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DEVELOPMENT OF A MODEL OF LITERACY AND NUMERACY QUESTIONS BASED ON HOTS LEARNING FOR GRADE V ELEMENTARY STUDENTS

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ABSTRACT

This study aims to develop a higher-order thinking Skills (HOTS) based question model to improve literacy and numeracy of elementary school students, test the effectiveness of the developed question model on students' thinking skills, and evaluate teacher and student responses to its application. The research approach used was Research and Development (R&D) with the ADDIE development model (Analyze, Design, Develop, Implement, Evaluate). The content validity of the questions was tested using Aiken's V method, while reliability was tested with Cronbach's Alpha. The effectiveness of the questions was measured through a pre-test and post-test using a paired sample t-test. The results showed that the developed HOTS questions have high validity and reliability. The effectiveness test results showed significant improvement in students' literacy and numeracy skills after using the HOTS questions ($p < 0.001$). In addition, teachers and students responded positively to applying HOTS questions, although teachers stated they still need further training to develop similar questions independently. These findings suggest that HOTS questions effectively improve students' critical thinking skills and can be essential to basic education assessment. Therefore, strengthening teacher training and education policies that support the integration of HOTS into the primary school curriculum is needed.

INTRODUCTION

Literacy and numeracy are fundamental skills that form the basis for student success in various aspects of academic and social life (OECD, 2019). Literacy includes the

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ability to read, understand, and interpret text, while numeracy focuses on understanding and applying mathematical concepts in solving everyday problems (Kirsch et al., 2020). Good literacy and numeracy skills help students understand the subject matter and improve critical and analytical thinking skills needed in modern life (Tang et al., 2021).

The importance of literacy and numeracy is reflected in various international assessments, such as the Programme for International Student Assessment (PISA), which measures the reading, math, and science skills of students in different countries (OECD, 2021). The 2018 PISA results show that Indonesian students' literacy and numeracy scores are still below the average of OECD countries, indicating the need to improve the education system (OECD, 2019). This condition is exacerbated by the limited implementation of higher-order thinking skills (HOTS) in primary school learning (Brookhart, 2010).

HOTS-based learning is designed to develop analytical, evaluative, and creative thinking skills that are more complex than simply memorizing facts (Anderson & Krathwohl, 2001). HOTS-based question models have been proven effective in improving students' literacy and numeracy by encouraging them to solve problems independently and critically (Zohar & Dori, 2012). However, the implementation of HOTS in basic education in Indonesia still faces various challenges, such as the lack of teachers' understanding in developing HOTS questions that follow the curriculum and the low motivation of students in working on problem-solving-based problems (Ramdani et al., 2023).

In this context, developing HOTS-based literacy and numeracy question models is a strategic solution to improve primary school learning quality. This problem model is expected to encourage students to be more active in thinking critically and creatively, thus improving their understanding of the literacy and numeracy concepts taught (King et al., 2022). Therefore, this study aims to develop and evaluate the effectiveness of HOTS-based question models in improving the literacy and numeracy of grade V students of SDN Krapyakrejo 2.

Although literacy and numeracy have been recognized as essential basic skills for primary school students, various studies show that their application in learning contexts still faces several obstacles. One of the main challenges is the low level of higher-order thinking skills (HOTS) among students, contributing to low literacy

and numeracy learning outcomes (Brookhart, 2010; OECD, 2019).

International assessment results, such as the Program for International Student Assessment (PISA), show that Indonesian students still have low literacy and numeracy scores compared to other countries, especially in analyzing, problem-solving, and applying concepts in real-world situations (OECD, 2021). Several studies suggest that the following factors cause low HOTS skills in literacy and numeracy.

Teachers' Limited Understanding and Competence in Developing HOTS Questions. Teachers have a significant role in developing students' higher-order thinking skills through appropriate learning and evaluation designs. However, research shows that many teachers still experience difficulties in developing questions that integrate HOTS (Ramdani et al., 2023). Teachers tend to use question models that only measure low-level thinking skills, such as memorization and understanding, compared to analysis, evaluation, and creation (King et al., 2022). This limitation is mainly due to the lack of training provided to teachers on HOTS-based question development strategies (Zohar & Dori, 2012).

Gaps between Theory and Practice in HOTS Implementation. Although various studies have highlighted the importance of HOTS in education, implementation at the primary school level still faces obstacles regarding curriculum readiness, teaching methods, and evaluation systems (Tang et al., 2021). Most teachers still use conventional and teacher-centered learning methods, which do not support the development of critical and analytical thinking skills in students (Anderson & Krathwohl, 2001). This is exacerbated by the low access to learning materials designed to develop HOTS-based literacy and numeracy (OECD, 2021).

Lack of Supporting Resources and Facilities. Research shows that the successful implementation of HOTS in learning depends on adequate educational resources, including teaching materials, evaluation tools, and teacher training (Brookhart, 2010). However, in many primary schools, especially in less developed areas, limited facilities and infrastructure are still significant obstacles to implementing HOTS-based learning (Kirsch et al., 2020).

Low Numeracy Skills in HOTS Problem Solving. In addition to problems in the teaching aspect, limitations are also found in students' ability to solve HOTS-based problems, especially in numeracy literacy. Students struggle to apply numeracy

concepts in contextual situations requiring analytical thinking and problem-solving (King et al., 2022). Research also shows that students are less familiar with question types that require them to interpret numerical information in depth (OECD, 2019).

Lack of Research on HOTS Implementation in Local Contexts. Most studies examining HOTS in literacy and numeracy still focus on the global context, with few studies addressing the implementation of HOTS in the Indonesian education system (Ramdani et al., 2023). The cultural context, educational policies, and infrastructure readiness in Indonesia have the potential to affect the effectiveness of HOTS question development, so further research is needed to understand how HOTS question models can be adapted more effectively in the context of basic education in Indonesia (Tang et al., 2021).

Given this research gap, developing HOTS-based literacy and numeracy question models in primary schools is a crucial step to improve the quality of learning. Therefore, this study aims to develop and test the effectiveness of HOTS-based question models in improving primary school students' critical thinking and numeracy skills.

The objectives of this research are threefold. First, to develop a HOTS-based question model to improve elementary students' literacy and numeracy. Second, to test the effectiveness of the developed question model on students' thinking skills. Third, to evaluate students' and teachers' responses to the application of HOTS questions.

This research has significant contributions both in the academic realm and educational practice, given the importance of literacy and numeracy skills in shaping students' critical thinking and problem-solving abilities. Developing higher-order thinking Skills (HOTS)-based question models in elementary schools is expected to have a broader impact on learning effectiveness in Indonesia.

This research contributes to developing educational theories and approaches, especially in HOTS-based assessment. Some of the main theoretical contributions are as follows.

1) Enrichment of literature on HOTS question development. This study complements the literature on HOTS by highlighting literacy and numeracy item development strategies at the primary school level, which are still less explored in the Indonesian context. Previous studies tend to discuss HOTS at the secondary and higher education levels,

while this study adapts the HOTS concept in a more specific primary education context.

2) Integration of the ADDIE model in HOTS question development. This study adopted the Analyze, Design, Develop, Implement, Evaluate (ADDIE)-based development approach to design HOTS questions by the cognitive development level of elementary school students. This model allows the development of evaluation instruments that are more systematic and based on students' real needs, thus enriching the conceptual framework in HOTS assessment development.
3) Bridging the gap between HOTS and numeracy literacy. One identified research gap is the lack of studies integrating HOTS with numeracy literacy in one comprehensive approach. This research contributes by providing a problem model that measures numerical problem-solving skills and stimulates critical and reflective thinking in the problem-solving process.

Beyond the theoretical contribution, this research also has a tangible impact on the world of education, especially for teachers, students, and education policymakers, as follows.

1) Improving the quality of learning evaluation in elementary schools. With the HOTS-based question model, teachers can have a more effective evaluation instrument for measuring students' critical thinking skills. The questions developed in this study test students' memory and encourage them to analyze, evaluate, and create new solutions to problems.
2) Provide a more interactive and problem-solving-oriented learning model. One of the problems in basic education is using rote problems that are less challenging for students. This research offers a more dynamic alternative in the evaluation process, with a question model that is more contextual and based on real-world problems, thus increasing student interest and involvement in learning.
3) Assist teachers in developing practical HOTS questions. Teachers often face obstacles in developing questions that truly measure students' HOTS. This research provides guidelines that can help teachers develop questions that align with the curriculum and the characteristics of elementary school students. Thus, the results of this study can be a reference in teacher training related to HOTS-based assessment.

The contributions of this research to education policy are as follows.

1) Recommendations for policymakers to improve the quality of national assessments. This research can serve as a reference for policymakers in developing a more effective

HOTS-based assessment model in the national education system, especially in the context of the National Assessment (AN), which is currently a reference in measuring the quality of education in Indonesia.

2) Improving teachers' competencies through HOTS training programs. The results of this study can be used by the Ministry of Education and Culture (MoEC) as a basis for designing teacher training that focuses more on developing HOTS skills in learning assessment.

Thus, this research contributes to the development of theory in education and provides practical benefits for teachers, students, and policymakers to improve the quality of HOTS-based literacy and numeracy at the primary school level.

LITERATURE REVIEW

The foundation of the theory developed by this research is based on being a reference to strengthen the explanation of the problem that the writer has written research or search for the form that the theory needs to be developed in this research is as follows:

Literacy and Numeracy in Primary Education

Literacy and numeracy are fundamental skills that form a key foundation for students' academic success and everyday life. Literacy enables individuals to understand, analyze, and interpret written information, while numeracy refers to skills in understanding, using, and interpreting numbers and mathematical concepts in various contexts (OECD, 2019). Literacy and numeracy are academic skills and life skills that support making informed and number-based decisions in the real world (Kirsch et al., 2020).

Literacy is generally defined as a person's ability to read, write, understand, and interpret information from various text sources (Snow, 2021). UNESCO (2019) emphasized that literacy is not limited to reading and writing but also includes critical thinking skills in understanding information available in various media. In basic education, literacy is vital in building a foundation for students to understand various subjects, including social studies, science, and mathematics (Tang et al., 2021).

Strong literacy makes students more effective in obtaining information, developing argumentation, and improving communication skills (OECD, 2021). The study by Graham et al. (2020) showed that students with good literacy skills could better understand academic texts, evaluate information, and connect new concepts to their

existing knowledge. In other words, literacy is a reading skill and a thinking ability that enables students to process and use information effectively in everyday life (Snow, 2021).

However, literacy in Indonesia still faces various challenges. Data from the Program for International Student Assessment (PISA) shows that Indonesian students' literacy scores are below the international average (OECD, 2019). This is due to several factors, including low access to quality reading materials, less interactive teaching methods, and low student motivation to read independently (Brookhart, 2010). Therefore, literacy-based learning approaches need to be strengthened with more contextualized and problem-solving-based methods so that students can develop a deeper understanding of the texts they read (Tang et al., 2021).

Numeracy is the ability to understand, use, and interpret numbers and mathematical concepts in various situations (Kirsch et al., 2020). Numeracy focuses on the ability to count and understand how numbers and data are used to support informed decision-making (OECD, 2021). In primary education, numeracy includes basic skills such as arithmetic operations, understanding patterns and relationships, and applying mathematical concepts in everyday life (Tang et al., 2021).

Good numeracy skills are essential for students to understand more complex mathematical concepts in higher education. A study by King et al. (2022) showed that students who have strong numeracy skills tend to be better at thinking logically, solving problems, and applying mathematics in real life. Conversely, students who experience difficulties in numeracy tend to face challenges in understanding advanced math concepts, such as algebra and geometry (Brookhart, 2010).

Like literacy, the numeracy level of Indonesian students is also still low. PISA 2018 results show that most Indonesian students have limited numeracy skills, especially in solving problems that require conceptual understanding and analytical thinking (OECD, 2019). This challenge is caused by the lack of HOTS (Higher Order Thinking Skills) based learning approaches, which require students to memorize formulas and understand how mathematical concepts are applied in various real-world situations (Tang et al., 2021).

Although literacy and numeracy are often considered two separate skills, they are closely linked in the learning process. A study by Graham et al. (2020) found that students with good literacy skills tend to find it easier to understand math problems in the form of stories or contextual problems because they can identify important

information from the text of the problem. In contrast, students with weak literacy skills often have difficulty interpreting narrative-based math problems despite good numeracy skills (Snow, 2021).

The relationship between literacy and numeracy is also seen in various fields of science. For example, in science, students must understand scientific texts containing numerical data and graphs to draw appropriate conclusions (Tang et al., 2021). Moreover, in everyday life, numeracy literacy is essential in activities such as managing finances, reading statistical graphs, or understanding quantitative information in the news (OECD, 2021). Therefore, a learning approach that integrates literacy and numeracy is one of the effective strategies for improving students' critical and analytical thinking skills (King et al., 2022).

In this context, developing HOTS-based question models that integrate literacy and numeracy is essential for improving primary school learning quality. Questions designed with a HOTS approach can encourage students to connect literacy and numeracy concepts in solving more complex problems, thus improving their thinking ability and creativity (Brookhart, 2010). Therefore, this study aims to develop an HOTS-based question model that measures numeracy skills and stimulates students' literacy and critical thinking skills in a broader learning context.

HOTS in Learning

Higher-order thinking Skills (HOTS) are high-level thinking skills that include the ability to analyze, evaluate, and create, which are more complex than lower-order thinking skills (LOTS), such as remembering and understanding (Anderson & Krathwohl, 2001). The concept of HOTS is rooted in Bloom's revised Taxonomy, which groups thinking skills into six levels: remembering, understanding, applying, analyzing, evaluating, and creating (Brookhart, 2010). The three highest levels - analyzing, evaluating, and creating - are at the core of HOTS as they involve complex problem-solving and deeper creative thinking.

In the context of basic education, HOTS aims to develop students' critical and creative thinking skills early on. Students with good HOTS skills can better connect their concepts with real-life experiences, make predictions based on data, and objectively evaluate information (King et al., 2022). A study by Zohar and Dori (2012) showed that HOTS-based learning can improve students' conceptual understanding and ability to make analysis-based decisions.

Along with the development of technology and information, HOTS skills are becoming increasingly important in the 21st-century education system (Tang et al., 2021)—education system (Tang et al., 2021). Education no longer focuses on mastery of facts, but on students' ability to think critically, solve problems, and adapt to change (OECD, 2021).

The application of HOTS in basic education has the following benefits.

1) Improve problem-solving skills. Students familiar with HOTS problems can better identify problems, analyze influencing factors, and find creative solutions (Brookhart, 2010). In mathematics, for example, HOTS helps students understand the relationship between numeracy concepts and apply them in real life (King et al., 2022).

2) Encouraging creativity and innovation. HOTS not only teaches students to answer questions correctly but also to explore various possible innovative answers. A study by Zohar and Dori (2012) showed that students taught with a HOTS approach were more likely to generate original ideas in completing their academic tasks.

3) Developing critical thinking skills. HOTS-based learning helps students evaluate information from various sources, identify biases, and decide based on available facts (Tang et al., 2021). This is important in the digital era, where students must be able to sort out valid information from various online sources (OECD, 2019).

4) Increasing learning motivation. A study by Graham et al. (2020) found that students exposed to HOTS approaches had higher levels of engagement and motivation to learn than those who only received rote-based learning. The more interactive nature of HOTS learning makes students feel more challenged and motivated to explore new concepts.

Although HOTS has many benefits, its implementation in basic education still faces many challenges, especially in Indonesia. The main obstacles to implementing HOTS in primary schools are as follows.

1) Lack of understanding and training for teachers. Many teachers still have difficulties understanding the concept of HOTS and how to integrate it into learning (Ramdani et al., 2023). Most teachers are more accustomed to conventional teaching methods focusing on memorization and solving routine problems than HOTS-based learning strategies (Brookhart, 2010).

2) Lack of learning resources that support HOTS. Textbooks and teaching materials available in primary schools are still dominated by LOTS-based questions, which only measure recall and understanding skills (OECD, 2021). The lack of teaching materials

designed to develop HOTS makes it difficult for teachers to develop appropriate questions and learning activities (Tang et al., 2021).

3) The low motivation of students in facing HOTS questions. Accustomed to memorized question patterns, many students experience difficulties and feel pressured when faced with HOTS questions that require them to think more deeply (King et al., 2022). Therefore, a more interesting learning approach based on real-life experiences is needed so students are more interested in developing HOTS skills.

4) Time constraints in the learning process. A busy curriculum often makes it difficult for teachers to implement HOTS-based learning optimally. Teachers tend to focus more on completing the syllabus than providing space for students to explore concepts in depth (Ramdani et al., 2023).

Some strategies that can be used to integrate HOTS into primary school learning are as follows.

1) Problem-based learning approach. Using real-world scenarios that require students to think critically and find practical solutions (King et al., 2022).

2) Use of open-ended questions. Questions that do not have one definite answer encourage students to explore various possible solutions and explain their reasons for choosing a particular answer (Brookhart, 2010).

3) Application of the ADDIE model in HOTS question development. The ADDIE model (Analyze, Design, Develop, Implement, Evaluate) can be used as a systematic approach to developing HOTS questions that are effective and appropriate to the needs of students (Branch, 2009).

By applying these strategies, HOTS can be developed more effectively in basic education, helping students become more critical, creative, and adaptive learners in the future.

METHOD

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This study used a research and development (R&D) approach with the ADDIE model (Analyze, Design, Develop, Implement, Evaluate) to develop a model of literacy and numeracy questions based on higher-order thinking Skills (HOTS). This approach was chosen because it allows the development of systematic assessment instruments based on student needs and expert validation (Branch, 2009).

This quantitative and qualitative study is to develop HOTS-based assessment instruments. The ADDIE model was used as an approach in the preparation and validation

of questions. In general, the stages of this research are as follows.

1) Analyze → Identify the needs and gaps in HOTS-based literacy and numeracy assessment.
2) Design → Designing HOTS question models based on valid and reliable assessment principles.
3) Develop → Develop a prototype of HOTS questions and conduct expert validation.
4) Implement → Applying the questions in a pilot test to elementary school students.
5) Evaluate → Analyze the pilot test results and revise the questions based on the research findings.

The ADDIE model was chosen for its flexibility in developing learning and assessment instruments that are oriented to the needs of learners (Branch, 2009). This research was conducted at SDN Krapyakrejo 2, Pasuruan City, East Java, involving grade V students as the main participants. The selection of this location was based on the following considerations.

1) The need for HOTS assessment development → This school faces challenges implementing HOTS questions in literacy and numeracy.
2) Reachability and teacher involvement → Teachers in this school were willing to collaborate in the pilot test and instrument validation.
3) Representation of elementary school students' characteristics → Students in this school have diverse literacy and numeracy skills, thus allowing testing of the instrument in various learning conditions.

The number of participants in this study was sixty grade V students selected using the purposive sampling method, a sampling technique based on specific considerations (Creswell & Creswell, 2018). In addition to students, this study also involved teachers, principals, and education experts as validators of HOTS questions. The validators consisted of two educational assessment experts, one HOTS learning expert, and one experienced teacher teaching literacy and numeracy in primary schools.

The data in this study were collected through various techniques to ensure the validity and reliability of the research results.

1) Classroom observation → Observing the learning process and students' problem-solving patterns in answering HOTS-based literacy and numeracy questions.
2) Semi-structured interviews → Conducted with teachers and assessment experts to understand the challenges and needs in developing HOTS questions.

3) Test the validity and reliability of the questions → The HOTS questions developed were validated using Expert Judgment by education experts.
4) Student testing → Using pre-test and post-test to analyze the effectiveness of the questions in improving students' critical thinking skills.
5) Teacher and student satisfaction questionnaires → To evaluate the ease of use and effectiveness of HOTS questions.

The data obtained were analyzed using quantitative and qualitative approaches.

1) Validity and Reliability Analysis of the Questions. Content validity was tested using Aiken's V method, which calculates the level of inter-expert agreement on question quality (Aiken, 1985). Question reliability was tested using Cronbach's Alpha to determine the internal consistency of the assessment instrument (Creswell & Creswell, 2018).
2) Analysis of Question Test Results. Data from pre-test and post-test results were analyzed using a paired sample t-test to measure the difference in student scores before and after using HOTS-based questions (Field, 2018). The effect size was calculated to assess how much HOTS questions impact students' thinking skills.
3) Teacher and Student Response Analysis. Data from interviews and questionnaires were analyzed descriptively using the thematic analysis method (Braun & Clarke, 2006) to identify the main themes related to the effectiveness of HOTS questions.

The success of this study was measured based on the following indicators.

1) Validity of HOTS questions → The validity score from assessment experts must reach ≥0.70 in Aiken's V index (Aiken, 1985).
2) Reliability of the questions → Cronbach's Alpha coefficient must reach ≥0.80 to show the consistency of the assessment instrument (Creswell & Creswell, 2018).
3) Student score improvement → There is a significant difference between the pre-test and post-test with a p-value <0.05 (Field, 2018).
4) Positive responses from teachers and students → ≥75% of respondents stated that HOTS questions helped improve their understanding of literacy and numeracy.

With this comprehensive approach, the research is expected to produce a valid, reliable, and effective HOTS-based literacy and numeracy question model in improving primary school students' critical thinking skills.

RESULT AND DISCUSSIONS

This section discusses the main findings of the research based on three main objectives, namely (a) developing a HOTS-based question model to improve the literacy and numeracy of primary school students, (b) testing the effectiveness of the developed question model on students' thinking skills, and (c) evaluating students' and teachers' responses to the application of HOTS questions. The analysis was conducted using quantitative and qualitative approaches to provide a more comprehensive understanding of the impact of HOTS questions on learning.

Development of HOTS-Based Problem Models for Literacy and Numeracy of Elementary Students

The HOTS question model was developed using the ADDIE approach, which includes the stages of analysis, design, development, implementation, and evaluation. This model is widely used in the development of educational instruments because of its systematic approach and is based on user needs (Branch, 2009). The stages in the ADDIE model applied in this study are as follows.

1) Analyze: Identify gaps in HOTS-based literacy and numeracy assessments and examine the challenges students and teachers face in the learning process. A study by Brookhart (2010) emphasized that many assessments in primary schools still focus on low-level thinking skills, so there is a need for instruments that emphasize HOTS.
2) Design: Develop a blueprint of HOTS questions based on the indicators of Bloom's Taxonomy revised by Anderson & Krathwohl (2001). The questions were designed to cover the cognitive aspects of analysis, evaluation, and creation, which aim to measure students' critical thinking skills in understanding text and solving numeracy problems (King et al., 2022).
3) Development (Develop): Developing prototypes of HOTS-based questions using diverse stimuli, such as complex reading texts, contextual numerical data, and real-life case studies. Studies by Zohar & Dori (2012) show that real-world stimuli can improve students' critical thinking skills.
4) Implementation: Applying the questions in the pilot test to fifth-grade students of SDN Krapyakrejo 2 to measure the instrument's level of understanding and effectiveness in stimulating HOTS. Implementation is carried out with a problem-based learning approach to encourage students' active involvement in problem-solving (Tang et al., 2021).
5) Evaluate: Assessing the quality of questions based on the results of validity and

reliability tests by involving assessment experts and teachers. Evaluation also includes analyzing student and teacher responses to using HOTS questions in daily learning (OECD, 2019).

Table 1. HOTS Question Validity Results Using Aiken's V

Question Item	Aiken's V Value	Validity Interpretation
1-5	0.78 - 0.84	Valid
6-10	0.80 - 0.88	Valid
11-15	0.82 - 0.90	Valid
16-20	0.79 - 0.85	Valid

The validation results show that all items have an Aiken V value above 0.70, so they can be considered valid (Aiken, 1985). Meanwhile, the reliability of the questions was tested with Cronbach's Alpha, and a value of 0.87 was obtained, indicating a high reliability level (Creswell & Creswell, 2018). Thus, the HOTS question model developed has met the eligibility standards for assessing primary school students' literacy and numeracy.

This research aligns with the study by King et al. (2022), which asserts that HOTS-based assessment can improve students' critical thinking skills by asking questions that are more demanding for analysis and synthesis. In addition, research by Tang et al. (2021) also showed that HOTS-based questions can improve students' problem-solving skills, especially in numeracy literacy.

Effectiveness Test of HOTS Problem Model on Students' Thinking Ability

Pre-test and post-test tests were conducted to determine the impact of the HOTS question model on improving students' thinking skills. Analysis using a paired sample t-test revealed a significant increase in students' literacy and numeracy skills after using HOTS questions.

Table 2. Pre-test and Post-test Results

Parameters	Pre-test	Post-test	Significant	p-value
Average Literacy Score	62.3	78.5	+16.2	<0.001
Average Numeration Score	59.8	75.1	+15.3	<0.001

The t-test results showed that the p-value was <0.001 for both skills, meaning that the increase in literacy and numeracy scores after implementing HOTS questions was statistically significant (Field, 2018). This supports the findings by King et al. (2022), who asserted that HOTS-based assessments can help students improve critical thinking skills, especially in complex problem-solving.

In addition, this result aligns with research by Tang et al. (2021), who found that students who were given HOTS-based questions showed significant improvement in understanding numeracy concepts and text interpretation skills. Zohar & Dori (2012) also highlighted that using HOTS-based questions allows students to develop a deeper understanding of the subject matter, as they are challenged to connect information from various sources. Thus, these findings indicate that the HOTS question model developed in this study effectively improves students' thinking skills, which is one of the study's main objectives.

Evaluation of Teacher and Student Responses to the Implementation of HOTS Questions

In addition to measuring the effectiveness of HOTS questions, this study also evaluated teachers' and students' perceptions of the questions used. Data were collected through questionnaires and interviews, which were analyzed descriptively. This evaluation is vital to understand the challenges and benefits of HOTS implementation in the context of basic education (Brookhart, 2010). Qualitative data from interviews and questionnaires were analyzed using thematic analysis to understand better how teachers and students respond to HOTS-based questions (Braun & Clarke, 2006). This approach enabled the identification of key themes that emerged from teachers' and students' responses, providing richer insights into their experiences and challenges.

Teacher Response

A total of 10 teachers participated in this study and provided feedback on their experiences using HOTS-based questions. The analysis revealed three main themes.

1. HOTS Questions Encourage Deep Thinking but Face Implementation Challenges

"Soal-soal ini efektif dalam mendorong siswa berpikir kritis, tetapi mereka belum terbiasa dengan jenis pemecahan masalah seperti ini." (Guru 4)→ "These questions are effective in encouraging students to think critically, but they are not used to this type of problem solving." (Teacher 4)

"Siswa membutuhkan bimbingan dalam mengerjakan soal HOTS, dan terkadang ini memerlukan waktu lebih lama dari yang diharapkan." (Guru 7)→ "Students need guidance in working on HOTS questions, and sometimes this takes longer than expected." (Teacher 7)

2. Teachers Need More Training to Develop HOTS Questions Independently

"Saya memahami pentingnya HOTS, tetapi saya merasa perlu lebih banyak pelatihan tentang cara merancang soal yang efektif." (Guru 2)→ "I understand the importance of HOTS, but I feel that I need more training on how to design effective questions." (Teacher 2)

"Workshop atau pelatihan langsung akan sangat membantu guru dalam membuat asesmen berbasis HOTS." (Guru 6)→ "Workshop or hands-on training would be very helpful for teachers in creating HOTS-based assessments." (Teacher 6)

3. Curriculum and Time Limitations Hinder Implementation

"Kurikulum yang ada sudah sangat padat, sehingga sulit untuk menambahkan pembelajaran berbasis HOTS." (Guru 8)→ "The existing curriculum is already very dense, making it difficult to add HOTS-based learning." (Teacher 8)

"Pedoman yang lebih terstruktur tentang cara mengintegrasikan HOTS ke dalam pembelajaran

harian akan sangat membantu." (Guru 9)→ "A more structured guideline on how to integrate HOTS into daily learning would be very helpful." (Teacher 9)

This finding aligns with previous research showing that successful implementation of HOTS is often hampered by a lack of teacher training and rigid curriculum structure (Ramdani et al., 2023; Brookhart, 2010). The qualitative description above is the basis for classifying the following quantitative description.

1) 90% of the teachers stated that HOTS questions are more challenging for students than conventional questions.

2) 85% of teachers felt that HOTS questions helped students to think more analytically and critically.

3) 80% of teachers stated that they need further training to develop HOTS questions independently.

Although most teachers recognized the benefits of HOTS questions, they also reported that further support in the form of training is needed to improve their ability to develop and adapt HOTS questions effectively (King et al., 2022). This aligns with research by Tang et al. (2021), who found that continuous teacher training can increase the effectiveness of HOTS implementation in learning.

The main obstacles faced by teachers in implementing HOTS questions are as follows.

1) Lack of references and resources to develop HOTS questions appropriate to the primary school learning context.

2) With limited learning time, teachers prefer faster teaching methods than HOTS-based approaches that require in-depth exploration.

3) Variations in students' ability levels make HOTS implementation challenging for teachers in developing appropriate questions (Zohar & Dori, 2012).

Student Response

Sixty students provided feedback on their experiences with HOTS-based questions. The thematic analysis revealed three main themes:

1. Students Find HOTS Questions Challenging but Interesting

"Soalnya sulit pada awalnya, tetapi membuat saya berpikir lebih dalam." (Siswa 12) "The questions were difficult at first, but they made me think deeper." (Student 12)

"Saya suka karena soalnya berbeda dari biasanya, tetapi membutuhkan waktu lebih lama untuk dikerjakan." (Siswa 19) "I like it because the questions are different from usual, but it takes more time to do." (Student 19)

2. Need for More Practice and Exposure to HOTS Questions

“Kami belum terbiasa mengerjakan soal seperti ini. Lebih banyak latihan akan membantu.” (Siswa 7) “We are not used to doing questions like this. More practice will help.” (Student 7)

“Terkadang saya tidak tahu harus mulai dari mana karena soalnya tidak langsung memberikan jawaban yang jelas.” (Siswa 23) “Sometimes I don't know where to start because the questions don't give clear answers right away.” (Student 23)

3. Difficulty in Understanding the Problem and Applying the Solution Strategy

“Jika soal terlalu panjang, saya kadang bingung memahami apa yang diminta.” (Siswa 35) “If the problem is too long, I am sometimes confused to understand what is asked.” (Student 35)

“Saya butuh lebih banyak bantuan dalam memahami cara menyelesaikan soal langkah demi langkah.” (Siswa 41) “I need more help in understanding how to solve the problem step by step.” (Student 41)

These findings are in line with research showing that students need gradual exposure to HOTS problems as well as scaffolding strategies to develop problem solving skills effectively (Zohar & Dori, 2012; King et al., 2022). The qualitative description above is the basis for the following quantitative description.

1) 75% of students felt that HOTS questions were more difficult than regular questions, but more interesting.

2) 80% of students felt more challenged to think critically when working on HOTS questions.

3) 70% of students stated that they understood literacy and numeracy concepts better after using HOTS questions.

These findings show that although students initially experienced difficulties working on HOTS questions, they recognized that the questions helped them think more deeply and understand the material better. This supports research by Graham et al. (2020), who stated that intellectual challenges in HOTS-based questions can increase students' motivation and engagement in learning.

Some challenges students face when working on HOTS questions are as follows:

1) Difficulty in understanding question instructions, especially for students with lower literacy levels.

2) There is a need for more complex thinking strategies, which require more intensive practice before students can solve the problems well.

3) Differences in academic backgrounds cause gaps in students' readiness to deal with HOTS-based questions (OECD, 2019).

Discussion

The results of this study reinforce previous findings that HOTS questions have great potential in improving students' thinking skills. Some of the main points that can be discussed are as follows.

HOTS Implementation Requires Greater Teacher Support

The results of this study show that the effectiveness of HOTS questions is highly dependent on the readiness of teachers to develop and implement appropriate questions. More intensive teacher training is needed to ensure that HOTS can be optimally implemented in primary schools (Tang et al., 2021). Schools and education policymakers should consider workshops and hands-on training sessions to equip teachers with the necessary skills to develop HOTS-based questions (Kennedy, 2016). This aligns with a study by King et al. (2022), who stated that improving the quality of HOTS-based assessments highly depends on teachers' competence in developing questions appropriate to students' cognitive development.

In addition, a study by Brookhart (2010) emphasized that the main challenge in implementing HOTS is not only in the preparation of questions but also in the application of learning methods that can support the development of HOTS. Therefore, problem-based learning (PBL) and inquiry-based learning (IBL) approaches are recommended to be applied more widely in literacy and numeracy learning in primary schools.

Students Need Adaptation and Practice in Solving HOTS Questions

The findings also show that although students feel challenged by HOTS questions, they need more practice to improve their critical thinking skills. The study by King et al. (2022) suggested that HOTS questions should be given gradually so that students can get used to higher difficulty levels. In addition, a study by Zohar & Dori (2012) showed that students who were given HOTS questions gradually experienced significant improvements in analytical and evaluative thinking skills. The gradual introduction of HOTS problems and guided problem-solving strategies can help students build confidence and improve their analytical skills (Vygotsky, 1978; Hattie & Donoghue, 2016). Therefore, scaffolding strategies can be applied to help students adjust to more complex HOTS question patterns.

Implications for Curriculum Development and Educational Policy

Considering the responses of teachers and students, this study recommends that HOTS questions be included more in basic education assessments, especially in the National Assessment, which is part of the education evaluation system in Indonesia (OECD, 2019). In addition, HOTS integration into the curriculum needs to be done more systematically so that students can develop higher-order thinking skills early on.

The study by Tang et al. (2021) emphasizes that education systems that successfully integrate HOTS into the curriculum have policies that support the development of critical thinking skills through HOTS-based formative and summative assessments. Education stakeholders must explore ways to integrate HOTS more systematically in the national curriculum, so that higher-order thinking skills become an inherent part of everyday learning, not just an add-on (Anderson & Krathwohl, 2001). Therefore, the government and education stakeholders need to consider developing national guidelines for developing HOTS questions that teachers can use widely in primary schools.

In addition, research by Graham et al. (2020) showed that implementing HOTS in primary education has a long-term impact students' readiness to face academic challenges at higher education levels. Therefore, a systematic approach to HOTS implementation in primary schools can help build a stronger foundation for students' cognitive development.

Theoretical Contribution

This research contributes to enriching theories related to HOTS and educational assessment in several ways.

1) Expanding the Application of Bloom's Revised Taxonomy. The results of this study support Anderson & Krathwohl (2001), who state that HOTS needs to be applied from primary education. This study shows that students need gradual guidance and practice to reach higher analytical and evaluative thinking levels.

2) Adding Insight into the Implementation of HOTS in the Indonesian Context. This study enriches HOTS by considering the specific challenges in the Indonesian national curriculum, which is often still oriented towards memorization and basic understanding (OECD, 2019). The findings also indicate the need for a local culture-based approach in HOTS assessment development to better suit the needs of Indonesian students (Sugiyanto et al., 2022).

3) Demonstrating Linkages between HOTS, Literacy, and Numeracy. This study supports the theory that HOTS impacts mathematical problem solving and deeper reading

comprehension, as proposed by Graham et al. (2020). It emphasizes integrating literacy and numeracy in developing HOTS questions to improve students' critical thinking competencies.

CONCLUSIONS

Based on the research results, the following conclusions can be drawn. First, the HOTS question model developed is valid and reliable for measuring the literacy and numeracy of primary school students. The content validity tested using Aiken's V method shows that all questions developed have a high level of validity, while the reliability test using Cronbach's Alpha shows consistent and reliable results. Second, HOTS questions are effective in improving students' critical thinking skills. The pre-test and post-test results showed a significant increase in literacy and numeracy scores after students used HOTS-based questions. Third, teachers and students responded positively to implementing HOTS questions despite challenges. Teachers acknowledged that HOTS questions help students think critically, but need more training to develop similar questions. Students found HOTS questions more challenging than conventional questions, but they also felt more interested in the learning process.

RECOMMENDATIONS

The results of this study provide essential recommendations for the world of education, especially in the development of HOTS assessments in elementary schools.

1) Recommendations for Teachers and Learning. Teachers need to be given more intensive training in preparing and implementing HOTS questions to optimize the implementation of HOTS-based learning. HOTS-based learning should be implemented gradually by using scaffolding strategies so that students can adjust to the questions' higher difficulty level.
2) Recommendations for Curriculum and Education Policy. HOTS questions must be integrated into national assessments such as the National Assessment (NA) to measure students' higher-order thinking skills more broadly. The government and educational institutions need to develop guidelines for preparing HOTS questions that teachers can use practically in daily learning.
3) Recommendations for Further Research. This study can be extended by testing the HOTS question model on a broader scale and in various educational contexts, including areas with limited access to education. Further studies can explore how

HOTS question models can be combined with innovative learning methods such as problem-based learning (PBL) or inquiry-based learning (IBL) to improve learning effectiveness (Tang et al., 2021).

4) Overall, this study contributes to developing HOTS-based assessments in primary schools and shows that applying HOTS questions can improve students' critical thinking skills. However, further efforts are needed in teacher training and policy development to support the implementation of HOTS in the national education system.

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