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Exploring Teachers Feedback Modalities on Math Engagement and Performance among Students

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Abstract: This study aimed to examine the impact of Teacher Feedback Modalities (TFM) on students' engagement and performance in mathematics. Conducted at Dagatkidavao Integrated School, the research involved 63 Grade 9 students divided into two randomly selected sections—one receiving TFM and the other receiving non-TFM or traditional feedback. A 40-item standardized exam adopted from DepEd Valencia was used to assess academic performance, and a quantitative design guided the study. Before the intervention, both groups showed very low engagement levels. After the implementation of TFM, student engagement significantly improved, reaching a highly engaged level for the TFM group and a moderately engaged level for the non-TFM group. In terms of academic performance, the TFM group showed greater progress, with students transitioning from fairly satisfactory to satisfactory levels. In the retention phase, the TFM group maintained a strong performance, with most students achieving a very satisfactory level, while the non-TFM group showed only a slight improvement. Statistical analysis using ANCOVA confirmed a significant difference in both engagement and performance between the two groups, favoring the TFM group. This indicates that the use of structured, meaningful feedback had a substantial effect on students' involvement and learning outcomes in mathematics.

Keywords: Teachers Feedback Modalities, Math Engagement, Performance.

INTRODUCTION

Mathematics is a core subject essential to students' academic and professional success. Despite its importance, many students struggle with engagement and performance due to factors like ineffective teaching strategies and insufficient feedback. Engagement involves students' motivation and active participation, while performance reflects their understanding and application of mathematical concepts. Research (e.g., Kim & Madigan, 2021) highlights that teacher feedback—whether written or verbal—significantly influences both engagement and performance by shaping motivation, understanding, and confidence.

Student disengagement in math is a growing issue, especially in secondary education, often triggered by a lack of interest, negative emotions such as anxiety, and uninspiring teaching approaches. Studies, including Reyes, *et al*. (2019), emphasize the impact of teacher support on students' emotional responses and academic involvement.

Academic performance also suffers from inadequate feedback mechanisms, with students frequently misunderstanding foundational concepts. As Wiliam (2016) argues, formative feedback is essential for correcting errors and supporting skill development. Without it, students face frustration and academic decline.

This issue is evident in national and international assessments. The Philippines ranked lowest in the 2019 TIMSS and scored poorly in the 2022 PISA, reflecting deep-seated challenges in the education system, such as limited resources and ineffective instruction. Local data, including the

Division Achievement Test (DAT) in Valencia City and results from Dagatkidavao Integrated School, also indicate low math performance and engagement, underscoring the urgent need for reform.

Student engagement is a critical factor in school success (Rimm-Kaufman, *et al*., 2015), as engaged learners are more attentive, motivated, and likely to succeed. Therefore, exploring effective feedback strategies is vital in enhancing students' engagement and performance in mathematics.

MATERIALS AND METHODS

This study utilized a quantitative research design, focusing solely on the collection and analysis of numerical data to identify patterns, trends, and relationships related to teacher feedback and student performance. The primary aim was to obtain objective, measurable evidence on the impact of feedback modalities without incorporating qualitative insights.

The research was conducted at Dagatkidavao Integrated School in Valencia City, Bukidnon, among Grade 9 students. The school, operating since 2002, serves both junior and senior high school levels, with adequate facilities including classrooms, a module depot, and a computer lab. For this study, three Grade 9 mathematics sections were involved, each averaging 30 students. Based on their pretest results and homogeneity of

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variance, two sections with the highest mean scores were selected. Random sampling determined which section became the experimental group (exposed to teacher feedback) and which served as the control group (exposed to non-teacher feedback).

Both groups were taught the same math lessons to ensure consistency in content. The study aimed to compare the effects of Teacher Feedbacking Modalities (TFM) and Non-Teacher Feedbacking Modalities (Non-TFM) on student engagement and performance.To measure outcomes, two instruments were used: a survey questionnaire to assess student engagement (non-academic) and a multiple-choice test to evaluate student performance (academic). The setting was chosen due to previously observed low performance and engagement among Grade 9 math students, with an average score of 50.71% in the 2023–2024 school year.

A. Non- Academic Test
Student Engagement

To assess student engagement, the researcher adopted an instrument based on the Student-Report Engagement Scale developed by Wang, Chen, and Jin (2014). This 33-item instrument, comprising four subcomponents – (1) Cognitive (8 items), (2) Behavioral (8 items), (3) Emotional (10 items), and (4) Social (7 items) – was pilot-tested at Dagatkidavao Integrated School, yielding a Cronbach's alpha coefficient of 0.744, indicating acceptable internal consistency.

The instrument used a 5-point Likert scale adopted from the scale develop by Appleton, *et al*. (2006) in Student Engagement Instrument (SEI) with the following descriptive interpretations:

Table 1: Non- Academic Test Student Engagement

Scale	Range	Descriptive Interpretation	Qualitative Interpretation
5	4.51-5.00	Always	Very Highly Engaged
4	3.51-4.50	Usually	Highly Engaged
3	2.51-3.50	Sometimes	Moderately Engaged
2	1.51-2.50	rarely	Low Engaged
1	1.00-1.50	Never	Very Low Engaged

B. Academic Assessment
Student Performance

A 50-item multiple-choice test, adopted from DepEd resources and constructed based on a Table of Specifications (TOS) aligned with the DepEd curriculum competencies, was initially adopted to assess student performance. To ensure content validity, these items underwent validation and pilot testing followed by item analysis. The results of the item analysis indicated that 10 items did not meet the criteria for acceptability and were subsequently removed. Following the removal of these 10 items, the researcher recalculated the Kuder-Richardson Formula 20 (KR-20) reliability coefficient for the remaining 40 items, which yielded a value of 0.704. The KR-20 is a measure of internal consistency reliability for tests with dichotomous items (like multiple-choice questions), indicating the extent to which the items on the test measure the same construct. This KR-20 value of 0.704 is considered acceptable, indicating satisfactory internal consistency for the revised 40-item multiple-choice test. Therefore, the researcher proceeded to use this 40-item instrument for the study.

Table 2: Academic Assessment Student Performance

Students' Performance Range	Qualitative Description
34 – 40	Outstanding
27 – 33	Very Satisfactory
20 – 16	Satisfactory
13 – 19	Fairly Satisfactory
12 below	Needs Improvement

The result was interpreted using the scale below adapted from the study of Coscos, *et al*. (2022) the standards set criteria the after the score will be transmuted:

For data analysis, descriptive statistics (frequency, mean, and standard deviation) were used to summarize the results. To examine the effects of the interventions, Analysis of Covariance (ANCOVA) was applied, controlling for any initial differences between groups. The study involved two groups: NTFM (n=30) and TFM (n=33). To ensure the reliability of the ANCOVA results, key

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assumptions were tested using Levene's test for variance homogeneity and the Shapiro-Wilk test for normality of residuals.

RESULTS AND DISCUSSION

This section Presents how the findings were analyzed and interpreted to test the hypotheses. Tables are also included to make data analysis easier. The presentation is the same order as the objectives of the study.

Table 3: Illustrates the summary of student's Engagement in Mathematics between the Teacher's Feedbacking Modalities Approach and Non-Teacher's Feedbacking Modalities Approach before and after the intervention period.

Indicator	Group							
	TFM				NTFM			
	Pretest		Posttest		Pretest		Posttest	
	Mean	QI	Mean	QI	Mean	QI	Mean	QI
Cognitive	2.50	LE	3.44	ME	2.50	LE	2.98	ME
Behavioral	2.66	ME	3.68	HE	2.62	ME	3.21	ME
	2.51	ME	3.80	HE	2.51	ME	3.63	HE
Emotional								
Social	2.50	LE	3.28	ME	2.43	LE	3.12	ME
Total	2.53	ME	3.55	HE	2.52	ME	3.23	ME

Scale	Range	Descriptive Interpretation	Qualitative Interpretation
5	4.51-5.00	Always	Very Highly Engaged
4	3.51-4.50	Usually	Highly Engaged
3	2.51-3.50	Sometimes	Moderately Engaged
2	1.51-2.50	rarely	Low Engaged
1	1.00-1.50	Never	Very Low Engaged

The total mean scores from Table 3 reveal that both groups began with Low Engagement in mathematics—TFM at 2.46 and NTFM at 2.37—but after the intervention, TFM rose to 3.55 (Highly Engaged) while NTFM increased to 3.23 (Moderately Engaged). This substantial difference shows that while both feedback approaches improved engagement, teacher feedback was more effective. Analyzing the engagement dimensions, the TFM group outperformed NTFM in all areas: cognitive (3.44 vs. 2.98), behavioral (3.68 vs. 3.21), emotional (3.80 vs. 3.63), and social (3.28 vs. 3.12). These results suggest that teacher-delivered feedback had a more comprehensive impact, likely due to its structure and immediacy. Interpreting these findings, the greater improvement in the TFM group underscores the importance of direct teacher involvement in providing timely, specific, and actionable feedback, which enhances not only academic effort but also emotional and social investment in learning. This supports Hattie and Timperley's (2017) view that effective feedback promotes deep engagement and aligns with Shute's (2018) emphasis on personalized feedback as a key driver of motivation and understanding. While TFM had a stronger effect, NTFM—such as peer and tech-based feedback—still proved beneficial, and educators might integrate these forms strategically, especially where teacher capacity is limited. Moving forward, targeted interventions could address weaker areas like social engagement and further explore the nuances of effective feedback delivery.

Table 4: level of student's performance in mathematics of those who are exposed to teacher's feedbacking Modalities and those who are not exposed to teacher's feedbacking modalities.

Range	QI	Group											
		TFM						NTFM					
		Pretest		Posttest		Retention		Pretest		Posttest		Retention	
		f	%	f	%	F	%	f	%	F	%	f	%
34-40	O												
27-33	VS			2	6.06	28	84.84						
20-26	S	3	9.09	20	60.61	3	9.09	1	3.33	7	23.33	20	66.67
13-19	FS	18	54.55	11	33.33	2	6.06	10	33.33	19	63.33	7	23.33
6-12	NI	12	36.36					19	63.33	4	13.33	3	10
Mean		14.18	FS	21.36	S	28.85	VS	11.73	NI	16.47	FS	20	S

Legend

Range	Qualitative Interpretation
34-40	Outstanding (O)
27-33	Very Satisfactory (VS)
20-26	Satisfactory (S)
13-19	Fairly Satisfactory (FS)
6-12	Needs Improvement (NI)

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Table 4 presents the mean scores and performance levels of students in mathematics exposed to Teacher Feedback Modalities (TFM) and Non-Teacher Feedback Modalities (NTFM) across pretest, posttest, and retention stages, revealing that the TFM group started with a "Fairly Satisfactory" mean of 14.18, improved to "Satisfactory" (21.36) after the intervention, and reached "Very Satisfactory" (28.85) in the retention stage, while the NTFM group began with a "Needs Improvement" mean of 11.73, progressed to "Fairly Satisfactory" (16.47), and reached "Satisfactory" (20.00) in retention. The data show that both groups improved over time, but the TFM group demonstrated a more substantial and sustained increase, with a higher proportion of students advancing to stronger performance levels. This suggests that teacher feedback—when specific, timely, and actionable—has a more powerful and lasting effect on learning outcomes and retention than non-teacher feedback. The implication is clear: schools should prioritize teacher-led feedback strategies to enhance academic performance, particularly in mathematics, and provide professional development that focuses on effective feedback delivery. This aligns with studies by Howard and Lee (2023), Tang and Liu (2021), and Peterson and Smith (2019), all of which emphasize the importance of personalized, encouraging feedback in improving student outcomes. The significant improvement of the TFM group also supports local findings, such as Abde, *et al*. (2024) in the Philippines and the 2022 study at Leyte Normal University, both of which reinforce the motivational and academic benefits of teacher feedback. While the NTFM group's gains were less dramatic, their improvement highlights the potential of non-teacher feedback—like peer reviews or self-assessment—as supportive tools, especially when teacher resources are limited, echoing the findings of Bayat, *et al*. (2022) and Noroozi, *et al*. (2022) [Howard, J. et al., 2023] [Tang, X. et al., 2023][Peterson, R. et al., 2019][Abde, R. et al., 2024][Eguia, M. L. G. et al., 2022][Bayat, A. et al., 2022].

Table 5: Comparison of Students' Engagement in Mathematics

Group		N		MEAN		SD	
TFM		33		3.55		.391	
NTFM		30		3.24		.270	
TOTAL		63		3.39		.371	
SOURCE	SS	Df	MS	F-value		Sig	Eta Squared
GROUP	1.501	1	1.501	13.031		0.001**	.178
PRETEST Covariate	.094	1	.094	.815		0.370^{ns}	.013
Error	6.909	60					
Total	736.493	63					

Note **-significant at 0.05 level
ns- not significant at 0.05 level

Table 5 presents an ANCOVA analysis comparing overall student engagement in mathematics between the Teacher Feedback Modalities (TFM) group and the non-TFM group, controlling for pretest scores. The results revealed a statistically significant difference favoring the TFM group, with a large F-value of 13.031 and a p-value of 0.001, indicating that the variance in engagement scores between the groups is unlikely due to chance. This suggests that teacher feedback had a significant effect on increasing student engagement. The TFM group had a higher mean score (3.55) compared to the non-TFM group (3.24), and an eta squared value of 0.178—classified as a large effect size—shows that 17.8% of the variance in overall engagement can be attributed to the feedback modality. These findings imply that teacher feedback significantly enhances student engagement across cognitive, behavioral, emotional, and social dimensions. The strong impact of teacher feedback likely stems from its tailored, process-oriented nature, as supported by Hattie and Timperley (2017) and Shute (2018), who emphasized that specific, actionable feedback improves motivation and learning involvement. In contrast, non-teacher feedback may still support engagement but appears less effective in promoting holistic involvement. Studies by Bayat, *et al*. (2022) and Noroozi, *et al*. (2022) affirm the role of peer feedback, but the current findings suggest that teacher guidance remains the most influential. Thus, the results strongly advocate for enhancing and prioritizing teacher feedback practices to foster deeper and more comprehensive student engagement in mathematics learning.

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Table 6: Analysis of Covariance (ANCOVA) of Students Performance in Mathematics in Posttest Scores

Group	N	MEAN	SD
TFM	33	21.36	3.872
NTFM	30	16.47	3.776
TOTAL	63	19.03	4.526

SOURCE	SS	Df	MS	F-value	Sig	Eta Squared
GROUP	183.485	1	183.485	20.595	0.000**	.256
PRETEST Covariate	358.555	1	358.555	42.170	0.000**	.413
Error	534.548	60				
Total	24089.000	63				

Note **-significant at 0.05 level

The table 6 presents an ANCOVA comparison of students' post-test mathematics performance between the Teacher Feedback Modalities (TFM) and non-TFM groups, controlling for pretest scores (Presentation). The analysis revealed a statistically significant difference favoring the TFM group, with an F-value of 20.595 and a p-value of 0.000, indicating that the type of feedback significantly influenced post-test performance (Analysis). The TFM group had a higher mean score (21.36) than the non-TFM group (16.47), and the eta squared value of .256—considered a large effect size—shows that 25.6% of the variance in post-test scores was due to the feedback modality. These findings imply that teacher feedback has a substantial and meaningful positive impact on students' mathematics achievement, likely due to its expert-driven, personalized, and growth-oriented nature (Interpretation/Implication). This is further supported by studies such as those by Howard and Lee (2023), Hattie and Timperley (2007), and Rakoczy, *et al*. (2019), which highlight that descriptive, timely, and process-focused teacher feedback enhances motivation, deepens understanding, and improves learning outcomes. Assumptions of normality and homogeneity of variances were met, strengthening the validity of the results. Overall, the data and supporting literature emphasize the crucial role of teacher feedback in boosting math performance, suggesting that educational efforts should prioritize professional development in effective feedback strategies to maximize student achievement.

Table 7: Analysis of Covariance (ANCOVA) of Students Performance in Mathematics in Retention Scores

Group	N	MEAN	SD
TFM	33	28.85	3.667
NTFM	30	20.00	4.969
TOTAL	63	24.63	6.191

SOURCE	SS	Df	MS	F-value	Sig	Eta Squared
GROUP	969.927	1	969.927	55.254	0.000**	.479
PRETEST Covariate	92.998	1	92.998	5.298	0.025**	.081
Error	1053.245	60				
Total	40610.000	63				

Note **-significant at 0.05 level

Table presents a comparison of students' performance on a mathematics retention test between the Teacher Feedback Modalities (TFM) group and the non-TFM group, using ANCOVA to control for pretest differences (Presentation). The results showed a highly significant difference favoring the TFM group, with a very large F-value of 55.254 and a p-value of 0.000, indicating a strong statistical effect of teacher feedback on long-term retention (Analysis). The TFM group had a substantially higher mean score (28.85) than the non-TFM group (20.00), and an eta squared value of .479—considered a very large effect size—revealed that 47.9% of the variance in retention scores was due to the feedback type. This suggests that teacher feedback not only boosts short-term performance but also supports deeper understanding and long-lasting retention of mathematical concepts (Interpretation/Implication). Although a minor violation of normality was noted in the TFM group, ANCOVA's robustness and the strength of the results reinforce the reliability of the findings. Supporting studies, such as those by Guo, *et al*. (2014), Nicol & Macfarlane-Dick (2016), and Howard & Lee (2023), confirm that teacher feedback enhances cognitive engagement, fosters self-regulation, and boosts motivation—key factors in retention. The data strongly indicate that consistent, encouraging, and targeted teacher feedback fosters enduring learning by promoting internalization and recall of mathematical ideas, making it essential for long-term academic success in mathematics.

CONCLUSION AND RECOMMENDATION

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The Grade 9 students who were exposed to teachers' feedbacking modalities showed notable improvements across cognitive, behavioral, emotional, and social dimensions of engagement in mathematics. While both groups experienced some level of engagement, the teacher-driven feedback intervention had a significantly stronger positive impact, particularly in enhancing students' critical thinking (cognitive), active participation (behavioral), motivation and confidence (emotional), and sense of belonging within the classroom (social), compared to those who were not exposed to the intervention.

In addition, the intervention had a substantial effect on student performance in mathematics for both the TFM and NTFM groups across pretest, posttest, and retention stages. The TFM group showed significant improvement, with a large percentage of students advancing to a higher performance category and maintaining strong retention of learning gains. In contrast, the NTFM group demonstrated some improvement, but their performance was not as dramatic, and their retention of learning gains was weaker compared to the TFM group.

Furthermore, it found that TFM significantly improved students' cognitive and behavioral engagement, highlighting the positive impact of teacher-driven feedback. However, there was no significant difference between the two groups in terms of emotional and social engagement. This suggests that while teacher feedback boosts cognitive involvement and active participation, it has a similar effect to non-teacher feedback on students' emotional and social engagement.

The analysis shows a clear difference in math performance between students who received Teacher Feedback Modalities (TFM) and those who did not (NTFM). Students in the TFM group scored significantly higher on both post-tests and retention tests, even after accounting for prior performance differences. This indicates that teacher feedback has a strong and positive effect on improving students' math outcomes.

Based on the results of the study, the following are the recommendations:

Parents can support teacher feedback by promoting a growth mindset at home and encouraging children to view feedback as an opportunity to improve. Open communication with teachers also helps reinforce classroom strategies, boosting students' confidence, motivation, and performance in math.

Policymakers should integrate structured feedback training into teacher development and curricula, regularly assess its effectiveness, and support evidence-based, collaborative teaching to improve student achievement.

Researchers should study how feedback affects engagement in diverse learners, while curriculum developers should embed structured feedback to enhance thinking and participation. Alternative strategies are needed to improve emotional and social engagement for a well-rounded approach.

Assessment specialists should integrate teacher feedback into assessment strategies to boost learning outcomes. Studying the best timing, structure, and delivery methods can enhance performance and retention, while further research on long-term effects will help refine feedback-based assessments for sustained student growth.

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