

Journal Writing: Effects on Students' Academic Performance and Attitude towards Mathematics in Modular Distance Learning

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Abstract Students are able to elaborate and reflect on their learning if they are given the opportunity to write them down in a journal. This study assessed the effects of Journal Writing Approach on Grade 10 Students' Academic Performance and Attitude in Mathematics. It aimed to (a) describe the level of performance of students when exposed to modular learning and those exposed to modular learning with journal writing; (b) find the level of students' attitude towards Mathematics when exposed to modular learning and those exposed to modular learning with journal writing; (c) identify the significant difference of students' performance between pretest scores and posttest scores when exposed to modular learning and those exposed to modular learning with journal writing; and (d) evaluate the significant difference of students' attitude in terms of pretest scores and posttest scores when exposed to modular learning and those exposed to modular learning with journal writing. A quasi-experimental research design was utilized in this investigation. Results showed that academic performance of both groups during the pretest were very low, and during the posttest, students exposed to Journal Writing Approach showed higher increase in post test scores. The level of students' attitude towards Mathematics for both exposed to Journal Writing Approach and without it was neutral. The group exposed to Journal Writing Approach has improved their academic performance based on the mean scores from a negative attitude in the pretest to a positive result during the posttest. But the students exposed to modular learning only remained undecided. More so, there is a significant difference on students' academic performance and attitude in Mathematics when exposed to modular learning and those exposed to modular learning with journal writing in favor of the latter. Hence, journal writing has shown positive effects in improving students' academic performance and attitude in Mathematics.

Keywords: academic performance, attitude, mathematics, journal writing approach, modular distance learning

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1. Introduction

Mathematics has been one of the major subjects in the curriculum. It is a tool and a language of almost all fields of sciences. It helps us recognize patterns and understand the world around us, yet many students in elementary, high school and even at the university level find mathematics difficult because it is an abstract discipline. Most of the students today experienced difficulty in learning Mathematics and feel that Mathematics is not an interesting subject to learn with. They just simply think that it is a subject required by the curriculum to finish a degree program or certificate or diploma and neglected to understand its significance to everybody's life and to the society.

Students' performance towards Mathematics was shown in the National Achievement Test (NAT) in 2019 which has low proficiency levels especially in Science, Math and English. The Programme for International Student Assessment

(PISA) of the Organization for Economic Cooperation and Development (OECD) showed that Filipino learners placed last among 79 participating countries and near last in Science, and Mathematics [1]. Also, from the study conducted by the Trends in International Mathematics and Science Study (TIMSS) in 2019, it revealed that Philippines scored significantly lower than any country that participated in Math and Science assessments [2]. In Malibud National High School under the Gingoog City Division, students have the Mean Percentage Score (MPS) of 32.67 in Mathematics which is interpreted as low performance.

From these poor results of Mathematics assessment, Filipino learners had already a glaring difficulty in understanding the subject, and it became more challenging for the to catch up learning the subject when the pandemic came in 2020 [3]. Classes were on risk and put on hold but according to the DepEd Secretary, education must still go on even during these times. So, the Department of Education proposed to still continue the academic year utilizing Distance Learning Modalities.

The Department of Education (DepEd) provides Self-Learning Modules (SLMs) with an alternative learning delivery modalities to be offered for various types of learners across the Philippines. DepEd ensures that all learners have access to quality basic education for S.Y. 2020-2021 with face-to-face classes still prohibited due to the public health situation [4].

Distant Learning Modality is the most efficient way to still deliver education especially on remote areas. Moreover, Dange and Sumaog emphasize the prevailing challenges of learners in the resources, preparedness, and communication in Modular Approach [5]. At some point, the implementation of Modular Distance Learning has disadvantages such as the direct influence of the teacher on the student is completely eliminated, the value of the teacher's personal example is reduced, and the possibility of transmitting academic ethics and learning traditions disappears [6].

With the limited interaction with students, journal writing is a good substitute for the teachers inability to assess students' performance [7]. It increases communication between students and teachers [8]. Students in journal writing allows them to be responsible for their own learning [9]. Communication through journaling is the capability of the students to explain or justify action in procedure and process. With this, students can have independent learning while they are away from their teachers. This helps the students evaluate themselves. And it enables to detect student misunderstanding in a deeper level than just giving up worksheets [10]. Consequently, it helps students think about the encountered math problem and analyzing how they can solve it [11].

One principle espoused by the National Council of Teachers of Mathematics state that students must learn Mathematics with understanding, actively building new knowledge from experience and prior knowledge [12]. Communication skills are important in the formation of cognitive structures, and that language is a tool for not just representing but also transforming ideas [13]. Improving language improves problem-solving skills, and that activating language habits that the child had mastered can help them perform better. Vygotsky (1978) stated that language is the most significant symbolic system for learning. Language, in any form, such as writing a journal, promotes cognitive development and that when students are involved their behavior and thinking are guided by it. Research findings supported Piaget's Stages of Cognitive Development that says learners construct knowledge rather than passively take information [14,15,16]. Engaging students in activities and reflecting to those activities through writing can aid learning and discovery [17].

In working on recovering students' performance in Distance Learning, the impact of their behavior and attitude in the new normal perspectives in their learning process has to be given much attention [18]. The behavior, and attitude of students can address the future and possible direction, several outcomes, and implication of the new normal classes and in the learning process as well. Thus, conducting studies with regards to attitude during this time is still essential. It develops the support of the new normal classes and learning perspective of students where it is vital to gain knowledge on their enhancement.

Several researchers have supported the findings that attitude has a significant influence in the student performance in Mathematics [19,20,21,22,23]. Thus, attitude of a person plays a vital role in learning Mathematics [24]. Students who are confident in their arithmetic abilities are more likely to succeed in Math, which is viewed as a desirable trait. If students lack confidence in their ability to conduct arithmetic, they are less likely to succeed, and unsuccessful behaviour is associated with negative feelings [25]. It further confirms that attitude is significant when aiming a good performance in Mathematics.

With the aforementioned findings and related studies, the researcher felt the dire need to know the effects of Journal Writing on students attitude and performance in Mathematics as this approach may aid students in their academic struggle during modular distance learning.

2. Materials and Methods

The study assessed the effects of Journal Writing Approach in Grade 10 Students' Academic Performance and Attitude in Mathematics at Malibud National High School Year 2021 - 2022. The research method that was employed in this study is the pretest-posttest quasi-experimental design using two intact classes. One class was subjected to Journal Writing Approach which was the experimental group. The other class served as the control group utilizing modular distance learning only. After the pretest, the experimental group was exposed to Journal Writing Approach while the other group was not. Then, the posttest was administered after the intervention. Analysis of quantitative data was then made.

There were two (2) instruments used to gather the data, namely, Mathematics Performance Test and Fennema-Sherman Mathematics Attitude Scale [26]. After the preliminary steps have been completed, proper protocols had been followed, then data on students' level of academic performance and attitude in Mathematics of Grade 10 students for both groups were gathered. Students in the experimental group are the students were exposed to Journal Writing Approach. Each student has a journal to write in a full sentence with free style format what they learned from their modules. The journal contained information on students' explanations or solutions of a problem being solved. The journals were collected together with their modules at the scheduled submission. While in the control group, students had their usual way of answering their modules and submitting them to the teacher during the scheduled date of submission.

The rating scale below was used to interpret students' mathematics performance:

Raw Score N = 30	Grade Scale	Qualitative Description	Interpretation
27 - 30	90% and above	Outstanding	Very High
23 - 26	85% - 89%	Very Satisfactory	High
19 - 22	80% - 84%	Satisfactory	Moderate/ Average
15 - 18	75% - 79%	Fairly Satisfactory	Low
0 - 14	74% and below	Did not meet expectation	Very Low

On the other hand, the following rating scale was used to interpret students' attitude in Mathematics:

Scale	Range	Qualitative Rating	Qualitative Interpretation
5	4.50 – 5.00	Strongly Agree	Highly Positive
4	3.50 – 4.49	Agree	Positive
3	2.50 – 3.49	Undecided	Neutral
2	1.50 – 2.49	Disagree	Negative
1	1.00 – 1.49	Strongly Disagree	Highly Negative

The Fennema-Sherman Mathematics Attitudes Scale was used to determine the attitude of students towards Mathematics. Its Cronbach's Alpha is 0.942. The 5-point rating scale which was adopted from the work of Kahveci (2010) and was used to analyze the attitudes of students towards Grade 10 Mathematics both for the experimental and control groups and is given in Table 2. The test is in Likert scale where students answered by encircling the codes under the following legend: A – strongly agree; B – agree; C – undecided; D – disagree and E – strongly disagree. Reverse scoring was applied to negative statements. The mean of each item was considered. The higher the mean, the more positive the developed attitude was given as an interpretation.

3. Results and Discussion

3.1. Mathematics Performance of the Experimental and Control Group

The Mathematics academic performance of the students exposed to Journal Writing Approach and those exposed to the modular distance learning approach only in terms of the pretest is presented in Table 4.

As shown in Table 1, 4% of the students in the Journal Writing group had low performance and 96% had very low performance in the pretest. On the other hand, 4% of the students in the control group had low performance and 96% had a very low performance in the

pretest. The overall mean score of the Journal Writing group in the pretest is 8.33 which indicates a very low performance while the control group had an overall mean score of 10.07 which also specifies a very low performance.

The result of this study shows that both groups had a very low level of performance in the pretest which implies that students in both groups have little or no prior knowledge of the concepts before the conduct of the experiment. It also shows that students have very low performance before the conduct of the study. The said result coincides to previous finding which states that students' performance in their pretest is low because of the weak foundation of topics and mathematical concepts [27]. The low mark demonstrates the students' lack of prior knowledge [27]. The result with nobody got the highest level indicates that majority of the students performed low in Mathematics in pretest [28].

Table 2 shows the Mathematics performance of the students exposed to Journal Writing Approach and the control group in terms of the posttest.

As seen in Table 2, 8% of the students in Journal Writing group had high performance, 17% had moderate performance, 13% had low performance, and 62% had a very low performance in the posttest. The overall mean is 13.67 with the total percentage of 46%.

On the other hand, 7% of the students in the control group had moderate performance and 93% had a very low performance in the posttest. The overall mean score of the Journal Writing group in the posttest is 13.67 while the control group had an overall mean score of 10.68 which both indicate very low performance.

Performance of students exposed in Journal Writing Approach has the higher increase in performance from 28% in the pretest to 46% in the posttest compared to the students in the control group, 34% in the pretest and 36% in the posttest. It coincides to the result in some studies showing a good increase in students' performance in the posttest [27,28]. Thus, integrating writing in Mathematics has the potential to increase and improve students' mathematics performance [9,29,30].

Table 1. Students' academic performance in Mathematics between two groups in terms of pretest

Range N = 30	Journal Writing Approach (Experimental Group)			Modular Learning (control)		
	F	%	Interpretation	f	%	Interpretation
27-30	0	0%	Very High	0	0%	Very High
23-26	0	0%	High	0	0%	High
19-22	0	0%	Moderate	0	0%	Moderate
15-18	1	4%	Low	1	4%	Low
0-14	23	96%	Very Low	27	96%	Very Low
Total	24	100%		28	100%	
	Mean: 8.33			Mean: 10.07		
Total Percentage Score: 28%			Very Low	Total Percentage Score: 34%		

Table 2. Students' academic performance in Mathematics between two groups in terms of posttest

Range N = 30	Journal Writing Approach Group			Control Group		
	f	%	Interpretation	f	%	Interpretation
27-30	0	0%	Very High	0	0%	Very High
23-26	2	8%	High	0	0%	High
19-22	4	17%	Moderate	0	0%	Moderate
15-18	3	13%	Low	2	7%	Low
0-14	15	62%	Very Low	26	93%	Very Low
Total	24	100%		28	100%	
	Mean: 13.67			Mean: 10.68		
Total Percentage Score: 46%			Very Low	Total Percentage Score: 36%		

3.2. Students' Attitude in Mathematics before and after the Intervention

Table 3 shows the Students' Attitude in Mathematics between the Journal Writing group and the control group before and after the intervention period. Students' attitude towards Mathematics in Journal Writing group had an overall mean of 3.5 in posttest which is interpreted as positive from 3.3 in pretest which means neutral. It implies further that their attitude towards Mathematics is pleasant. The highest indicators described —*strongly agree* which means highly positive is “I am sure I can do math” (4.52).

And next highest mean in the experimental group – “Knowing mathematics will help me earn a living” (4.28) and “I’ll need math for my future work” (4.42) were *positive*. The following were the least indicators – “I don’t think I can do advance math” (2.84), “Getting a teacher to talk to me seriously in math is a problem” (2.88), and “It’s hard to believe a female could be a genius in mathematics” (2.82) which all interpreted as *negative*. This result shows that students in experimental group saw the importance and essentiality of Mathematics in living than the control group. Also, they have the sense of equality when it comes to math and liked their mathematics teacher as well.

Table 3. Students' Attitude in Mathematics before and after intervention

Attitude in Mathematics	Journal Writing Approach				Control Group			
	Before		After		Before		After	
	Mean	Interpretation	Mean	Interpretation	Mean	Interpretation	Mean	Interpretation
I am sure that I can learn math.	3.7	P	4.52	HP	4.09	P	4.18	P
My teacher have been interested in my progress in math.	3.78	P	3.84	P	4.06	P	3.88	P
Knowing mathematics will help me earn a living.	3.52	P	4.28	P	3.21	U	3.82	P
I don't think I could do advanced math.	2.89	U	2.84	U	3.24	U	2.7	U
Math will not be important to me in my life's work.	3.48	U	3.8	P	4.06	P	3.18	P
Males are not naturally better than females on math.	3.22	U	3.28	U	2.9	U	2.9	U
Getting a teacher to take me seriously in math is problem.	2.81	U	2.88	U	2.94	U	2.64	U
Math is hard for me.	2.81	U	3.4	U	2.21	N	2.4	N
It's hard to believe a female could be a genius in mathematics.	3	U	2.8	N	2.81	U	2.64	U
I'll need mathematics for my future work.	4.11	P	4.4	P	3.73	P	3.73	P
When a woman has to solve a math problem, she should ask a man for help.	3	P	2.88	U	2.4	N	2.48	N
I am sure of myself when I do math.	3.7	P	3.8	P	3.7	P	3.76	P
I don't expect to use much math when I get out of school.	2.48	U	3.36	U	2.88	U	2.73	U
I would talk to my math teachers about a career that uses math.	3.03	U	3.52	P	2.24	N	3.36	U
Women can do just as well as men in math.	2.89	U	3.44	U	2.09	N	2.48	N
It's hard to get math teachers to respect me.	2.26	N	3.12	U	1.84	N	2.88	U
Math is a worthwhile, necessary subject.	3.56	P	3.92	P	3.7	P	3.64	P
I would have more faith in the answer for a math problem solved by a man than a woman.	2.52	U	2.92	U	2.58	U	2.51	U
I'm not the type to do well in math.	3.19	U	3.2	U	2.79	U	2.58	U
My teachers have encouraged me to study more math.	3.93	P	3.84	P	3.61	P	3.33	U
Taking math is a waste of time.	3.44	P	3.72	P	3.33	U	3	U
I have a hard time getting teachers to talk seriously with me about math.	2.26	N	2.92	U	2.33	N	2.45	N
Math has been my worst subject.	2.7	U	3.28	U	2.48	N	2.58	U
Women who enjoy studying math are a little strange.	2.89	U	3.12	U	3	U	2.54	U
I think I could handle more difficult math.	3.37	U	3.52	P	2.93	U	3.27	U
My teachers think advanced math will be a waste of time for me.	3.63	P	3.32	U	3.15	U	2.7	N
I will use mathematics in many ways as an adult.	3.52	P	4	P	3.64	P	3.55	P
Females are as good as males in geometry.	3.26	U	3.72	P	3.12	U	3	U
I see mathematics as something I won't use very often when I get out High School.	2.63	U	3.4	U	2.64	U	2.61	U
I feel that math teachers ignore me when I try to talk about something serious.	3.26	U	3.4	U	3.24	U	2.79	U
Women certainly are smart enough to do well in Math.	3.3	U	3.24	U	3.21	U	3.33	U
Most subjects I can handle OK, but I just can't do good job with math.	2.33	N	3.24	N	2.42	N	2.12	N
I can get good grades in math.	3.59	P	3.52	P	3.15	U	3.58	P
I'll need a good understanding of math for my future work.	4.19	P	3.96	P	3.58	P	3.48	U
My teachers want me to take all the math I can.	3.7	P	3.88	P	3.27	U	3.55	P
I would expect a woman mathematician to be a forceful type of person.	2.7	U	2.92	U	2.48	N	2.39	N
I know I can do well in math.	3.7	P	3.96	P	3.76	P	3.72	P
Studying math is just as good for women as for men.	3.7	P	3.4	U	3.09	U	3.12	U
Doing well in math is not important for my future.	3.85	P	3.12	U	3.15	U	2.64	U
My teachers would not take me seriously if I told them I was interested in a career in science and mathematics.	3.26	U	2.92	U	3.18	U	2.7	U
I am sure I could do advanced work in math.	3.7	P	3.84	P	3.55	P	3.48	U
Math is not important for my life.	4.07	P	3.4	U	3.79	P	3.24	U
I'm no good in math.	3.07	U	3.12	U	2.79	U	2.79	U
I study math because I know how useful it is.	3.89	P	4	P	4.12	P	3.55	P
Math teachers have made me feel I have the ability to go in mathematics.	3.93	P	3.8	P	3.64	P	3.36	U
I would trust a female just as much as I would trust a male to solve important math problems.	3.74	P	4	P	3.45	U	3.51	P
My teachers think I'm the kind of person who could do well in math.	3.33	U	3.92	P	3.7	P	3.85	P
Overall Mean	3.3	U	3.5	P	3.13	U	3.08	U

The following three indicators have the highest mean described —agree which means positive. I am sure that I can learn math (4.18), My teacher have been interested in my progress in math (3.88), and “Knowing mathematics will help me earn a living” (3.82). The least indicators described disagree which means negative – “Most subjects I can handle OK, but I just can’t do good job with math” (2.12), I have a hard time getting teachers to talk seriously with me about math (2.45), and “Math is hard for me” (2.4). Moreover, the overall mean of the control group decreases from 3.13 in pretest to 3.08 in posttest which is interpreted as neutral.

The students’ overall mean – neutral is similar to the result of a study [31]. It implies further that students were uncertain or undecided with their attitude towards Mathematics.

As observed in the result, students have appreciation towards their teacher and find the essence of Mathematics in living which contradicts to some finding [32] stating that students find hard in figuring out the beauty of it. Similarly, majority of the students consider and find the usefulness of Mathematics [33]. Relevance and worth is the most answered response of students. Getting a good teacher to talk seriously in Mathematics, and the subject is not hard for most of the students, affirm the findings that teachers and social support have impact on students’ attitudes towards Mathematics [34].

Table 4. Comparison of students’ academic performance between groups

GROUP		N	Mean	SD
Journal Writing Approach		24	13.6	6.17
Control Group		28	10.6	2.58

SOURCE	SS	Df	MS	F-value	P-value
GROUP	136.23	1	136.23	6.44	0.01
Pretest (Covariate)	22.08	1	22.08	1.04	0.31
Error	1035.35	49	21.13		
Total	8733	52			

*significance at $\alpha > 0.05$.

The mean posttest score of the Journal Writing group in terms of academic performance is 13.6 with a standard deviation of 6.17 while the control group has a mean score of 10.6 with a standard deviation of 2.58. As seen in the table, the F-value is 6.44 and the p-value is 0.01 implying that there is a significant difference in the academic performance between the two (2) groups in favor of the experimental group.

Thus, the null hypothesis stating that there is no significant difference between the attitude of the students in Mathematics when exposed to Journal Writing Approach and those exposed to modular distance learning only is rejected. Furthermore, students exposed to Journal Writing Approach have a better performance compared to students exposed to Non-Journal Writing Approach [9,33,35]. Respondents benefited in using journal writing in the mathematics class. It helped them communicate with their mathematics teacher and utilize mathematical tools, symbols and number [28]. There is a merit in implementing journal writing [36]. And integrating writing in Mathematics increases students’ mathematics performance [29].

Table 5 presents the comparison of attitude of students who were exposed to two varied interventions.

Table 5. Comparison of students’ attitude between groups

GROUP	N	Mean	SD
Journal Writing Approach	24	3.65	0.38
Control Group	31	3.24	0.27
Total	55	3.42	0.38

SOURCE	SS	Df	MS	F-value	P-value
GROUP	1.534	1	1.53	25.60	0.00*
Pretest (Covariate)	2.46	1	2.46	41.06	0.00
Error	3.11	52	0.06		
Total	649.4	55			

*significance at $\alpha > 0.05$.

The mean posttest score of the Journal Writing group in terms of attitude is 3.65 with a standard deviation of 0.38 while the control group has a mean score of 3.24 with a standard deviation of 0.27. As seen in the table, the F-value is 25.60 and the p-value is 0.00 implies that there is a significant difference in the attitude between the two (2) groups in favor of the experimental group.

Thus, the null hypothesis, stating that there is no significant difference between the attitude of students exposed to different approaches is rejected.

Students who are exposed to journal writing perform better than those in the control group [37]. Mathematics communication in writing is effective in producing a positive attitude towards mathematics [30,38].

4. Conclusions and Recommendations

Based on the results, the following conclusions were drawn:

The level of students’ academic performance when exposed to the Journal Writing Approach and those exposed to modular distance learning only is both very low. The mean score of the group exposed to Journal Writing Approach has increased from the pretest to posttest while students in the control group remains to have very low academic performance.

The level of students’ attitude towards Mathematics when exposed to Journal Writing Approach and those exposed to modular learning only during the pretest is both neutral and undecided. The mean score of the group exposed to Journal Writing Approach has improved from the pretest to posttest with qualitative rating of positive from neutral or undecided. On the other hand, students exposed to modular learning only remains neutral or undecided on their attitude towards Mathematics.

Both groups have very low performance in Mathematics in the pretest and posttest. Students exposed to Journal Writing Approach has a higher increase in performance than those in the control group. There is a significant difference between the academic performance of the students exposed to varied approaches in favor of those exposed to Journal Writing Approach.

Both groups have neutral or undecided attitude towards Mathematics in the pretest. Students exposed to Journal Writing Approach obtained positive attitude in the posttest while students in the other group remains neutral. There is

a significant difference between the attitude of the students in Mathematics when exposed to different approaches in favor of the Journal Writing group.

Teachers are encouraged to use Journal Writing Approach in teaching Mathematics in the secondary level. It is observed that this approach has the potential to improve students' academic performance and attitude towards Mathematics. It is also suggested that this approach will be used in a longer time period for better results. Also, teachers are encouraged to have the journals checked and return as often as needed for feedbacking and monitoring purposes. Parents and teachers are invigorated to support and monitor students' progress in school by reading the entries of their journal, if available. Lastly, researchers may consider replicating this study using different topics in Mathematics and other psychosocial variables.

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