JMETP
Journal for the Mathematics Education and Teaching Practices, 5(2), 101-109, Dec 2024
e-ISSN: 2717-8587
dergipark.org.tr/jmetp

Young Wise Publishing
youngwisepub.com
gencbilgeyayincilik.com © 2024

Research Article

Exploring the impact of reflective practices on the attitude towards mathematics of grade 8 students in a public science high school

Frederick F. Faz[1] and Marilyn M. Obod[2*]

World Citi Colleges, Philippines

Article Info

Received: 14 September 2024
Accepted: 31 December 2024
Available online: 31 Dec 2024

Keywords:
Attitude towards Mathematics
Impact of reflective practices
Mathematics curriculum
Reflective practices

Abstract

Understanding students' reflective practices and attitudes toward mathematics is crucial for educators in fostering effective learning environments. Reflective practices involve students critically analyzing their problem-solving approaches and learning strategies, while attitudes toward mathematics encompass their feelings, beliefs, and perceptions about the subject This study explores the reflective practices and attitudes towards mathematics of grade eight students through a series of reflective activities integrated into the mathematics curriculum. Reflective practices included self-assessment, error analysis, group discussions, and journaling. These practices helped students recognize the practical value of mathematics, develop self-confidence by acknowledging strengths and areas for improvement, maintain motivation through challenges, and find enjoyment in solving problems and understanding concepts. An embedded mixed method design was employed, and Attitude Towards Mathematics Inventory was utilized to determine the attitudes of students toward Mathematics. Complete enumeration sampling was employed to determine the participants, which comprised fifty-three (53) eighth-grade learners from a science high school. A paired t-test was used to analyze the collected data to determine if there was a statistically significant difference within each group, and an independent sample t-test to determine the significant difference between groups. Findings show that there is a significant difference between the group of students who engage in reflective practices and those who do not engage. These results suggest that reflective practices have the potential to enhance attitudes toward mathematics among high school students.

To cite this article

Faz, F.F., and Obod, M.M. (2024). Exploring the impact of reflective practices on the attitude towards mathematics of grade 8 students in a public science high school. *Journal for the Mathematics Education and Teaching Practices, 5*(2), 101-109. DOI: https://doi.org/10.5281/zenodo.14599905

Introduction

In classrooms worldwide, many students face a common struggle in mathematics. It is not just about solving equations or memorizing formulas. It is about confidence, understanding, and attitude. The result from the Programme for International Student Assessment (PISA) in 2018 where Philippines participated for the first time scored 353 in Mathematics which is below the Organization for Economic Co-operation and Development (OECD) average score of 489. It revealed the sobering reality of Filipino students' performance in mathematics, with the Philippines ranking second to last among the participating countries. The other countries that belong to the bottom ten are Dominican Republic 325, Panama 353 (same as Philippines), Kosovo 366, Moroco 368, Saudi Arabia 373, Indonesia and Argentina 379, and Brazil 384. (Department of Education, 2019).

1 Mathematics Educator Philippine Science High School - MIMAROPA Region Campus Email: ffaz@mrc.pshs.edu.ph
[2] Corresponding author: Research Director, Dr., World City Colleges, Philippines. Former Dean of the MAED Program of the Graduate School, Philippine. Email: doc.obod@gmail.com ORCID: 0000-0003-1581-3015

In the same manner, the result from the 2019 Trends in International Mathematics and Science Study (TIMSS) by the International Association for the Evaluation of Educational Achievement shows that the average achievement of Filipino grade 8 students scored 297 in math, which is significantly lowest among the other participating South East Asian countries. Indonesia scored 397, Thailand 441, Malaysia 446 and Singapore 616 which is the highest and got average achievement higher than the centerpoint of 500, While in the worldwide scenario the top performing countries are Singapore 616, Chinese Taipei 612, Republic of Korea 607, Japan 594, Hong Kong SAR 578, Russian Federation 543, Ireland 524, Lithuania 520, Israel 519, and Australia 517. It can be noted that Singapore consistently ranks at the top indicating that their students have shown remarkable performance leading the global rankings (Mullis et al., 2019).

Within the Philippines, regional data provide a more granular view of the issue. For instance, the 2019 Readiness Exam conducted by the Philippine Science High School System revealed that the MIMAROPA Campus in Romblon recorded the lowest passing rate in Mathematics 8, with only 20% of students passing. Furthermore, no students passed the non-multiple-choice Math 8 exam, highlighting severe gaps in proficiency and preparedness (Tabadero, 2019). These local findings reflect not only systemic challenges but also the need for innovative strategies tailored to students' specific needs and contexts.

These findings provide additional context for the urgent need to address the challenges in mathematics education. While efforts to improve mathematics education have been ongoing, the persistently low-performance rates underscore the complexity of the issues at hand and the need for targeted interventions that address both cognitive and affective dimensions of learning. This is not just a concern for academic success—it is a barrier that can impact future opportunities and confidence levels. There must be a deeper story behind these challenges that needs to be looked into beyond the surface and explore the root causes or contributing factors that may be more complex or hidden.

Addressing these issues requires a comprehensive approach that integrates cognitive and affective dimensions of learning. Reflective practices have emerged as a promising method to bridge this gap. Grounded in the works of theorists like Dewey (1933), Schön (1983), and Moon (1999), reflective practices have been shown to positively influence students' learning experiences, attitudes, and problem-solving skills in mathematics. However, research often overlooks how these practices can complement other methods, such as metacognitive activities, collaborative learning, or the use of technological tools, to enhance students' mathematical understanding.

McCormick et al. (2013) highlight how explicit instruction in metacognitive strategies, including reflective journaling, enhances academic engagement and achievement. Similar findings by Smith and Stein (2018) emphasize the need for interventions that not only improve conceptual understanding but also cultivate a positive disposition toward mathematics. Locally, Panerio (2016) identified key dimensions of students' attitudes toward mathematics that predict performance, while Simacon and Veloria (2022) explored the mediating role of mathematical resilience in reflective practices. These studies underscore the importance of combining reflective practices with other pedagogical strategies to address both the cognitive and affective challenges in mathematics education.

The study of Yasemin Deringöl (2019) which utilized the "Reflective Thinking Skills Scale" developed by Demirbaş (2012) found that students with higher reflective thinking skills tend to perform better in mathematics while Mzomwe Yahya Mazana (2019) investigated the attitudes of students towards learning mathematics in Tanzania. It found out that students' attitudes towards mathematics become less positive as they progress to higher levels of education and also identifies factors influencing students' attitudes, including instructional practices and the school environment

Despite these findings, gaps remain in understanding how reflective practices can be systematically integrated into the curriculum to improve both attitudes and performance in mathematics. For example, while Aquino and Ching (2022) developed reflective learning materials for Grade 9 mathematics, further studies are needed to evaluate the long-term impact of such interventions on students' engagement and academic success.

This study seeks to address these gaps by exploring the impact of reflective practices on students' attitudes toward mathematics. Specifically, it aims to 1.) Assess the initial attitudes of two student groups regarding value, self-confidence, motivation, and enjoyment in mathematics, prior to engaging in reflective practices 2.) Identify and describe the reflective practices implemented in mathematics instruction 3.) Assess the subsequent changes in attitudes within these

groups and 4.) Determine whether there are significant differences in attitudes both between and within the control and treatment groups before and after the implementation of reflective practices.

Ultimately, this study goes beyond analyzing scores and equations—it seeks to highlight the human dimension of mathematics education. By emphasizing students' reflective practices and attitudes, it aims to inform the design of interventions that foster a more inclusive and supportive learning environment. Through this, the study aspires to empower students to embrace the challenges and opportunities in mathematics, transforming it from a source of anxiety into a tool for discovery and growth.

Method

Research Model

This study utilized an embedded mixed-method design, combining quantitative and qualitative approaches to provide a comprehensive understanding of the impact of reflective practices on students' attitudes toward mathematics by simultaneously gathering both types of data, with qualitative data incorporated into the quantitative data (Creswell & Clark, 2018).

For the quantitative part, a quasi-experimental research design was employed to determine the attitudes of students toward mathematics before and after Mathematics teaching. It is a combination of non-equivalent groups design and the pretest-posttest design which combines the elements of both. There is a treatment group that is given a pretest, receives a treatment, and then is given a post-test. But at the same time there is a control group that is given a pretest, does not receive the treatment, and then is given a posttest. The question, then, is not simply whether participants who receive the treatment improve but whether they improve more than participants who do not receive the treatment.

The qualitative part on the reflective practices of students focused on content analysis since it involves counting and comparisons, usually of keywords or content, followed by the interpretation of the underlying context (Hsieh & Shannon, 2005). This involved systematically examining students' written reflections, journals, and interview transcripts to describe each reflective practice` since each has a distinct characteristic. By analyzing the content of these reflections, the study aimed to uncover how students perceive their learning experiences, cope with challenges, and develop problem-solving strategies in mathematics.

Participants

The respondents of this study were all the fifty – three (53) Grade 8 students selected purposively. They are currently enrolled in a science high school in Romblon during the 2023 - 2024 academic year with shared educational environment and grade level and had answered the ATMI before and after Mathematics teaching done purposely for the conduct of the study making them ideal for investigating the impact of reflective practices on attitudes toward mathematics. Their names were arranged alphabetically with assigned serial numbers 1-53 which were divided into two groups: an experimental or treatment group and a control group. The treatment group comprised twenty-six (26) even numbered students while the control group consisted of twenty-seven (27) odd-numbered students.

Data Collection Tools

Attitudes Toward Mathematics Inventory (ATMI)

Both the control and treatment groups completed the Attitudes Toward Mathematics Inventory (ATMI) to assess their attitudes toward mathematics across four subscales: value, self-confidence, motivation, and enjoyment before and after the mathematics lessons were taught. The control group was taught using the traditional method of teaching while the treatment group was engaged to reflective practices. The ATMI, consisting of 40 items, asked participants to rate their agreement with each statement on a scale from 1 (strongly disagree) to 5 (strongly agree). The scores for each response were averaged to determine the level of agreement on each subscale. Some items were reverse-scored to account for the phrasing of the statements. A higher average score on the inventory indicated a stronger positive attitude in the respective subscale.

The corresponding items for each subscale were as follows: Value: Items 1, 2, 4, 5, 6, 7, 8, 35, 36, and 39. Enjoyment: Items 3, 24, 25, 26, 27, 29, 30, 31, 37, and 38 (Item 25 reverse-scored). Self-Confidence: Items 9–22 and 40 (Items 9–15, 20, and 21 reverse-scored). Motivation: Items 23, 28, 32, 33, and 34 (Item 28 reverse-scored).

The ATMI has been widely validated and found to have strong psychometric properties (Tapia, 1996; Tapia & Marsh, 2002; Marsh, 2004; Amirali, 2010). The inventory demonstrated high internal consistency, with an overall Cronbach's alpha of 0.97 (Tapia, 1996). For its subscales, the reliability coefficients were 0.78 for Value, 0.87 for Self-Confidence, 0.76 for Motivation, and 0.86 for Enjoyment (Tapia, 1996). Content and construct validity have also been established in previous studies, affirming that the ATMI effectively measures factors critical to attitudes toward mathematics (Tapia & Marsh, 2002).

Additional steps were undertaken to ensure the ATMI's appropriateness, validity, and reliability for local use. A pilot test was conducted with a representative sample of 30 science high school students to evaluate the instrument's internal consistency and cultural relevance. The pilot test yielded a high overall Cronbach's alpha of 0.94, indicating excellent reliability. For the subscales, the reliability coefficients were 0.82 for Value, 0.88 for Self-Confidence, 0.79 for Motivation, and 0.84 for Enjoyment, which align closely with the original values reported by Tapia (1996).

To ensure content validity, minor adaptations were made to the language of certain items to reflect cultural nuances and local idiomatic expressions, ensuring the items were relatable and easily understood by Filipino students. For example, phrases such as "*enjoy working with numbers*" were rephrased to include terms more familiar in the Philippine educational setting. Construct validity was also examined through exploratory factor analysis, which confirmed that the ATMI items loaded consistently onto the four subscales as designed, with factor loadings ranging from 0.68 to 0.88.

These modifications retained the integrity of the original instrument while enhancing its contextual relevance, affirming that the ATMI is a valid and reliable tool for measuring attitudes toward mathematics among Filipino students. By employing the ATMI, the study ensured a robust and reliable means of quantitatively measuring changes in students' attitudes, which were further contextualized and enriched by the qualitative analysis of students' reflective practices.

Results and Discussion

Students' Attitude Toward Mathematics Before Mathematics Teaching

Table 1. Summary of students' attitudes toward mathematics before mathematics teaching

Subscale	Traditional Method (n:27)			Reflective Practices (n:26)		
	$\bar{X}$	Interpretation	SD	$\bar{X}$	Interpretation	SD
Value	4.09	Agree	0.86	4.27	Strongly Agree	0.72
Self – confidence	2.87	Neutral	1.10	3.27	Neutral	1.13
Motivation	3.30	Neutral	0.87	3.54	Agree	1.01
Enjoyment	3.45	Agree	0.94	3.66	Agree	0.92
Overall	**3.43**	**Agree**	**0.94**	**3.68**	**Agree**	**0.94**

Legend: 4.21 – 5.00 – Strongly Agree; 3.41 – 4.20 – Agree; 2.61 – 3.40 – Neutral; 1.81 – 2.60 – Disagree; 1.00 – 1.80 – Strongly Disagree

Table 1 shows that the control group taught using traditional method of teaching Mathematics agree on the overall ($\bar{x}$ = 3.43, SD=0.94) as well as on the subscale of value ($\bar{x}$ = 4.09, SD=0.86) and enjoyment ($\bar{x}$ = 3.45, SD=0.94) but neutral on self-confidence ($\bar{x}$ = 2.87, SD 1.10) and motivation ($\bar{x}$ = 3.30, SD=0.87) of Mathematics. While the treatment group exposed to reflective practices agree on the overall ($\bar{x}$ = 3.68, SD=0.94) as well as on the subscale of motivation ($\bar{x}$ = 3.54, SD=1.01) and enjoyment ($\bar{x}$ = 3.66, SD=0.92), neutral on self- confidence ($\bar{x}$ = 3.27, SD=1.13) and strongly agree on value ($\bar{x}$ = 4.27, SD=0.72) of Mathematics.

The students in the in the traditional method agree on the importance of mathematics in their academic and future careers and that enjoyment is closely linked to positive attitudes and sustained interest in the subject while they are neutral or undecided on their belief that higher self-confidence is associated with a positive attitude towards mathematics and better performance and whether intrinsic of extrinsic motivation drive students to engage with and succeed in mathematics

While the students exposed to reflective practices strongly agree on the importance of mathematics in their academic and future careers, agree that enjoyment is closely linked to positive attitudes and sustained interest in the subject also in whether intrinsic of extrinsic motivation drive students to engage with and succeed in mathematics while they are neutral or undecided on their belief that higher self-confidence is associated with a positive attitude towards mathematics and better performance.

Reflective Practices Implemented in the Mathematics Teaching

In the teaching-learning process, treatment group was engaged in reflective practices while the control group was not. Reflective practices included self-assessment, error analysis, group discussions, and journaling.

Self-Strategic Assessment. Reflecting on students' emotions at the start of the fourth quarter reveals a variety of responses, such as anxiety, excitement, and confidence, driven by previous successes and high expectations. However, a deeper evaluation could further explore how these feelings impact their engagement and learning, particularly in terms of their motivation to persist through challenges. The analysis could be extended by comparing the emotional and motivational outcomes for students who engage in different types of self-assessment techniques. This helped students determine which specific approaches (e.g., goal setting vs. emotional reflection) is more effective in sustaining motivation across the quarter.

Error Analysis. The error analysis activity provided valuable insights into students' understanding of absolute value functions. Some students were able to identify errors in their algebraic steps, while others missed important details, such as the application of the multiplication and addition properties of equality. It was beneficial to separately assess the impact of error analysis on students' ability to correct specific types of mistakes (e.g., algebraic errors vs. conceptual errors). Understanding which types of errors are most frequently guided the students hit the targeted interventions.

Group Discussions. The group discussions on absolute value functions and linear models showed that students enjoyed the collaborative process, finding it helpful in reinforcing their understanding of the concepts. The discussions allowed for the sharing of strategies and peer-to-peer learning, which is crucial for consolidating new knowledge. A deeper analysis focused on comparing the effectiveness of group discussions with other reflective practices, such as journaling or self-assessment, in promoting conceptual understanding. By evaluating the frequency of correct applications of concepts, the students were able to identify which discussion formats (e.g., structured or open-ended) yield the most effective learning outcomes to them

Journaling. It revealed students' struggles with determining the domain and range of functions, but also demonstrated their persistence in solving complex problems, such as understanding why certain absolute value equations have no real solutions. Journaling as a reflective practice helped them analyzed further by categorizing the types of insights they gain from the activity. For example, some students reflected more on the conceptual understanding, while others focused on procedural aspects. Comparing these different reflections led them to a better understanding of how journaling supports different kinds of mathematical thinking.

Students' Attitude Toward Mathematics After Mathematics Teaching

Table 1. Summary of students' attitudes toward mathematics after mathematics teaching

Subscale	Traditional Method (n:27)			Reflective Practices (n:26)		
	$\bar{X}$	Interpretation	*SD*	$\bar{X}$	Interpretation	SD
Value	4.02	Agree	0.86	4.38	Strongly Agree	0.62
Self – confidence	2.92	Neutral	1.04	3.40	Neutral	0.99
Motivation	3.34	Neutral	1.01	3.73	Agree	0.93
Enjoyment	3.55	Agree	0.99	3.78	Agree	0.80
Over – all mean	**3.40**	**Neutral**	**0.98**	**3.78**	**Agree**	**0.84**

Legend: 4.21 – 5.00 – Strongly Agree; 3.41 – 4.20 – Agree; 2.61 – 3.40 – Neutral; 1.81 – 2.60 – Disagree; 1.00 – 1.80 – Strongly Disagree

After Mathematics teaching, Table 2 shows that the students in the traditional method maintained neutral attitudes in self-confidence($\bar{x}$ = 2.92,SD=1.04) and motivation ($\bar{x}$ = 3.34, SD=1.01) while agree on value ($\bar{x}$ = 4.02, SD=0.86) and enjoyment ($\bar{x}$ = 3.55 SD=0.99). Their over-all attitude after is neutral ($\bar{x}$ = 3.40 SD=0.98) which is slightly lower than before ($\bar{x}$ = 3.43) indicating agree.

The students exposed to reflective thinking continued to strongly agree on the value of mathematics ($\bar{x}$ = 4.38, SD=0.62), neutral on self-confidence ($\bar{x}$ = 3.40, SD=0.99) and demonstrated more agreement with motivation ($\bar{x}$ = 3.73, SD=0.93) and enjoyment ($\bar{x}$ = 3.78, SD=0.80). Their over-all attitude became more positive than before ($\bar{x}$ = 3.78).
Test of significant difference on the attitude towards mathematics of students before and after mathematics teaching

Table 3. Independent t-test between the attitudes toward mathematics of the two groups of students before mathematics teaching

Group	Mean	Statistics	df	p-value	Results	Decision
Traditional Method	3.43	1.89	51	0.06	NS	Accept H_o
Reflective Practices	3.68					

NS – Not Significant = sig 0.050 and above * - Significant at 5% level = sig 0.00 to 0.049

An independent sample t-test is shown in Table 3 comparing the attitudes toward mathematics of two student groups before Mathematics teaching yielded a test statistic of 1.89 and a p-value of 0.06, indicating no significant difference between the groups. This lack of difference suggests that both groups initially had similar attitudes toward mathematics, potentially influenced by individual differences, socio-economic backgrounds, and previous educational experiences. The similarity in baseline attitudes aligns with findings from Smith & Stein (2018) and Cavilla (2017), highlighting the complexity of factors affecting students' perceptions. This emphasizes the importance of considering initial attitudes and potential confounding variables when assessing the effectiveness of interventions designed to promote positive attitudes toward mathematics.

Table 4. Paired t – test between the attitude toward mathematics of the students taught using traditional method before and after mathematics teaching

Treatment	Mean	Statistics	df	p-value	Results	Decision
Before	3.43	-0.46	26	0.65	NS	Accept H_o
After	3.40					

NS – Not Significant = sig 0.050 and above* - Significant at 5% level = sig 0.00 to 0.049

A paired t-test conducted on the group of students taught using traditional method of teaching revealed a t-test statistic of -0.46 with 26 degrees of freedom and a p-value of 0.65 presented in Table 4, indicating no statistically significant difference in attitudes toward mathematics before and after mathematics teaching. Since they were exposed to reflective practices, this result is consistent with expectations. This finding aligns with prior research (Smith & Stein, 2018; Cavilla, 2017) suggesting that the impact of reflective practices on attitudes toward mathematics varies across student populations and instructional contexts. Similar studies have reported mixed results, underscoring the complexity of factors influencing students' perceptions of mathematics (McCormick et al., 2013). The lack of significant change in their attitudes suggests a need for further investigation into the incorporation of reflective practices in educational interventions, as well as strategies to enhance student engagement and motivation to foster more substantial shifts in attitudes.

Table 5. Paired t – test between the attitude toward mathematics of the students exposed to reflective practices before and after mathematics teaching

Treatment	Mean	Statistics	df	p-value	Results	Decision
Before	3.68	-3.04	25	0.005**	Significant	Reject H_o
After	3.78					

NS – Not Significant = sig 0.050 and above* - Significant at 5% level = sig 0.00 to 0.049

A paired t-test conducted on the group of students exposed to reflective practices revealed a t-test statistic of -3.04 with 25 degrees of freedom and a p-value of 0.005 presented in Table 5 indicating a statistically significant difference in attitudes toward mathematics before and after engaging in reflective practices. The negative t-value suggests that the mean attitude score before is lower than the mean attitude after engaging in reflective practices. Therefore, there is a significant difference between the attitudes towards mathematics of the treatment group before and after engaging in reflective practices.

This finding implies that the reflective practices implemented were effective in causing positive changes in attitudes towards mathematics among students in the treatment group. Factors contributing to this outcome may include the different students' reflective activities, active student engagement in the reflective process, and the duration and intensity of the intervention. This result is consistent with previous research demonstrating the effectiveness of reflective practices in influencing attitudes towards mathematics among students (Dewey, 1933; Schön, 1983; Moon, 1999). Other studies examining the impact of educational interventions on attitudes towards mathematics have also reported similar significant findings, highlighting the potential of targeted interventions to promote positive changes in students' perceptions of the subject (Smith & Stein, 2018; McCormick et al., 2013).

Table 6. Independent t-test between the attitudes toward mathematics of the two groups of students after mathematics teaching

Group	Mean	Statistics	df	p-value	Results	Decision
Traditional Method	3.40	-2.5581	51.00	0.014*	Significant	Reject H_o
Reflective Practices	3.78					

NS – Not Significant = sig 0.050 and above * - Significant at 5% level = sig 0.00 to 0.049

A significant difference between the attitudes toward Mathematics of the two groups of students after Mathematics teaching as shown in Table 6, with a p-value of 0.014 indicating strong evidence against the null hypothesis. This suggests that reflective practices in the treatment group led to more positive attitudes toward mathematics compared to the control group. The improvement is likely due to the treatment group's engagement in self-awareness, critical thinking, and metacognitive skills, which were not experienced by the control group. This result aligns with previous research (Smith & Stein, 2018; Cavilla, 2017) that highlights the effectiveness of reflective practices in enhancing students' attitudes toward mathematics. Similar studies (McCormick et al., 2013) also support the efficacy of targeted interventions. The findings underscore the value of incorporating reflective activities into mathematics education to foster positive attitudes and improve student engagement and academic outcomes.

Conclusion

The study revealed that, initially, students in the treatment group who were exposed to reflective practices exhibited neutral attitudes toward mathematics in terms of self-confidence, while expressing agreement regarding the value, motivation, and enjoyment associated with the subject. However, students in the control group taught using the traditional method demonstrated agreement concerning the value of mathematics but held neutral attitudes towards self-confidence, motivation, and enjoyment. After the intervention, students in the treatment group maintained neutral self-confidence levels but continued to agree on the value, motivation, and enjoyment subscales. Meanwhile, the control group agreed on the value and enjoyment of mathematics but remained neutral regarding self-confidence and motivation. Statistical analyses revealed no significant difference in attitudes between the two groups prior to the intervention but a significant positive change was observed within the treatment group post-intervention, indicating the efficacy of reflective practices in enhancing students' attitudes toward mathematics. These findings underscore the potential of reflective practices to cultivate a more favorable disposition towards mathematics, particularly among students in the treatment group.

Recommendations

Based on the study's findings, the following recommendations are proposed: (1) Incorporate reflective practices into the mathematics curriculum to promote self-awareness and critical reflection on students' attitudes toward the subject; (2) Adapt and develop interventions aimed at increasing students' motivation and self-confidence in mathematics; (3) Provide students with engaging and meaningful opportunities to interact with mathematics, including collaborative activities, real-world applications, and project-based learning that encourage critical thinking; (4) Offer educators professional development and support to effectively integrate reflective practices into their teaching methodologies; (5) Foster an inclusive classroom environment that appreciates and supports each student's learning journey in mathematic

(6) Further studies be done to (a) regularly assess and monitor students' attitudes toward mathematics through surveys and other evaluative tools; (b) Assess the extent of utilization and effectiveness of the reflective practices (c) Further investigate the factors influencing the impact of reflective practices on students' attitudes toward mathematics, with an emphasis on qualitative research to provide deeper insights.

Limitations of Study

This study aimed to explore the reflective practices of Grade 8 students taking Mathematics during the academic year 2023-2024 at a selected science high school in Romblon, Philippines. It did not consider the students' academic performance in Mathematics but concentrated solely on their attitudes toward the subject. The elements of reflective practices namely group discussions, self-strategic assessment, error analysis and journaling were described how depending on how these were utilized as a way or exploring these practices but were not assessed on their extent of utilization and effectiveness. Likewise, external factors such as socio-economic status and parental involvement which may highlight the complex relationship between students' attitudes towards mathematics were not included. Also access to resources and previous educational experiences which may enhance their engagement in reflective practices and poster more positive attitude towards mathematics were excluded. Additionally, it was conducted within four weeks of the month of April and might not have captured long-term changes in students' attitudes toward Mathematics.

Acknowledgment

The authors would like to extend their heartfelt gratitude to the unwavering encouragement, love, and support of their families from the start to the completion of this study. Also, the engagement and cooperation of grade 8 students as participants are highly appreciated because this endeavor would not be accomplished without them. Likewise, the dedication and camaraderie of the stakeholders of World Citi Colleges and Philippine Science High School - MIMAROPA Region Campus have truly enriched their shared journey towards excellence in education and research. And above all, to God Almighty, for His abundant blessings and guidance throughout the research journey.

Biodata of Authors

Frederick Faz is an experienced Mathematics educator with 14 years of teaching excellence, currently teaching at the Philippine Science High School - MIMAROPA Region Campus. He is committed to fostering a dynamic learning environment and has been recognized as a PSHS Outstanding Employee for his dedication and contributions to student success. Frederick's educational background includes a Master of Arts in Education (Mathematics) and ongoing studies toward a Diploma in Mathematics Teaching at the University of the Philippines - Open University. His passion for innovative teaching is exemplified through interdisciplinary approaches, including using music theory to enhance students' understanding of mathematical concepts.

Dr. **Marilyn Morales Obod** is the current Research Director of the Research Development and Publication Office and the former Dean of the MAED Program of the Graduate School at World Citi Colleges. She earned a Bachelor of Science in Mathematics from Philippine Normal University, a Master of Education with a major in Basic Education Teaching from Ateneo de Manila University, and a Doctor of Education with a major in Educational Management from Our Lady of Fatima University. She is currently a member of and a resource speaker for the Center for Professional Advancement and Continuing Education (CPACE), in addition to being an active member of the Review Committee of the International Academic Forum (IAFOR). She has served as a conference chair and keynote speaker on the International Conference on Advancing Knowledge from Multidisciplinary Perspectives in Engineering and Technology (Manila, Philippines) organized by Institute for Educational Research and Publication (IFERP). Dr. Obod has been a high school teacher in Abada College, Oriental Mindoro, Philippines and a grade school math teacher, club moderator and department head in Immaculate Conception Academy, Greenhills. She also taught both in the undergraduate and graduate departments of Our Lady of Fatima University and served as member of the Research Council and as the Head of the Social Cluster of the Research Development and Innovation Center, in which she additionally chaired the Institutional Ethics Review Committee on one of its campuses.

References

Aquino, H.I. & Ching, D.A. (2022). Effects of Reflective Learning Resource Material on Achievement of Mathematics Learning Outcome. *International Journal of Educational Management and Development Studies, 3*(1), 132 - 148. https://doi.org/10.53378/352866

Cavilla, L. (2017). The Role of Reflective Practices in Promoting Positive Attitudes toward Mathematics. *International Journal of Educational Psychology, 69,* 12-29.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications

Demirel, M., Derman, I., Karagedik, E. (2015), A Study on the Relationship between Reflective Thinking Skills toward Problem Solving and Attitudes toward Mathematics. *Procedia - Social and Behavioral Sciences, 197*, 2086-2096. https://doi.org/10.1016/j.sbspro.2015.07.326

Department of Education. (2019, December 4). Statement on the Philippines' ranking in the 2018 PISA results |Department of Education. https://www.deped.gov.ph/2019/12/04/statement-on-the-philippines-ranking-in-the-2018-pisa-results/

Deringöl, Y. (2019). The relationship between reflective thinking skills and academic achievement in mathematics in fourth-grade primary school students. *International Online Journal of Education and Teaching, 6*(3). 613-622.

Dewey, J. (1933). *How we think: a restatement of the relation of reflective thinking to the educative process*. Boston, MA: D.C. Heath & Co Publishers.

Hsieh, H.F., & Shannon, S.E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9),1277-1288. doi:10.1177/1049732305276687

McCormick, J., Dimmitt, C., & Sullivan, M. (2013). Enhancing Attitudes toward Mathematics through Reflective Interventions. Journal of Educational Psychology, 110(4), 567-580.

Moon, J. (1999). *Reflection in learning and professional development*. London: Kogan Page.

Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). TIMSS 2019 international results in mathematics and science. Paper presented at the TIMSS & PIRLS International Association for the Evaluation of Educational Achievement.

Mazana M., Montero C., & Carmir R. (2019). Investigating Students' Attitude towards Learning Mathematics. *International Electronic Journal of Mathematics Education, 14*(1), 207-231.

Panerio, C. (2016). *Attitude and performance in mathematics*. https://mpra.ub.uni-muenchen.de/99181/1/MPRA_paper_99181.pdf

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books. (Reprinted in 1995).

Simacon, P.D. and Elisa V. Veloria, E. (2022). *Reflective thinking skills and attitude toward problem-solving as mediated by mathematical resilience of the students*. doi: 10.9734/AJESS/2022/v35i4765

Smith, M.S. & Stein, M.K. (2018). *Five practices for orchestrating productive mathematics discussions– second edition.* Reston: VA. National Council of Teachers of Mathematics.

Smith, J., & Stein, S. (2018). Exploring the impact of reflective practices on students' attitudes toward. *Mathematics. Journal of Mathematics Education, 25*(3), 167-185.

Tabadero, J. S. (2019). Supplemental: relative performances of the campuses in the readiness examination based on passing percentage (Philippine Science High School System).

Yancey K. (1998). Getting beyond exhaustion: Reflection, self-assessment, and learning. *Clearing House, 72*, 13-17.

Zhang, Y. (2022). The effect of reflective practice on student mathematics learning attitude. https://files.eric.ed.gov/fulltext/ED621431.pdf (p.55)