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Guided Discovery Learning Approach: Its Effect on the Mathematics Performance of Grade 7 Struggling Learners

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Abstract*— This study explored the impact of the Guided Discovery Learning Approach on Grade 7 students' mathematics performance. Sixty-four students were divided into two groups: one using this approach and the other receiving traditional instruction. Pretest results showed low performance in both groups, with no significant difference. Post-test outcomes indicated improvements in both groups, with the experimental group achieving significantly more significant gains. The results suggest that the experimental group effectively promotes active learning, critical thinking, collaboration, and real-world application. The present approach enhances engagement and understanding by connecting content to students' backgrounds and encouraging guided exploration. The study recommends integrating it into the mathematics curriculum, especially for students needing additional support. Systematic use of this approach may lead to better learning outcomes and foster a more inclusive educational environment. Continued research is needed to evaluate its long-term impact and adaptability across various learning contexts.

***Index Terms:* Effect of Guided Discovery Learning Approach, Mathematics Performance, Grade 7 Struggling Learners.**

I. INTRODUCTION

Mathematics is a critical subject taught in elementary and secondary education that provides students with fundamental knowledge and skills to organise their lives (Ariyanti & Santoso, 2020). Unfortunately, the COVID-19 pandemic has exacerbated the current education crisis and widened the learning gap in mathematics among young students (Sooknanan & Seemungal, 2023). The situation has led to a decline in math learning, as students may need more remediation to progress to new lessons, leading to learning gaps (Torres, 2021). However, schools and teachers take steps to address this issue, such as implementing differentiated instruction, providing additional support to struggling students, and leveraging technology to facilitate remote learning. Despite the challenges, it is essential to prioritise efforts to close the learning gap in mathematics, ensuring that the students have the knowledge and understanding for their academic and future careers.

Filipino students performed poorly in mathematics in the 2018 Programme for International Student Assessment (PISA), with less than 20% reaching the minimum proficiency level and over 50% showing very low proficiency. This performance places them significantly behind their peers worldwide in mathematical skills. Performance disparities also exist between public and private school students, with average scores of 343 and 395, respectively. (Department of Education 2019).

The Philippines has faced long-standing challenges in mathematics education, as evidenced by its low rankings in previous Trends in International Mathematics and Science Study (TIMSS) evaluations. Filipino students ranked 40th out of 42 countries in 1995 and 36th out of 38 in 1999 (Kelly, 2002). In the TIMSS 1999 evaluation, Filipino learners ranked 36th out of 38 participating countries (Mullis et al., 2004).

Guided Discovery Learning (GDL) is a student-centred model where students actively explore concepts, formulas, and ideas with teacher guidance. Rather than simply learning new information, students are encouraged to discover knowledge through structured activities. (Amiyani et al., 2018). This approach is efficient for mathematics, as it helps students connect and apply concepts. It enhances critical thinking and promotes active participation in learning, allowing students to discover mathematical concepts independently with ongoing teacher support. (Wahyu & Sutiarso, 2017).

Researchers, including Said et al. (2019), recommend GDL as an effective method to improve learners' performance. This approach enables students to search for information with teacher support, fostering self-dependence. The teacher acts as a mentor, guiding rather than providing direct answers. Therefore, it is crucial to examine the experiences of both Mathematics teachers and students in using GDL to enhance academic performance.

Given the current state of mathematics education in the Philippines, particularly at Santa Barbara National Comprehensive High School in Iloilo, the researcher identified the need for an effective strategy to help struggling learners improve their mathematics performance. With this in mind, the researcher is determined to implement the Guided Discovery Learning Approach (GDLA) for Grade 7 students during the 2024-2025 school year to determine its impact on enhancing their mathematics performance.

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Vol 12, Issue 04, April 2025

II. LITERATURE REVIEW

A. Guided Discovery Model (GDL)

One of the learning models that is student-centred is the guided discovery model. The invention is not a model of learning that is done to find something new. However, in this model, students are expected to find knowledge actively, like making guesses and estimates and trying to that students can find concepts, formulas and the like with guidance teachers. Students find the concept through the guidance and direction of the teacher because, in general, most students still require basic concepts to find something. This model is beneficial for mathematics courses according to mathematical characteristics (Kiki Yuliani & Sahat Saragih, 2015).

According to Markaban (2006) measures guided discovery model are(1) to formulate the problem to be given to students with the data to taste; (2) of the data provided by the teacher, students prepare, process, organise, and analyse data; (3) The students draw up a conjecture (forecast) of the results of the analysis done; (4) if necessary, a conjecture that has made the teacher checks the students; (5) verbalisation conjecture also handed over to the students to arranging; (6) After students find what they need, teachers should provide exercises or additional questions to examine whether the findings were accurate. From the above description, it was concluded that the guided discovery model is a learning model that presents a problem or question that makes the students think, observe, make conjectures, explain, and analyse to find knowledge with guidance and instructions from teachers.

B. The effectiveness of using GDL in enhancing the performance of learners in Mathematics

Mathematics is believed to be the most important subject in education; hence, Mazana et al. (2019) stated that mathematics is important because it spreads to other educational streams. Despite its significance in our education, it is one of the few subjects with a high rate of underperformance among learners.

According to Bustos (2020), guided discovery is a strategy where a teacher provides learners with examples of a specific problem and assists the learners in finding out the rules and approaches to solving that problem themselves. Hence, GDLA is seen as one of the most effective strategies that could be used to enhance the performance of learners in Mathematics. Many studies have been conducted on the effectiveness of using GDLA to enhance learners' mathematics performance. For instance, a study by Said et al. (2019) investigated using the Guided-Discovery Model in Mathematics. The study's findings revealed that GDL is an effective strategy that should be used to improve learners' cognitive ability and help them understand Mathematics quickly. Similarly, Maarif (2016) posits that GDL is effective because it improves learners' Mathematics analogical abilities. Supriadi et al. (2018) agreed with Maarif (2016) in a study that compared Project-based learning with GDL. The study's findings indicate a discernible disparity in the mathematical aptitude of students who received instruction through Problem-Based Learning (PBL) compared to those taught using GDL. The individuals who received instruction via GDL had a notable aptitude in Mathematics, substantiating the efficacy of employing GDL to augment learners' performance in this subject. As a result, the GDL approach is widely recognised for its effectiveness in promoting active learning, collaboration, and engagement within the classroom setting. This result aligns with the findings of Adeniran and Lambaya (2022), who discovered that learners taught using both the traditional technique and GDL exhibited superior performance in the post-test when instructed through GDL compared to those taught using the traditional method.

C. Teaching Students Who Struggle Learning Mathematics

Struggling math students are easily distracted and, therefore, have difficulty focusing on multi-step problems and procedures (Hudson et al., 2006; Miller & Hudson, 2006; Sherman et al., 2009).

A common struggle for students when working on a problem is interpreting what is asked of them initially to solve it (Allsopp et al., 2003; Hudson et al., 2006). If the context of the problem is unfamiliar to them or does not make sense, or if the problem is not translatable to a number sentence, the students easily become frustrated (Allsopp et al., 2003). Little understanding of math vocabulary and a limited ability to read problems and verbally explain one's thinking leads to early frustration and, in turn, low achievement (Allsopp et al., 2003; Clements, 2003; Sherman et al., 2009). Other limiting factors included difficulty focusing on important information, limited ability to visualise the situation, limited self-checking ability, little interest in the context of the problem, and limited time to solve problems (Allsopp et al., 2003; Clements, 2003). The study of Sherman et al. (2009) found evidence of several factors that resulted in students being unsuccessful at math. The authors grouped these factors into two categories: environmental and personal-individual. Environmental factors included instruction, curriculum materials, and the gap between the learner and the subject matter. In contrast, personal-individual factors included locus of control, memory ability, attention span, and understanding of math language (Sherman et al., 2009).

Effective pedagogical approaches in the classroom benefited the struggling learner when curriculum content, classroom context, and academic and social behaviour expectations were multidimensional and systematic (Xin et al., 2005). Research supports the belief that students who struggle with learning mathematics need explicit instruction for conceptual understanding (Gersten & Baker, 1998; Hudson et al., 2006; Kroesbergen & Van Luit, 2003). It is

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International Journal of Science, Engineering and Management (IJSEM)

Vol 12, Issue 04, April 2025

critical to establish the necessary knowledge before implementing problem-solving in math instruction (Xin et al., 2005). Often, these students have not succeeded in math with one-size-fits-all instruction and have lacked the resilience to overcome personal and environmental obstacles (Bernard,36 1995). Contributions from the school that increased the mathematics performance flow achieving students included caring and supportive relationships, positive and high expectations, and opportunities for meaningful participation in classroom discourse (Hudson et al., 2006; Sherman et al., 2009).

III. PURPOSE OF THE STUDY

The study aimed to assess the effect of the GDLA as an intervention for traditional teaching on the Mathematics Performance of Grade 7 struggling learners.

Specifically, the study aimed to answer the following questions:

1. What is the pretest mathematics performance of the learners' with and without the guided GDLA?
2. Is there a significant difference in the pretest mathematics performance of the learners who used and did not use the GDLA?
3. What is the learners' post-test mathematics performance with and without using the guided GDLA?
4. Is there a significant difference in the learners' post-test mathematics performance with and without the GDLA?
5. Is there a significant difference in the learners' mathematics performance on the pretest and post-test after using the GDLA?
6. Is there a significant difference in the pretest and post-test of the learners' mathematics performance without using a GDLA?

IV. THEORETICAL FRAMEWORK

This study was anchored on forming the theory of Guided discovery developed by Dr. Charles E. Wales at the Centre for Guided Design, West Virginia University (Leutner, 1993). Guided discovery learning is a constructivist instructional design model combining principles from discovery learning and sometimes radical constructivism with cognitive instructional design theory principles. Discovery learning is much older, and other forms of structuredness do exist. "Guided Discovery is characterised by convergent thinking.

In this approach, the instructor devises a series of statements or questions that guide the learner, step by logical step, making a series of discoveries that lead to a single predetermined goal. In other words, the instructor initiates a stimulus, and the learner reacts by engaging in active inquiry, thereby discovering the appropriate response. Mosston (1972) specifies ten cognitive operations that might occur as the learner engages in active inquiry: recognising, analysing, synthesising, comparing and contrasting, drawing conclusions, hypothesising, memorising, inquiring, inventing, and discovering.

By actively doing and consequence discovering facts or concepts, the learner will understand and, therefore, remember the subject matter. Mosston (1972) cautions that "discovery learning cannot occur if the answers are given." He also points out certain drawbacks of this teaching method: it precisely controls and manipulates learning behaviour and could therefore be abused, and is designed for individual rather than group use." - The Discovery Learning Concept, retrieved, 17:17, September 15 2006 (MEST).

Learners should be recognised as engaged participants while teachers guide the learning process. Many learners struggle to understand their mathematics lessons because they nowadays focus on their gadgets and online games. The GDLA is designed to integrate mathematics with new approaches and styles to improve learners' mathematical knowledge and skills so that they can become active participants in the teaching and learning process.

The GDLA emphasises active student involvement, where learners uncover concepts, principles, or skills with the teacher's support. Rather than passively receiving information, students are encouraged to explore, inquire, and engage with the material. Teachers play a facilitative role by offering scaffold—structured support, gradually withdrawing as students develop greater competence. As noted by Wales, learning is an active process, and practical instruction involves guiding learners through exploration and problem-solving rather than providing direct answers. This method is intentionally designed to build understanding step by step, ultimately promoting learner independence.

V. CONCEPTUAL FRAMEWORK

This study is guided by the conceptual model, as shown in the paradigm.

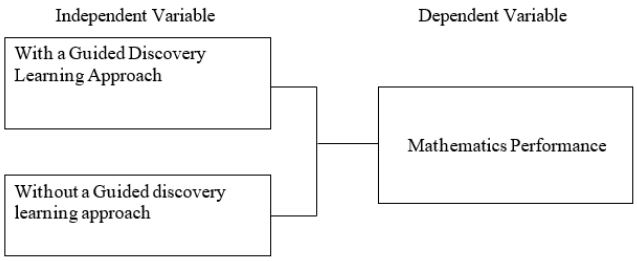

Figure 1. The illustration shows the intervention of the GDLA concerning the Mathematics Performance of Grade 7 Struggling Learners.

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Vol 12, Issue 04, April 2025

The study's paradigm shows that the GDLA can contribute to the Mathematics Performance of Grade 7 struggling learners. The independent variable comprises the use and non-usage of the GDLA in teaching, while the dependent variable is the Mathematics Performance of Grade 7 struggling learners.

VI. METHODOLOGY

A. Research Design

The study used a quasi-experimental pretest post-test control group design. Quasi-experiments aim to evaluate interventions but do not randomise the participants (Harris, 2006).

B. Subjects of the Study

The study involved 64 Grade 7 learners from Santa Barbara National Comprehensive High School in Santa Barbara, Iloilo. The section taught by the teacher-researcher was used to manage and control the various stages of experimentation throughout the study's conduct.

C. Research Instrument

A researcher-made, validated, and pilot-tested "performance test" in mathematics was used to gather the data needed in this study. This research instrument consisted of a 50-item test on functions.

D. Data Gathering Procedure

The researcher sought permission from the Schools Division Superintendent of the Schools Division of Iloilo to conduct the study. A copy of the approved letter was furnished to the school principal of Santa Barbara National Comprehensive High School, Santa Barbara, Iloilo. Subsequently, the researcher also obtained permission from the school principal to carry out the study. Before the study was conducted, a consent form was distributed to the learners' parents or guardians to secure their approval for participation.

The study involved three phases: pre-experiment, experimental proper, and post-experiment.

The unit covered the third quarter topics of Grade 7 Mathematics. A pretest and post-test were administered before and after the unit to establish a statistical analysis. Both groups answered the same set of questions in the pretest and post-test. The study lasted approximately six weeks, during which the teacher-researcher followed a set timeline.

Before experimenting, the researcher oriented the learners on the procedures and activities. The students were briefed on the type of test and the instructional approaches used in the study—guided discovery learning approach and non-guided discovery learning approach. Both groups took a pretest and post-test based on the lessons outlined in the Learning Exemplars provided by the Department of Education (DepEd).

After the pretest, the experimental phase began. The researcher taught both the experimental and control groups. The experimental group was taught using the Guided Discovery Learning Approach, focusing on whether this method would improve their mathematics performance. The lessons included sets, subsets, union and intersection of sets, cardinality, equal and equivalent sets, finite and infinite sets, Venn diagrams, subsets of real numbers, plotting and locating integers on the number line, comparing and ordering integers, operations on integers (addition, subtraction, multiplication, division), GEMDAS, and absolute value.

The Guided Discovery Learning Approach involved introducing topics, engaging students with instructional materials, posing probing questions, and guiding them to discover solutions. Each activity was followed by a short class discussion as an intervention (Ofuonyebuzor, 2017). The teacher acted as a facilitator to support learner growth and success.

Research panel members were invited to observe both classes to ensure proper control. Meanwhile, without special treatment, the control group was taught using the lecture method, involving worksheets, board work, and drill practice.

After the instructional phase, a post-test was administered to assess the impact of the intervention. Test responses were then checked, analysed, and interpreted using the Statistical Package for the Social Sciences. The experimental period began on January 6, 2025, and concluded on February 28, 2025.

The interventions for both groups were held in the afternoon from 1:00 to 2:00 PM and 4:00 to 5:00 PM, for 30 contact hours each.

E. Data Analysis

After the experiment, the data gathered for this study were subjected to appropriate computer-processed statistics employing the SPSS software. The level of significance was 0.05.

Mean and standard deviation were used for descriptive statistics, and the t-test for dependent and independent samples was used for inferential statistics.

F. Ethical Considerations

The Code of Ethics has guided the study's actions by moral principles. Putting the participants' welfare first, the researcher asked for their consent to participate voluntarily. Anonymity was preserved, formal correspondence was sent by email, and they were identifiable by number coding. They were given the researcher's word that the information they submitted would only be utilized for that purpose. The researcher removed the contents from a backup CD and password-protected personal computer six months after completing the final report, and destroyed all hard copies of the material (Crewsell, 2013).

ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 12, Issue 04, April 2025

VII. RESULTS AND DISCUSSION

Table I: Pretest Mathematics Performance of Grade 7 Struggling Learners with and Without the Use of GDLA

Category	N	Mean	Description	Sd
Entire group	64	15.20	Low	3.74
With GDLA	32	15.16	Low	4.10
Without GDLA	32	15.25	Low	3.41

Note: High (33.34-50.00)
Average (16.67-33.33)
Low (0.00-16.66)

The findings showed that the pretest mathematics performance of Grade 7 struggling learners as an entire group was "low" (M=15.20, SD=3.74); the mathematics performance with GDLA was "low" (M=15.16, SD=4.10) and without GDLA was also "low" (M=15.25, SD=3.41). This result indicates that both groups had the same level of mathematics performance. This outcome is because the topics have not yet been explained to them. (Makhubele, Luneta, 2013) It has emphasised that one critical factor that makes students perform poorly in mathematics is didactic, which is basically about the methods of instruction which sometimes are not appropriate and, as such, inhibit students' understanding of lessons.

Table II: t-test Result of the Difference in the Pretest Mathematics Performance of Grade 7 learners with and without the Use of GDLA

Category	Mean	df	t-value	Sig
With GDLA	15.16	62	.100	.921
Without GDLA	15.25			

Table 2: t-test Result of the Difference in the Pretest Mathematics Performance of Grade 7 Learners with and without the Use of the GDLA The findings revealed no significant difference in the pretest mathematics performance of the Grade 7 learners with and without the use of the GDLA (t[62]=.100, p=.921).

The present study's results supported Michael's (2015) study, which found that poor student performance in mathematics results from not ensuring fun and support while providing a challenging class environment that makes all students eager to learn.

Table III: Post-test Mathematics Performance of Grade 7 Struggling Learners with and without the use of the GDLA

Category	N	Mean	Description	Sd
Entire group	64	22.10	Average	8.23
With GDLA	32	25.38	Average	8.58
Without GDLA	32	18.81	Average	6.47

Note: High (33.34-50.00)
Average (16.67-33.33)
Low (0.00-16.66)

The findings showed that the post-test Mathematics Performance of Grade 7 struggling learners as an entire group was "average" (M=22.10, SD=8.23), the mathematics performance of struggling learners with GDLA was "average" (M=25.38, SD=8.58) and without GDLA was "average" (M=18.81, SD=6.47).

The present study's results supported those of Suharti et al. (2020) and Yusufet al. (2023), which found that discovery-based learning materials boost student engagement in the learning process, contributing to better learning outcomes.

Table IV: t-test Result of the Difference in the Post-test Mathematics Performance of Grade 7 struggling learners with and without the use of the GDLA

Category	N	Mean	df	t-value	Sig
With GDLA	32	25.38	62	3.46	0.001
Without GDLA	32	18.81			

**p<.05, significant*

The result showed a significant difference between the post-test Mathematics performance of struggling learners using the GDLA and without the use of the GDLA (t[62]= 3.46, p=.001). This result means that learners exposed to the GDLA performed better than those not exposed to the GDLA, and it indicated a significant medium effect because the post-test scores of the learners with the GDLA were significantly higher than those without the GDLA.

The present study's results supported Choike's (2000) study, which found that by seeking and asking questions, students gather information and discover knowledge by themselves. Knowledge discovered by oneself builds the learner's high intellectual potency level, increases expectancy, and encourages high-level thinking. This results in academic achievement in mathematics. (Oyegwe,1998; Opute-Imala & Idialu, 2001).

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International Journal of Science, Engineering and Management (IJSEM)

Vol 12, Issue 04, April 2025

Table V: t-test Result of the Difference in the Pretest and Post-test Mathematics Performance of Grade 7 struggling learners with the use of the GDLA

Category	M	Mean Diff	t-value	df	Sig
With GDLA	15.16				
		10.22	-7.57*	31	**0.000**
Without GDLA	25.38				

**p<.05 significant*

The findings showed a significant difference between the pretest and post-test Mathematics performance of Grade 7 struggling learners with and without using the GDLA (t[31] = -7.57, p=000). This finding was supported by the mean gain (Mean Diff = 10.22).

This present result, supported by the study of Mukhtar et al. (2023), has shown that discovery-based approaches, particularly in structured environments, can strengthen students' conceptual understanding and help them build critical and analytical thinking skills. Moreover, the present findings also conform to the study of Alfieri et al. (2011), which revealed that GDL is more effective than direct instruction in enhancing problem-solving skills, especially when accompanied by adequate scaffolding.

Table VI: t-test Result of the Difference Pretest and Post-test Mathematics Performance of Grade 7 Struggling learners without the use of the GDLA

Category	M	Mean Diff	t-value	df	Sig
With GDLA	15.25				
		3.56	-3.43	31	0.002
Without GDLA	18.81				

**p<.05 significant*

The findings revealed a significant difference in the pretest and post-test Mathematics performance of Grade 7 struggling learners without using the GDLA (t[31]= -3.43, p=.002).

This finding was supported by the mean gain (Mean Diff = 3.56).

The present result supports the study of Putri and Musdi (2024), which found that effectiveness is evident in the significant improvement in post-test scores compared to pretest scores. It also supports the hypothesis that well-designed GDL materials can improve problem-solving skills.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The following were the findings of the study:

1. The pretest Mathematics performance of Grade 7 struggling learners with and without using the GDLA was "Low."
2. No significant difference existed between the pretest Mathematics performance of Grade 7 struggling learners who used and did not use the GDLA.
3. The post-test Mathematics performance of the Grade 7 struggling learners, with and without using the GDLA, was "Average."
4. A significant difference existed between the post-test Mathematics performance of Grade 7 struggling learners with and without the GDLA, implying that the learners using the GDLA performed better than those without the GDLA.
5. There was a significant difference in the learners' pretest and post-test Mathematics performance using the GDLA, implying that the learners performed better in their post-test.
6. A significant difference existed between the pretest and post-test Mathematics performance of the learners without using the GDLA, implying that the learners without the GDLA also performed better in their post-test.

IX. CONCLUSIONS

Based on the findings gathered and observations made by the researcher, the following conclusions were drawn:

1. Since the topics were unfamiliar to the learners, the GDLA could enhance the mathematics performance of Grade 7 struggling learners. This method fosters creative learning and critical thinking within the classroom.
2. The experimental and control groups were comparable at the start of the study, which is needed to attain a valid result.
3. The improvement in post-test performance among learners, both with and without the GDLA, demonstrated that those exposed to this method performed better than those taught using traditional instruction. This study suggests that 21st-century learners benefit more from an approach that fosters creativity, computation, and critical thinking, enhancing their higher-order thinking skills.
4. Teaching mathematics using the GDLA h is more effective than traditional methods. The study showed that applying this approach in the classroom positively impacts learners' performance, resulting in higher scores than those taught without it.
5. Implementing the GDLA in teaching mathematics motivated learners to engage more actively, enhancing their understanding and performance. This innovative method helps learners grasp concepts more easily.
6. Meanwhile, learners not exposed to the GDLA also improved their post-test performance. This approach indicates that traditional teaching methods can

positively contribute to learners' academic progress.

X. RECOMMENDATIONS

The researcher formulated the following recommendations based on the findings and conclusions made in the study.

1. Teachers should incorporate the GDLA alongside other teaching methods in mathematics, adapting to the specific needs of their learners.
2. Teachers should continuously implement innovative changes, particularly by integrating new strategies in the mathematics classroom, to enhance learners' understanding and performance.
3. Learners should adopt the GDLA to enhance their performance more effectively.
4. Teachers should continue developing their creativity and problem-solving skills, particularly in integrating critical thinking into the mathematics classroom, to enhance learners' understanding and learning experience.
5. Teachers are encouraged to enhance their understanding and expand the application of the GDLA in mathematics lessons by participating in seminar workshops and training sessions and through personal efforts for professional growth.
6. Administrators should support and create opportunities for teachers' professional growth, particularly in adopting new teaching strategies for mathematics and other learning approaches.

Future researchers should continue exploring strategies and techniques that best support struggling learners in enhancing their mathematical knowledge and skills alongside the GDLA and other teaching methods.

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