensions; Understanding, Need, Challenges, and Practice, private school teachers report higher mean scores. Private school teachers demonstrate a stronger conceptual grasp of HOTS (M = 3.38, SD = 0.83) compared to their public-school counterparts (M = 3.06, SD = 0.93), with lower variability indicating more consistent understanding. Similarly, the perceived necessity of HOTS is slightly higher in private schools (M = 3.26, SD = 0.94) than in public schools (M = 3.10, SD = 0.90), though with greater individual variation. These findings suggest that institutional factors, such as curriculum emphasis and professional development access, influence perceptions of HOTS.

Challenges in implementing HOTS are more pronounced in private schools (M = 3.24, SD = 0.93) than in public schools (M = 3.17, SD = 0.89), with slightly higher variability reflecting diverse experiences in balancing HOTS with academic expectations. In terms of application, private school teachers report more frequent use of HOTS strategies (M = 3.22, SD = 0.97) compared to public school teachers (M = 3.03, SD = 0.94), though with considerable variation in practice. Overall, the results indicate a consistent advantage for private school teachers in understanding, valuing, and applying HOTS, albeit with some variability. These findings align with studies suggesting that perceptions of HOTS are shaped by institutional factors, including school type, location, curriculum priorities, and access to professional development opportunities (Ismail et al., 2022; Nykyporets et al., 2023; Ragab et al., 2024). To bridge this gap, targeted interventions in public schools, such as enhanced training and resource allocation, are necessary to improve HOTS integration while acknowledging diverse teaching contexts.

3. The Relationships between the Four Dimensions of Teachers' Perspectives

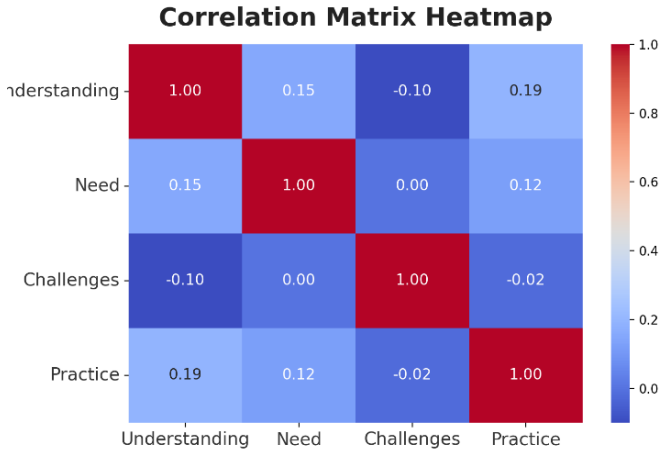

Figure 1. The Correlation Matrix Heatmap

The correlation matrix heatmap elucidates the interrelationships among the four dimensions revealing generally weak associations. The strongest, albeit still weak, relationship exists between Understanding and Practice ($r = 0.19$), indicating that a higher conceptual grasp of HOTS slightly increases the likelihood of its classroom integration. Similarly, the association between Understanding and Need ($r = 0.15$) is minimal, suggesting that teachers' comprehension does not heavily influence their perception of HOTS' importance; instead, external factors, such as curriculum mandates, may drive this perception. Moreover, the weak correlation between Need and Practice ($r = 0.12$) reinforces that recognizing the importance of HOTS does not necessarily translate into its practical implementation.

Notably, the Challenges dimension exhibits negligible or slightly negative correlations with Understanding ($r = -0.10$) and Practice ($r = -0.02$), underscoring that the difficulties teachers face in integrating HOTS are largely independent of their understanding or perceived necessity. This implies that systemic factors, such as rigid curricula, limited resources, or insufficient professional development, are likely the primary contributors to these challenges. While teachers' understanding and perceived need for HOTS are interrelated, their direct impact on practice is limited, and the challenges in integrating HOTS appear to be driven by broader institutional and systemic issues. These insights underscore the importance of targeted interventions, including enhanced teacher training, better resource allocation, and policy reforms, to effectively bridge the gap between understanding, need, and practice in HOTS integration.

4. Teachers' Understanding of HOTS

The analysis of teachers' understanding of HOTS highlights a strong conceptual grasp, with notable areas of consistency and divergence. Teachers demonstrated the highest understanding of foundational components of HOTS, as reflected in the highest mean score ($M = 3.56$, $SD = 0.65$), indicating uniform agreement. Similarly, high mean scores ($M = 3.30$, $SD = 0.82$; $M = 3.23$, $SD = 0.87$) suggest coherent recognition of the importance of integrating HOTS to promote critical thinking and problem-solving skills.

Conversely, lower mean scores (M = 2.96, SD = 1.02; M = 2.93, SD = 0.98) reveal variability in teachers' familiarity with classroom activities fostering HOTS and their understanding of theoretical frameworks like Bloom's Taxonomy. Moderate understanding was observed in differentiating higher-order from lower-order thinking skills and addressing implementation challenges (M = 3.06, SD = 1.00; M = 3.08, SD = 0.91), with nuanced differences in responses. Additionally, teachers showed a fair understanding of methods for assessing HOTS (M = 3.16, SD = 0.88), though variability suggests room for improvement.

While teachers exhibit a robust grasp of HOTS fundamentals, gaps in practical application and theoretical linkages remain. These findings support previous research indicating that teachers have a solid grasp of HOTS fundamentals but struggle with both theoretical understanding and practical implementation (Chaojing, 2023; McNamara et al., 2015; Richland & Begolli, 2016; Yuliati & Lestari, 2018). Addressing these disparities through targeted professional development could enhance pedagogical practices and improve student outcomes in higher-order cognitive skills.

5. Teachers' Needs of Integration of HOTS

The analysis of teachers' perceived need for HOTS highlights a strong overall agreement on its importance, with some variations across specific aspects. Teachers strongly recognize the necessity of prioritizing HOTS to prepare students for real-world challenges (M = 3.24, SD = 0.85), emphasizing its practical relevance in equipping students with critical skills for navigating complex situations. Similarly, there is broad agreement on the role of HOTS in enhancing critical thinking, decision-making, and problem-solving abilities (M = 3.23, SD = 0.86; M = 3.22, SD = 0.87), reflecting a consensus on its broader educational value.

However, lower mean scores (M = 3.02, SD = 0.95; M = 3.04, SD = 0.92) suggest some uncertainty or lack of emphasis on integrating HOTS into the curriculum and improving overall student outcomes. These findings may indicate systemic challenges or gaps in institutional support for effective implementation. Moderate agreement is observed regarding the role of HOTS in fostering creativity, innovation, and analytical skills in the digital age (M = 3.13, SD = 0.89; M = 3.05, SD = 0.91), with room for further emphasis on these aspects.

While teachers demonstrate strong recognition of the importance of HOTS, particularly in preparing students for real-world challenges and enhancing critical thinking, areas such as curriculum integration and fostering creativity require additional support. These findings provide a foundation for targeted interventions to strengthen teachers' capacity to implement HOTS effectively in their classrooms. These findings are supported by research indicating that teachers widely acknowledge the importance of prioritizing HOTS to enhance students' critical thinking, decision-making, and problem-solving skills in real-world contexts (Abdullah et al., 2017; Carroll & Harris, 2020; Falloon, 2020).

6. The Challenges of Integration of HOTS

The analysis of challenges faced by teachers in integrating HOTS into mathematics learning highlights several critical barriers, with varying levels of consensus among respondents. Limited time in the curriculum emerged as the most significant challenge (M = 3.29, SD = 0.86), reflecting strong agreement on its impact. Insufficient training (M = 3.25, SD = 0.90) and

students' struggles with HOTS-based tasks (M = 3.25, SD = 0.85) were also identified as major obstacles, with moderate variability suggesting differences in teachers' experiences.

The lack of appropriate teaching resources (M = 3.20, SD = 0.92) and challenges related to large class sizes (M = 3.17, SD = 0.91) and assessing students' mastery of HOTS (M = 3.15, SD = 0.88) were perceived as moderate barriers, with relatively consistent responses. Standardized testing pressures were seen as the least significant challenge (M = 3.08, SD = 0.96), though the higher variability indicates differing perceptions based on individual or institutional contexts.

The findings reveal that time constraints, insufficient training, and student struggles are the most pressing challenges in integrating HOTS. These findings are consistent with studies indicating that the challenges teachers encounter in incorporating HOTS into mathematics include curriculum and resource constraints, insufficient training, and limited knowledge of HOTS assessment (Chun & Abdullah, 2019; Kania & Kusumah, 2025; Yen & Halili, 2015). Addressing these barriers through systemic changes, professional development, and resource allocation is essential to support teachers in fostering higher-order thinking skills. These insights provide a foundation for future research and targeted interventions to enhance HOTS integration in mathematics instruction.

7. The Practice of Integration of HOTS

The analysis of teachers' practices in integrating HOTS into mathematics learning reveals generally positive engagement, with notable strengths and areas for improvement. Teachers frequently incorporate problem-solving activities and encourage analytical thinking, as reflected in the highest mean scores (M = 3.25, SD = 0.88) and consistent practices in designing tasks that promote HOTS (M = 3.22, SD = 0.93; M = 3.19, SD = 0.88). These findings highlight a strong emphasis on fostering critical thinking and problem-solving skills in mathematics instruction.

However, challenges persist in assessing students' mastery of HOTS and adapting teaching strategies, as indicated by the lowest mean scores (M = 2.94, SD = 1.01; M = 2.96, SD = 1.03) and higher variability in responses. Moderate engagement is observed in providing opportunities for students to create solutions to complex problems and collaborating with colleagues to develop HOTS strategies (M = 3.01, SD = 1.01; M = 3.01, SD = 0.95). Teachers also frequently use real-world examples to contextualize mathematical concepts, with a mean score of 3.16 (SD = 0.89), reflecting an awareness of the importance of practical applications.

While teachers demonstrate a strong commitment to integrating HOTS through problem-solving and analytical activities, challenges in assessment and instructional adaptation remain. Addressing these issues through professional development and collaborative initiatives could enhance the effective implementation of HOTS in mathematics education. These findings provide a foundation for targeted interventions to improve HOTS integration practices. These findings are consistent with studies indicating that difficulties remain in evaluating students' proficiency in HOTS and adjusting instructional approaches (Nykyporets et al., 2023; Talamás-Carvajal et al., 2024).

D. CONCLUSION AND SUGGESTIONS

The findings of this study underscore a critical gap between teachers' understanding of HOTS and their effective implementation in the classroom. While teachers across different educational levels and institutional settings demonstrate a strong recognition of HOTS and acknowledge its necessity for preparing students for real-world challenges, practical application remains inconsistent. This discrepancy suggests that mere conceptual understanding does not necessarily translate into pedagogical competence.

Variability in HOTS implementation is evident across different teacher demographics. Senior high school teachers exhibit a more pronounced comprehension and perceived need for HOTS, whereas junior high school teachers encounter greater challenges and inconsistencies in execution. Furthermore, teachers in private schools demonstrate a stronger appreciation and application of HOTS, albeit with some degree of variability. These disparities highlight the influence of institutional context and teaching experience on the adoption of HOTS in pedagogical practices.

Despite these variations, common obstacles persist across all teacher groups. Time constraints, insufficient professional development, and student difficulties in engaging with complex cognitive tasks are identified as primary barriers to effective HOTS integration. While teachers frequently employ problem-solving exercises and promote analytical thinking, a lack of emphasis on embedding HOTS into curricular frameworks further impedes its systematic implementation. The weak associations revealed in the correlation matrix heatmap suggest that the four dimensions of HOTS—understanding, perceived necessity, application, and institutional support—do not strongly reinforce one another, indicating the need for a more cohesive and structured approach to HOTS training and application.

In light of these findings, it is crucial to bridge the gap between theory and practice. Institutions should provide targeted, sustained professional development programs to equip teachers with the skills and strategies needed to integrate HOTS effectively. Educational policies must support curriculum reforms that allow flexibility for HOTS-driven teaching, and institutions should offer resources like teaching materials and peer networks to aid implementation. Future research should focus on identifying effective professional development models and institutional supports to overcome current challenges and enhance HOTS integration in the classroom.

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REFERENCES

Abdullah, A. H., Mokhtar, M., Halim, N. D. A., Ali, D. F., Tahir, L. M., & Kohar, U. H. A. (2017). Mathematics teachers' level of knowledge and practice on the implementation of higher-order thinking skills (HOTS). *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(1), 3–17. https://doi.org/10.12973/eurasia.2017.00601a

Abosalem, Y. (2016). Assessment Techniques and Students' Higher-Order Thinking Skills. *International*

Journal of Secondary People, *4*(1), 1–11. https://doi.org/10.11648/j.ijsedu.20160401.11

Apino, E., & Retnawati, H. (2017). Developing instructional design to improve mathematical higher order thinking skills of students. *Journal of Physics: Conference Series*, *812*(1), 12100. https://doi.org/10.1088/1742-6596/812/1/012100

Atta, S. A., Atta, S. O. A., Belbase, S., Assan, F. K., & Samuel, A. (2024). An Investigation of The Connection of Bloom's Taxonomy to the Core Mathematics Curriculum for Senior High Schools in Ghana. *Golden Ratio of Social Science and Education*, *4*(1), 01–37. https://doi.org/10.52970/grsse.v4i1.229

Azid, N., Ali, R. M., El Khuluqo, I., Purwanto, S. E., & Susanti, E. N. (2022). Higher Order Thinking Skills, School-Based Assessment and Students' Mathematics Achievement: Understanding Teachers' Thoughts. *International Journal of Evaluation and Research in Education*, *11*(1), 290–302. https://doi.org/10.11591/ijere.v11i1.22030

Carroll, K. A., & Harris, C. M. (2020). Using A repetitive instructional intervention to improve students' higher-order thinking skills. *College Teaching*, *69*(2), 82–90. https://doi.org/10.1080/87567555.2020.1823310

Chaojing, M. (2023). A study on strategies for cultivating higher-order thinking skills in primary and secondary school students. *Frontiers in Educational Research*, *6*(20), 67–71. https://doi.org/10.25236/FER.2023.062011

Chun, T. C., & Abdullah, M. N. L. Y. B. (2019). The teaching of higher order thinking skills (HOTS) in Malaysian schools: Policy and practices. *MOJEM: Malaysian Online Journal of Educational Management*, *7*(3), 1–18. https://doi.org/10.22452/mojem.vol7no3.1

Du Plessis, A. E. (2020). *The Realities Beyond the Numbers: The Policy–Pedagogy Relationship BT - Out-of-Field Teaching and Education Policy: International Micro-Education Policy* (A. E. Du Plessis (ed.); pp. 93–109). Springer Singapore. https://doi.org/10.1007/978-981-15-1948-2_4

Falloon, G. (2020). From simulations to real: Investigating young students' learning and transfer from simulations to real tasks. *British Journal of Educational Technology*, *51*(3), 778–797. https://doi.org/10.1111/bjet.12885

Gallagher, S. E., & Savage, T. (2023). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*, *28*(6), 1135–1157. https://doi.org/10.1080/13562517.2020.1863354

Graham, L. J., White, S. L. J., Cologon, K., & Pianta, R. C. (2020). Do teachers' years of experience make a difference in the quality of teaching? *Teaching and Teacher Education*, *96*. https://doi.org/10.1016/j.tate.2020.103190

Gupta, T., & Mishra, L. (2021). Perceptions of secondary school teacher on HOTS: A qualitative analysis. *Multicultural Education*, *7*(4), 95–100. https://doi.org/10.5281/zenodo.4679571

Hino, K., Makino, T., & Kawakami, T. (2020). Mid-career teacher learning in a mathematics professional development program Focusing on the growth of teachers' perspectives. *Hiroshima Journal of Mathematics Education*, *13*, 57–78. https://doi.org/10.24529/hjme.1304

Ismail, S. N., Muhammad, S., Omar, M. N., & Shanmugam, K. S. (2022). The Practice Of Critical Thinking Skills In Teaching Mathematics: Teachers'perception And Readiness. *Malaysian Journal of Learning and Instruction*, *19*(1), 1–30. https://doi.org/10.32890/mjli2022.19.1.1

Jailani, J., Sugiman, S., & Apino, E. (2017). Implementing the problem-based learning in order to improve the students' HOTS and characters. *Jurnal Riset Pendidikan Matematika*, *4*(2), 247–259. https://doi.org/10.21831/jrpm.v4i2.17674

Jansen, T., & Möller, J. (2022). Teacher judgments in school exams: Influences of students' lower-order-thinking skills on the assessment of students' higher-order-thinking skills. *Teaching and Teacher Education*, *111*. https://doi.org/10.1016/j.tate.2021.103616

Judijanto, L., Sidabutar, H., & Kansil, I. C. (2024). Teacher ' s Dilemma : Facing Endless Curriculum Changes. *Jurnal Ilmiah Edukatif*, *10*(2), 201–211. https://doi.org/10.37567/jie.v10i2.3311

Kania, N., & Kusumah, Y. S. (2025). The Measurement Of Higher-Order Thinking Skills: A Systematic Literature Review. *Malaysian Journal of Learning and Instruction*, *22*(1), 97–116. https://doi.org/10.32890/mjli2025.22.1.6

Kosasih, A., Supriyadi, T., Firmansyah, M. I., & Rahminawati, N. (2022). Higher-order thinking skills in primary school. *Journal of Ethnic and Cultural Studies*, *9*(1), 56–76.

https://doi.org/10.1002/tea.21340

Marco-Bujosa, L. M., McNeill, K. L., González-Howard, M., & Loper, S. (2017). An exploration of teacher learning from an educative reform-oriented science curriculum: Case studies of teacher curriculum use. *Journal of Research in Science Teaching*, *54*(2), 141–168. https://doi.org/10.1002/tea.21340

McNamara, D. S., Jacovina, M. E., & Allen, L. K. (2015). Higher order thinking in comprehension. In *Handbook of Individual Differences in Reading* (pp. 164–176). Routledge.

Mitani, H. (2021). Test score gaps in higher order thinking skills: Exploring instructional practices to improve the skills and narrow the gaps. *AERA Open*, *7*, 23328584211016470. https://doi.org/10.1177/23328584211016470

Nykyporets, S. S., Stepanova, I., & Hadaichuk, N. (2023). Tools and techniques to develop higher order thinking skills in students of non-linguistic technical universities of Ukraine during online learning. *Norwegian Journal of Development of the International Science, 1117: 44–49.* https://ir.lib.vntu.edu.ua/handle/123456789/37921

Pratama, G. S., & Retnawati, H. (2018a). Urgency of Higher Order Thinking Skills (HOTS) Content Analysis in Mathematics Textbook. *Journal of Physics: Conference Series*, *1097*(1). https://doi.org/10.1088/1742-6596/1097/1/012147

Pratama, G. S., & Retnawati, H. (2018b). Urgency of higher order thinking skills (HOTS) content analysis in mathematics textbook. *Journal of Physics: Conference Series*, *1097*(1), 12147. https://doi.org/10.1088/1742-6596/1097/1/012147

Ragab, A., Kaid, A., & Sayed, A. K. (2024). Enhancing Higher Order Thinking Skills (HOTS) in Education: Strategies and Outcomes. *TOFEDU: The Future of Education Journal*, *3*(5), 1488–1499. https://doi.org/10.61445/tofedu.v3i5.267

Retnawati, H., Djidu, H., Kartianom, Apino, E., & Anazifa, R. D. (2018). Teachers' Knowledge About Higher-Order Thinking Skills and Its Learning Strategy. *Problems of Education in the 21st Century*, *76*(2), 215–230. https://doi.org/10.33225/pec/18.76.215

Retnawati, H., Rafi, I., Mahmudi, A., Arliani, E., Zulnaidi, H., Abd Hamid, H. S., & Prayitno, H. J. (2023). A phenomenological study of challenges that prospective mathematics teachers face in developing mathematical problems that require higher-order thinking skills. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(10), em2339. https://doi.org/10.29333/ejmste/13631

Richland, L. E., & Begolli, K. N. (2016). Analogy and Higher Order Thinking : Learning Mathematics as an Example. *Journal of Behavioral and Brain Sciences*, *3*(2), 160–168. https://doi.org/10.1177/2372732216629795

Richland, L. E., & Simms, N. (2015). Analogy, higher order thinking, and education. *Wiley Interdisciplinary Reviews: Cognitive Science*, *6*(2), 177–192. https://doi.org/10.1002/wcs.1336

Sa'dijah, C., Murtafiah, W., Anwar, L., Nurhakiki, R., & Cahyowati, E. T. D. (2021). Teaching higher order thinking skills in mathematics classrooms: Gender differences. *Journal on Mathematics Education*, *12*(1), 159–180. https://doi.org/10.22342/jme.12.1.13087.159-180

Shukla, D., & Dungsungnoen, A. P. (2016). Student's Perceived Level and Teachers' Teaching Strategies of Higher Order Thinking Skills: A Study on Higher Educational Institutions in Thailand. *Journal of Education and Practice*, *7*(12), 211–219. https://eric.ed.gov/?id=EJ1099486

Singh, C. K. S., & Marappan, P. (2020). A review of research on the importance of higher order thinking skills (HOTS) in teaching english language. *Journal of Critical Reviews*, *7*(8), 740–747. https://doi.org/10.31838/jcr.07.08.161

Stayanchi, J. (2018). Higher order thinking through Bloom's taxonomy. *Kwansei Gakuin University Humanities Review*, *22*, 117–124. https://www.kwansei.repo.nii.ac.jp

Sutarni, S., Sutama, S., Prayitno, H. J., Sutopo, A., & Laksmiwati, P. A. (2024). The development of realistic mathematics education-based student worksheets to enhance higher-order thinking skills and mathematical ability. *Infinity Journal*, *13*(2), 285–300. https://doi.org/10.22460/infinity.v13i2.p285-300

Tajudin, N. M., & Chinnappan, M. (2016). The Link Between Higher Order Thinking skills, Representation and Concepts in Enhancing TIMSS Tasks. *International Journal of Instruction*, *9*(2), 199–214. https://doi.org/10.12973/iji.2016.9214a

Talamás-Carvajal, J. A., Ceballos, H. G., & Ramírez-Montoya, M.-S. (2024). Identification of Complex

Thinking Related Competencies: The Building Blocks of Reasoning for Complexity. *Journal of Learning Analytics*, *11*(1), 37–48. https://doi.org/10.18608/jla.2024.8079

Tangkui, R., & Keong, T. C. (2020). Enhancing pupils' higher order thinking skills through the lens of activity theory: Is digital game-based learning effective? *International Journal of Advanced Research in Education and Society*, *2*(4), 1–20. https://myjms.mohe.gov.my/index.php/ijares/article/view/11553

Tanujaya, B., Mumu, J., & Margono, G. (2017). The Relationship between Higher Order Thinking Skills and Academic Performance of Student in Mathematics Instruction. *International Education Studies*, *10*(11), 78–85. https://doi.org/10.5539/ies.v10n11p78

Tyas, M. A., Nurkamto, J., Marmanto, S., & Laksani, H. (2019). Developing Higher Order Thinking Skills (HOTS) – Based Questions: Indonesian EFL Teachers' Challenges. *Proceeding of the 2nd International Conference on Future of Education*, *2*(1), 52–63. https://doi.org/10.17501/26307413.2019.2106

Widana, I. W. (2020). The effect of digital literacy on the ability of teachers to develop HOTS-based assessment. *Journal of Physics: Conference Series*, *1503*(1), 12045. https://doi.org/10.1088/1742-6596/1503/1/012045

Widana, I. W., Suarta, I., & Citrawan, I. W. (2019). Work motivation and creativity on teacher ability to develop HOTS-based assessments. *International Journal of Social Sciences and Humanities*, *3*(3), 188–200. https://doi.org/10.29332/ijssh.v3n3.378

Wijayasari, E., Kurniawati, K., & Winarsih, M. (2020). Challenge of History Teachers in Teaching and Learning Higher Order Thinking Skills (HOTS). *Paramita: Historical Studies Journal*, *30*(1), 36–45. https://doi.org/10.15294/paramita.v30i1.20031

Yen, T. S., & Halili, S. H. (2015). Effective teaching of higher order thinking (HOT) in education. *The Online Journal of Distance Education and E-Learning*, *3*(2), 41–47. https://tojdel.net/journals/tojdel/articles/v03i02/v03i02-04.pdf

Yoke, S. K., Hasan, N. H., Jangga, R., & Kamal, S. N.-I. M. (2015). Innovating with HOTS for the ESL Reading Class. *English Language Teaching*, *8*(8), 10–17. https://doi.org/10.5539/elt.v8n8p10

Yuliati, S. R., & Lestari, I. (2018). Higher-Order Thinking Skills (Hots) Analysis of Students in Solving Hots Question in Higher Education. *Perspektif Ilmu Pendidikan*, *32*(2), 181–188. https://doi.org/10.21009/pip.322.10

Zaidi, N. L. B., Grob, K. L., Monrad, S. M., Kurtz, J. B., Tai, A., Ahmed, A. Z., Gruppen, L. D., & Santen, S. A. (2018). Pushing critical thinking skills with multiple-choice questions: does Bloom's taxonomy work? *Academic Medicine*, *93*(6), 856–859. https://doi.org/10.21009/PIP.322.10

Zana, F. M., Sa'dijah, C., & Susiswo, S. (2024). Mathematics teachers' obstacles in aligning cognitive levels of the assessment and curriculum to develop HOTS for high school students. *AIP Conference Proceedings*, *3049*(1). https://doi.org/10.1063/5.0195402

Zhaffar, N. M., Wan Abdullah, W. A. A., Nor, N., Musa, N. A., & Othman, M. S. (2021). Issues and challenges of the implementation of hots in religious teaching in Malaysia. *International Journal of Academic Research in Progressive Education and Development*, *10*(2), 308–316. https://doi.org/10.6007/IJARPED/v10-i2/9789

Zohar, A., & Cohen, A. (2016). Large scale implementation of higher order thinking (HOT) in civic education: The interplay of policy, politics, pedagogical leadership and detailed pedagogical planning. *Thinking Skills and Creativity*, *21*, 85–96. https://doi.org/10.1016/j.tsc.2016.05.003