

Process Oriented Guided Inquiry Learning and Mathematical Higher Order Thinking Skills of Grade 10 Students

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Abstract

Higher order thinking skills (HOTS) are recognized as one of the most essential skills required in the twenty-first century, however, Filipino students have been found to have difficulties in the subjects that require HOTS. Thus, this study utilized a descriptive design to know the perception of the students with regard to learning cycle activities and assigned team roles as features of Process Oriented Guided Inquiry Learning (POGIL). Also, pre-experimental research design was used to measure the effectiveness of POGIL approach in the Mathematical HOTS of the students in terms of analyzing, evaluating, and creating. Furthermore, cluster sampling technique was used in choosing twenty-eight (28) grade 10 students as respondents and evaluated their mathematical HOTS using a pre-test and post-test assessment. Based on the findings, students felt the effectiveness of assigned team roles and learning cycle activities in enhancing their skills and character towards learning. Moreover, there is a highly significant difference in the mean pre and post-test performance of the respondents before and after using the POGIL approach in mathematical HOTS (p -value=0.000). This implies that the POGIL is an effective teaching strategy that successfully improved Mathematical HOTS of the students. Based on the research findings, the researchers advise educators to use the POGIL approach in exposing their students to more active, collaborative and guided teaching-learning processes.

Keywords: *Analyzing, Creating, Evaluating, Mathematical Higher Order Thinking Skills, Process Oriented Guided Inquiry Learning*

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Introduction

To create an environment conducive to good teaching and learning, educators and their preferred teaching methods must be supported and organized methodically by the institution (Wegner et al., 2013). Section 5 of Republic Act No. 10533, also known as the "Enhanced Basic Education Act of 2013", requires educators to use learner-centered curriculum and pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative, and integrative. The purpose of the mathematics curriculum, according to the Philippines Trends in International Mathematics and Science Study (TIMSS, 2019), is to foster and develop problem-solving and critical-thinking skills. Higher Order Thinking Skills (HOTS), on the other hand, are recognized as one of the most important skills required in the twenty-first century as it helps students develop critical thinking, creativity, communication, and cooperation, all of which are significant 21st-century abilities (Scott, 2015). However, it has been discovered that Filipino students struggle in the subjects that call for HOTS.

Mathematics is one of the most important subjects that require special attention in the Philippines. Program for International Student Assessment (PISA) 2018 results revealed that the Philippines is one of the countries with poor mathematical literacy, ranking second to last out of 79 participating countries. Filipino academic performance was also evaluated, and it was discovered that students excel at acquiring knowledge but struggle in subjects that require HOTS (Dinglasan & Patena, 2013; Ganal & Guiab, 2014). Santisimo Rosario Integrated National High School (SRINHS) is one of the schools that claim to have students with difficulties in mathematics. SRINHS received a Mean Percentage Score (MPS) of 48.94% in mathematics based on the 2014-2015 NAT results of Grade 10 students. This is significantly lower than the DepEd's 75% MPS standard and is interpreted as low mastery in NAT test- scores descriptive equivalence. As a response to these necessities, Process Oriented Guided Inquiry Learning (POGIL) has been adopted in teaching mathematics concepts as it provides structured direction and allows learners to efficiently engage in inquiry learning (Baepler et al., 2014).

Following Muhammad and Purwanto (2020), the POGIL technique improved learners' ability to solve mathematical problems; however, more research is needed to determine whether the POGIL model will also improve students' mathematical HOTS. Researchers should also investigate students' perceptions and satisfaction with how their participation in POGIL's assigned team roles contributes to their learning (Yadav et al., 2021). Thus, the purpose of this study was to learn about students' perceptions and satisfaction with learning cycle activities and assigned team

roles as POGIL features, as well as whether this POGIL approach is effective in improving students' HOTS, specifically analyzing, evaluating, and creating.

This study was conducted to 1) determine the perception of the student-respondents to their participation in the mathematical tasks as they are assigned to a certain role particularly being the manager, recorder, presenter, and reflector; 2) describe the satisfaction of student-respondents to a phase of learning cycle in POGIL when it comes to explore, invent and apply; 3) determine the pre- and posttest scores performance of the students before and after using the POGIL approach in the students' mathematical HOTS in terms of analyzing, evaluating and creating; and 4) test the difference in the pre-and posttest performance of the respondents before and after using the POGIL approach.

Methodology

The POGIL technique was implemented in one class with 28 Grade 10 students as respondents during the academic year 2021–2022 under the online learning modality, at Santisimo Rosario Integrated High School in San Pablo City. Descriptive and experimental research design was used where researchers-made instruments such as pretest, posttest, and survey questionnaires are used in describing the effects of POGIL and assessing students' perception and satisfaction with POGIL's learning cycle activities and assigned team roles. In selecting the class-respondents, researchers used probability sampling- cluster sampling.

The researchers first sent a copy of the validated pre-test assessment through google forms in examining the initial level of students' HOTS. Researchers prepared lesson plans to ensure that the method's characteristics and principles were applied throughout the course. The topic used to assess students' HOTS before and after the implementation of POGIL approach includes illustrating, calculating, interpreting, and solving problems involving measures of position. In keeping with the format of the class discussion with POGIL approach used over the four-week sessions, researchers who serve as subject teachers began the class with a motivational activity that intended to introduce the topic. This was followed by an activity for the students to investigate in which the class was divided into seven groups of four members, each with a specific role. The assigned presenter presented their output and afterward, educators did topic abstraction, where students were encouraged to do the concept invention phase through inquiry learning. Finally, students were given the opportunity to participate in the application phase, in which they answered the given problems and applied their acquired knowledge. Then after, the researchers disseminated

the post-test assessment and survey questionnaires. Following data collection, the results were statistically analyzed for interpretation.

Findings

The overall mean of students' perceptions of assigned team roles is 3.61, which was interpreted as "Highly Responsible." This implies that student-respondents recognized the importance of each role in completing group tasks while gaining knowledge and developing skills such as self-confidence, leadership ability, sense of responsibility, communication skills such as speaking, writing, and listening, analytical thinking skills, and teamwork. Students' satisfaction with learning cycle activities, on the other hand, revealed an overall mean of 3.75, with all indicators marked as "Very Satisfactory". This indicates that the student-respondents view the learning cycle as an effective way to execute skills as they are required to think, collaborate, and apply their learnings during mathematics class and group discussions. Furthermore, each stage of learning is observed to bring out different skills in the learners. Each phase necessitates students to demonstrate learning and thinking abilities on how they are going to solve and interpret given mathematical topics. The learning cycle serves as the class guide for a step-by-step process for how the class discussion and activity will take place.

As with the students' performance prior to the application of the POGIL approach, the overall mean of pretest results shows that students' HOTS is below the approaching level. This implies that students only barely understood the question, they provided an undefined solution and conclusion and presented an inaccurate output that failed to meet the majority of the given conditions. Students made at least 5 errors or missed information with the answers they have provided. Meanwhile, the post-test performance of students following the implementation of the POGIL approach is observed to be proficient. This indicates that the majority of students have a thorough understanding of the subject and can investigate the provided mathematical problem. Students are also capable of providing a clear and valid conclusion and solution, and present an output based on the given conditions with a single error or missed information.

Conclusion

Since the study demonstrated the efficacy of applying the POGIL approach to students' mathematical HOTS, educators are encouraged to use engaging and collaborative activities in their classes, particularly in mathematics, where each student has a specific role with a specific task. This will assist students in developing the necessary skills and positive attitudes toward learning. Classroom teachers are also encouraged to use the learning cycle activities as a guide, particularly

in mathematics teaching, to ensure an organized and smooth flow of class discussions and activities. Furthermore, future researchers can apply a parallel pedagogy to various branches of mathematics, academic disciplines, and modes of learning and evaluate its significant impact on students' mathematical higher order thinking skills.

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