

# Fostering Higher Order Thinking Skills in Mathematics Instruction: An Analysis of its Impact to Students Performance in the Junior High School Education

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## ABSTRACT

The goal of this program was to improve participating teachers' comprehension and implementation of Higher-Order Thinking Skills (HOTS) in Mathematics instruction. Using a focused HOTS-based instruction approach in the classroom discussion, the proponent maximizes the 18 Mathematics teachers in Palo National High School-Palo I District, Palo, Leyte, Philippines. The knowledge and pedagogical techniques they needed to help their students surely develop high-level thinking abilities. Teachers' knowledge, abilities, and dedication in putting HOTS-oriented instruction into practice were clearly enhanced by this study. The overall results indicate success, and positive impact on students' performance and opening

the door for further advancements in fostering deep-thinking and problem-solving skills in Mathematics education, even though areas like answering HOTS questions require more attention. Analysis of the data reveals a positive impact of the program on teachers' understanding of HOTS. The program clearly met its objectives of increasing the learner's performance, promote awareness, knowledge, and application abilities linked to HOTS, even though areas like problem-solving and critical thinking still need improvement for there are few teachers who needs training workshop on how to integrate HOTS in their daily lesson. Building on this framework, subsequent interventions like Project SMART (Strengthened Mathematical Approaches Relative to Teaching) can explore these advanced capabilities in greater detail, enabling educators to help learners develop critical thinking and problem-solving skills.

**Keywords:** *Fostering; Higher Order Thinking Skills; Problem Solving Skills; Impact*

## INTRODUCTION

The cognitive level of Bloom's taxonomy, which has three levels of ability—analyzing, assessing, and creating—is the foundation for higher-order thinking skills (HOTS). According to a different viewpoint, HOTS incorporates critical, analytical, creative, and metacognitive thinking abilities and reflection to solve

issues, make choices, innovate, and produce things. In addition, HOTS is a crucial component of both critical and creative thinking, and creative thinking pedagogy fosters the development of more original concepts, idealized viewpoints, and imaginative insights in pupils. The goal of HOTS is to help students become proficient in the analysis, interpretation, and evaluation of both new and current material.

HOTS promote risk-taking open-mindedness, curiosity, fact-finding interest, planning and proper procedures, systematic thinking, thoroughness, logical reasoning based on facts, and self-control. By developing HOTS, an individual can manage the knowledge they have learned into long-term memory, adapt to different new problems in order to foster attitudes and creative ways of thinking toward more complex problems, and encourage the achievement of high-quality and globally competitive human resources. The ability to use information in problem-solving and decision-making will be enhanced by HOTS development.

Moreover, the implementation of HOTS is the most important policy because of its significance in modern education. The Department of Education is focusing on this by aligning it to our curriculum which teachers should incorporate HOTS into classroom instruction. The stages of scientific learning, access to collaboration, and HOTS improves competency skills that access psychomotor abilities as an implication of content knowledge, as well as communicative, critical, creative, and fundamental knowledge competencies that access the cognitive portions of Bloom's taxonomy to the highest level.

However, it is said that HOTS development must start with a supportive learning design, specifically through student focused active learning. Active learning is a kind of student-centered education that includes engages students directly in the process, empowers them to take charge of their own learning, and increases their freedom and independence through student responsibility. The student-centered learning strategy includes instruction, but assessment also has a significant role in the creation of HOTS.

In order to fully equipped the teachers and learners for a variety of future issues relative to HOTS integration, a teacher should possess a variety of abilities and skills in teaching. more complicated needs. Critical thinking is one of the crucial skills that every (Douglas, 2012; Kingetal., (2015; Richland & Simms, 2015; Partnership for 21st Century Learning, 2015). One measure of higher order thinking skills, or HOTS, is the ability to think critically (King, Goodson & Rohani, 2010; Conklin, 2012; Tan & Halili, 2015).

The cognitive processes that go beyond memorization and recall are included in Higher Order Thinking Skills (HOTS), which call on students to analyze, assess, and produce. These abilities are crucial for equipping students to deal with challenging situations, adjust to quickly changing surroundings, and pursue lifelong learning. The growing need for critical thinking, problem-solving, and creativity in the workforce has led to a major increase in the emphasis on HOTS in the context of contemporary education. Conventional teaching approaches frequently place more emphasis on lower-order skills like comprehension and memory, which are fundamental but do not adequately prepare students for the demands of the twenty-first century.

The significance of HOTS in raising student performance is highlighted by recent studies. Through a meta-analysis, Antonio and Prudente (2024) showed that inquiry-based methods greatly improve HOTS in science instruction. In a similar vein, Zhang and Chen (2023) found that digital integration and collaborative learning are important processes in smart classroom settings that promote HOTS. These results demonstrate the increasing necessity of incorporating HOTS into curriculum in order to satisfy the demands of the twenty-first century.

Despite its acknowledged significance, many educational systems find it difficult to successfully include HOTS. Teachers frequently deal with issues like inadequate training, strict curricula, and scarce resources (Mayor, 2022). There is a mismatch between assessment procedures and the development of HOTS since standardized testing still places a strong emphasis on factual memory.

## LITERATURE REVIEW

Developing problem-solving skills in the classroom is crucial for teaching mathematics (Firmansyah et al., 2022). According to the stated goal of Indonesia's Ministry of Education in Right No. 22 2026, problem-solving is crucial to mathematics education (NCTM, 2000). It enhances students' educational experiences by making it easier to apply learned knowledge and abilities in unusual contexts (Masfingatin, 2013; Rumanová et al., 2020). Despite being universally acknowledged as essential, prior studies have found that some teachers do not adequately prepare their students to handle mathematical issues. These educators frequently overemphasize math skills and formula application while ignoring other crucial components of problem-solving (Misu & Rosdiana, 2013; Purnomo et al., 2021; Sa'dijah et al., 2020; Sulistyowati, 2009; Susiswo et al., 2021).

Learning achievement is measured by Higher Order Thinking Skills (HOTS). High hierarchical learning outcomes for students are called HOTS-based learning outcomes. Bloom's thinking taxonomy's cognitive level thinking exercises. Hierarchically, the Bloom's taxonomy markers for HOTS-based learning result include analyzing (C4), assessing (C5) and producing (C6) (Anderson and Krathwohl, 2001; Anggraini et al.)

High-level thinking is among the modifications that the education system, particularly in today's era of the fourth industrial revolution. As the curricular system in the Philippines necessitates that students be able to develop HOT according to the curriculum. (Sunarti et al., 2018; Jatmiko et al., 2018; Prahani et al. al., 2018; Suyidno et al., 2018). Resources that have high integrity and the ability to process in the 4.0 century will make the world of education able to compete worldwide. Where the talents needed in the 4.0 industrial. These include the 4Cs (Creativity, Critical, Collaboration, Communication) and are backed by the capacity to make decisions, take responsibility, and solve problems.

Numerous studies have broken down these HOTS into a number of measures to gauge their success. The ability to evaluate factual, conceptual, procedural, and metacognitive knowledge is further subdivided into analyze. The capacity to assess is further compromised down into the capacity to assess knowledge

that is factual, conceptual, procedural, and metacognitive. The ability to create is further broken down in to the ability to produce conceptual, procedural, and metacognitive knowledge (Kusuma, et al., 2017).

In addition, high-level competencies known as HOTS encompass the areas of analysis, synthesis, and assessment (Anderson et al., 2001; Hill, 2015). The components of HOTS that are essential to the growth of human intellect are creativity, analytical abilities, and critical thinking processes. It is crucial to practice HOTS during the learning process since they impact the speed at which ideas are generated, the efficiency of when someone is presented with a stimulus in the form of a problem, it will initiate pupil learning (Srivastava & Mudholkar, 2001) and Liline et al. (2024). Regarding HOTS, critical thinking is an essential competency that not only those that work with computers should have. In the classroom, the said skills must be taught concurrently as high as HOTS.

Moreover, to increase students' performance, high-level thinking skills must be taught. HOTS-based learning outcomes are related to IQ and achievement indexes achieved by pupils. High accomplishment indexes are typically found in students with HOTS. Conversely, students with low accomplishment indices typically lack HOTS (Tanujaya et al., 2017).

Furthermore, there have been HOTS fostering initiatives. To promote HOTS, various activities are employed (Hariadi et al., 2022; Yaniawati et al., 2022). One of it using differentiated instruction like using manipulative objects and allowing learners to make a reflection by answering real-life problems integrated in the discussion (Kang & Park, 2023; Mali et al., 2023; Tettamanzi et al., 2023). Therefore, it is highly acceptable that curriculum design has recently led to problem-solving real-life issues. (Basitere et al., 2023). Apart from that, critical thinking has also become a study trend in mathematics learning (Jamaluddin et al., 2023; (2023) Sánchez-Ruiz et al.

### **Theoretical Framework**

This study patterned on Marzano's Instructional Model on Higher Order Thinking. This model covers the intentional teaching of reasoning, problem-solving, and decision-making abilities as part of regular classroom practice. This technique includes using graphic organizers, systematic questioning, and metacognitive reflection to assist students with knowledge analysis, alternative evaluation, and creative problem-solving. By incorporating these strategies into regular teaching, educators promote deeper cognitive engagement and go beyond memorization, guaranteeing that students not only get knowledge but also develop critical and autonomous thinking skills. The practicality of Marzano's model is its strongest point; it gives educators easy-to-use, research-based resources that they can incorporate into their lesson to help all students achieve higher-order thinking.

Using the said model, the researchers designed an innovation that aligns to classroom instruction which is Project SMART (Strengthening Mathematical Approaches Relative to Teaching) in which teachers utilizes during classroom discussion using HOTS (Higher Order Thinking Skills). This innovation gives teachers a clear pedagogical tool to help students comprehend and eventually acquire higher-order language skills, as well as a clear model for how students should reply to and generate higher-order questions. From

a social constructionist perspective where learners are actively engaged in all mathematical lessons which fulfills the following roles in this framework.

### **Objectives**

The study explores the teachers' integration of higher order thinking skills in the Junior High School education. Specifically, the study answers the following questions:

1. What is Higher Order Thinking Skills in the teaching and learning process?
2. What are the different activities you have tried using HOTS?
3. How do HOTS integrations affects the performance of the learners?
4. What possible recommendations can you give using HOTS integration that will help improve the overall performance of students in Mathematics?

### **Significance of the study**

The phenomenological study was conducted to understand the impact of the HOTS integration to students' performance in the Junior High School education and the possible recommendations for the enhancement of the numeracy rating. The result of this study will significantly benefit the following:

*Department of Education (DepEd Officials).* The result of the study will serve as an eye opener to the DepEd Officials on the next plan of national training that will surely help the professional growth of teachers. Moreover, this study would serve as basis for the department to formulate a DepEd Order or program that will strongly advise and guide all the teachers to consistently integrate HOTS on their daily lesson delivery.

*School Administrators.* Task to enhance and update the Annual Improvement Plan for the specific INSET training to be given to teachers as well as design an innovation that will help teachers catch the interest of the students in Math.

*Department Heads.* This study helps them guide the teachers in their respective departments to strengthened the conduct a Learning Action Cell on the integration of HOTS in their respective lesson.

*Teachers.* As the provider of basic education to our young learners can share the necessary learning that students' needs to know about Higher Order Thinking Skills (HOTS). This will also help them understand the purpose of answering questions with HOTS which will improve their critical thinking skills.

*Parents.* As the facilitators of their children's education, this will give them the opportunities to help develop and support their children's studies. The study will also ensure that their children's learning journey is aligned with the 21st-century style.

*Students.* This study will teach them the importance of developing their critical thinking skills.  
*Researcher.* This study's findings will provide future researchers with information on the impact of the integrating HOTS in the daily discussion.

## **Scope and Delimitation of the Study**

This study investigates the impact of integrating HOTS in the daily lesson of teachers in the Junior High School and the overall impact of students' performance in Mathematics. The participants are the 18 teachers in Palo National High School, Palo I District, Area I, Leyte Division. The teachers are composed of Junior High School only. The participants are the Mathematics teachers from Grade 7 to 10. The selected school is Palo National High School integrating HOTS in their daily lesson. The study focuses on the different activities used by teachers using HOTS and its impact on the students' overall performance.

## **METHODS**

### **Research Design**

This study employed the methodology of qualitative data collection and analysis to understand the educator's perception of the integration of HOTS in the teaching and learning. Interview guide questions and focus group discussions were employed among all Palo National High School Junior High School Mathematics teacher participants in Palo I District, Area I Leyte Division to gather the educators' way of integrating HOTS and its impact to students' overall performance in Mathematics in the Junior High School Education. The content analysis was used to analyze the verbatim responses, particularly from the interview conducted, and confirmed responses from the focused group discussion to find themes and sub-themes. This study, therefore, used qualitative content analysis, which involves systematic analysis of the content, identifying and determining themes, words, or concepts in some texts (Hassan, 2024).

### **Research Participants**

In order to answer the research questions, the researchers chose eighteen participants from Palo National High School in Palo I District, Area I Leyte Division. The Junior High School Teachers are teaching Mathematics from Grade 7 to 10 cooperated in a one-time interview.

This study's participants are Junior High School teachers assigned in Palo National High School, Palo I District in Area 1 Leyte Division. The researchers ask permission from the Schools Division Superintendent where the school is under and participate in one-time interview and focused group discussion.

This study used the phenomenological approach. Phenomenological approach was used to describe things that are already a part of the world we live in. Events, circumstances, feelings, or ideas can all be considered phenomena (Patton, 2015). Phenomenology is both a philosophical movement and a collection of research methods that focus on understanding people's experiences. Simply put, phenomenology involves examining phenomena, which can be anything that a person consciously perceives or experienced. In essence, it's about getting a deeper insight into how people interpret the world around them.

### **Locale of the Study**

The study was conducted in Palo National High School, Palo I District, Area I in Leyte Division, Region VIII, Philippines.

### **Ethical Considerations**

The study subscribed to the principles of informed consent, where all teacher participants are fully informed about the study's objective, and their safety is ensured. On the participants' rights, voluntary interview participation is essential. The researchers highly emphasize that the participants are free to withdraw from participating in the study at any stage if they wish to do so. Privacy ensures that the confidentiality and anonymity of the participants are always protected. Using offensive and discriminatory language is avoided in conducting the interview and the focus group discussion with all participants. Lastly, trust that the participants are not subjected to any deception in this research process or its published outcomes and will have the right to know the conclusion of this study.

Likewise, the researchers know and understand that using a person's previous work without proper acknowledgment should be strictly followed.

### **Data Gathering Procedure**

The researchers seek approval from the office of the Superintendent of Leyte Division before conducting the study. The participants were asked to respond to the interview questionnaire on the definition of (1) Higher Order Thinking in the teaching and learning process, share their (2) different activities applied using HOTS in the Junior High School education, tell the (3) impact of HOTS integration in the students' performance in Mathematics, and give their (3) possible recommendation that will help enhance the overall performance of the students in Math.

The researchers personally gathered the participants in one classroom for the one-time interview and FGD with the permission of the Schools Division Superintendent and District Supervisor. Afterward, the researchers informed the participants of the purpose of the interview and Focus Group Discussion (FGD). Each teacher participant was oriented with the purpose of the study and were requested to sign an Informed Consent Form before the start of the interview. The researchers ask individually the participants on the prepared questions based on the interview guide questions. The responses of the teachers were recorded using cellphone.

The other way of gathering the data is through an interview where the teachers can freely relate and share the experiences they have using HOTS and the impact of using HOTS in the students' performance in Math. Teachers are allowed to answer the questions collectively or individually. The interview lasts an hour only. Afterwards, a Focus Group Discussion (FGD) is conducted.

During the data collection process, the responses of the teacher participants were recorded for interpretation with proper privacy protection.

## **Data Analysis**

After the data collection, a record for each detailed interview was created, and critical conversation points were saved in a Word-format file. All the names and information of the participants were removed from all transcripts to ensure anonymity. The data sets were read many times to look for specific statements of meaning or quotes from the participants. Essential clusters of meaning were developed at the stage of the research process. And from that cluster of important statements, the researchers then wrote both textural and structural descriptions of how the participants integrate HOTS on their daily lesson delivery and the impact of integrating HOTS to the overall performance of the students in Math. The textural description describes the real experience of the participants using HOTS.

All the data were sorted into themes and sub-themes. The themes are the different integration of the teacher participants experienced using HOTS. Sub-themes were the impact of using HOTS to the students' performance and the possible recommendations that teacher participants can share for the enhancement of HOTS integration that may improve the overall students' performance in Math.

Lastly, the textural and structural descriptions of the participants' usual integration of HOTS in the daily lesson and the impact of the integration were presented.

## **Validation Techniques**

The study used one technique, member checking (Creswell, 2013). This member checking process analyzed data from the study participants to verify whether the information and findings were true and accurate. Afterwards, the researcher also interviewed two teachers who were excluded from the study to determine the credibility of the results.

## **RESULTS AND DISCUSSIONS**

This chapter presents the findings of the study based on the interviews and focus group discussions conducted with the teachers on the use of HOTS and impact of HOTS integration in the students' performance in Math. The results are presented in four parts. The first part presents the meaning of HOTS in the teaching and learning.

The second part is the different activities applied by the teachers using HOTS. The third part is the impact of HOTS integration in the classroom discussion. The last part is the possible recommendation of the participants for the enhancement of HOTS that can help in the overall performance of students in Math.

The way teachers integrate HOTS and its impact of using HOTS on their daily lesson are presented based on the following themes.

### **Teacher's Understanding of Higher Order Thinking Skills (HOTS)**

Teacher participants defined Higher Order Thinking is a cognitive process that entail analyzing, evaluating, and creating rather than merely retaining knowledge. One participant said: *"In the context of teaching and learning, Higher Order Thinking Skills (HOTS) refer to students' capacity to do more than just memorize and recall knowledge. Rather, HOTS entail the application, analysis, evaluation, and creation of knowledge. Instead of just repeating facts, these abilities let kids think critically, solve issues, make decisions, and come up with fresh ideas"* (T4, L3-L7)

### **Activities Applied Using HOTS**

Having different activities with the integration of HOTS is very much important for it improves students' skills in reasoning and problem-solving ability. One of the participants shared her experience of using or integrating HOTS in her daily lesson and she said: *"I used problem-solving, case studies and project-based learning. And I can say that it really made learning fun and enjoyable"* (T11, L8-9)

Another participant added that: *"As for me, I apply the following activities which I observed is helpful and really improve the students' performance like, round robin, numbered heads together, pairs check, three step interviews, think pair share, and project-based learning. Those are the activities I applied"* (T13, L9-L12)

### **Impact of HOTS Integration to the Students Performance**

Integrating HOTS in the daily lesson of teachers improves comprehension, problem-solving, creativity, and academic achievement. The use of Higher Order Thinking Skills (HOTS) greatly enhances student performance. Research indicates that learners who participate in HOTS activities outperform those who solely rely on rote memorization in reading, science, and language acquisition.

One participant mentioned that: *"As a Mathematics teacher, the impact which I can share using or integrating HOTS in my daily discussion which really gave a good result on the students' performance. These good results are the following, it improves students' academic achievements, it enhances critical thinking and problem-solving skills of learners, it resulted to greater engagement and motivation and it transfer skills beyond the class"* (T18, L10-L14)

Another participant added that: *"I as a teacher in Math could strongly say that applying HOTS made a remarkable impact on the performance of my students in Math 9. It is evident on their grades and way of reasoning during class discussion. That result made me so happy and proud that all my effort ended with a good result"* (T9, L11, L14)

### **Recommendations for the Enhancement of HOTS Integration**

In order to improve the integration of higher-order thinking skills, teachers should provide learning activities that promote analysis, evaluation, and creation in addition to memorizing. Open-ended questions, problem-based assignments, and chances for students to apply ideas in practical settings can all help achieve this. Fostering inquiry, teamwork, and reflection pushes students to think critically, draw connections between different fields, and come up with creative solutions. In the end, emphasizing higher-order thinking helps students gain the cognitive agility necessary to succeed in challenging and dynamic situations while also deepening their learning.

One teacher said: *"As a teacher in Math 10, I strongly recommend that DepEd should be serious in taking into consideration of coming up with a training to the teachers that will be monitored and evaluated as to the improvement and strong implementation of the said training so that students' performance will be given focused"* (T16, L22-L25)

Another participant added that: *"I recommend that DepEd Central Office needs to come up with an order that will strongly monitor teacher's integration on HOTS and may design a tool solely use for its integration. School Head may also design a contextualized criterion for the selection of the most outstanding teachers who religiously implement it, I mean integrate HOTS in their daily lesson so that expected outcome is really evident"* (T4, L28-L39)

### **SUMMARY**

This study investigated the impact of fostering Higher Order Thinking Skills (HOTS) in Mathematics instruction in the Junior High School education. The researchers aimed to identify the activities applied using HOTS, the impact of students' performance using HOTS and the recommendation for the enhancement of HOTS integration.

Specifically, this study aimed to explore the different activities employed by the Mathematics Teachers using HOTS and its impact to students' overall performance in Math and how they will enhance or improve the use of HOTS for more achievements.

This study employed a qualitative research method, specifically the phenomenology approach, so as to explore the use of HOTS and its impact to students' performance in Math. Phenomenology studies explores the lived experience, characterized by pre--conceptual, pre--theory understanding. The research participants were 18 Junior High School Mathematics teachers in Palo National High School, Palo I District, Area 1, Leyte Division, Region VIII, Philippines.

## CONCLUSION

The study reveals that most of the Mathematics teachers in Palo National High School applies or use HOTS in their daily discussion. The teachers apply problem-solving, case studies, round robin, numbered heads together, pairs check, three step interviews, think pair share, and project-based learning. And teachers stated that using HOTS improves students' performance and develop their critical thinking skills and way of reasoning. Teachers shared their recommendations that DepEd Central Office should make an order to strengthened the use of HOTS in the daily lesson and conduct a monitoring on the application of HOTS. Other participants mentioned that teachers who religiously apply HOTS should be given awards especially if the improvement on the students' performance is evident.

This study highlights the serious application of HOTS for better result of students' performance rather than having a classroom discussion without HOTS application.

Ultimately, findings from this study present a hopeful perspective that someday not just Mathematics teachers will seriously apply HOTS in their daily lesson but also the rest of the subject teachers for it made a remarkable impact on the students' performance.

Findings from this study support the continuous application or use of HOTS in the classroom discussion because it gives a positive result on students' performance and develop students critical thinking skills. In addition, the positive findings of this study align the creation of a new school-based innovation project called Project SMART which means (Strengthened Mathematical Approaches Relative to Teaching) that will support more on the professional growth of teachers.

## RECOMMENDATIONS

Based on the conclusions arrived at, it is recommended that DepEd should strengthened the practice of HOTS integration for it gave a positive result to students' performance and made a remarkable increase on the assessment results of students in Mathematics subject. It also observed by the participants that using HOTS help students think critically. The result showed that fostering Higher Order Thinking Skills in Mathematics lessons gave a positive result to student's overall performance.

And it is recommended that DepEd Central Office should conduct workshops or professional training aligned to Higher Order Thinking Skills and create a monitoring tool as to the implementation of the teachers in the filled. Another is School Head may also design a contextualized criterion for the selection of the most outstanding teachers who religiously implement and integrate HOTS in their daily lesson it for more motivation drive on the part of the teachers.

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