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MATHDALI INTERVENTION PROGRAM AND ITS EFFECTIVENESS ON THE MATHEMATICS PERFORMANCE OF GRADE 4 STUDENTS

Willam DC. Enrique, PhD and *Maria N. Cusipag, PhD*
willamenrique@baliuagu.edu.ph; mariacusipag@yahoo.com

Abstract

Mastery of concepts in mathematics is essential for the Filipino 21st century learners. The Philippines, having ranked second lowest in the results of the educational achievement test administered through the Program for International Student Assessment (PISA) in 2018, it is but necessary that research studies be conducted to find out how mathematics could be taught to enhance learners' skills in mathematics. Thus, this study made use of an intervention called *Mathdali Intervention Program (MIP)* which makes use of videos and games presented by the teacher thru tablets in her interactive classroom discussions. The participants were two classes in grade four from the Baliuag University Basic Education Department. Using the quantitative research design, it was revealed that the students improved in their mathematics performance in all the four quarterly exams administered during the school year. Their attitudes toward mathematics improved, and they perceived the intervention program as very effective. Themes gathered from the interviews include (1) usefulness of mathematics in one's daily life, (2) motivation in learning and teaching mathematics, (3) ease in understanding mathematics, (4) improvement in math performance, (5) teaching mathematics as a learning experience, (6) training as beneficial for math teachers, and (7) Mathdali Intervention Program to be continued in the classroom. The program has been strongly recommended by the teacher and the learners having been proven effective in their mathematics classes.

Keywords: Mathdali Intervention Program, Program for International Student Assessment, 21st century learners, interactive classroom discussions

Mathematics has become a necessity for people of all ages to be successful in life. It has gained more attention with the rapid advances of information and communication. It has been considered as the mother of all learning in both arts and sciences (Andaya, 2014). It is essential in almost every field like measurement in sizes, angles in sports stroke, technology, and economics. It is not just a tool for computation but a means for understanding structures, relationships, and patterns to produce solutions for complex real-life problems.

Moreover, the trends nowadays are interactive and more visual class discussion compared to the traditional way of teaching mathematics. However, although the usefulness of mathematics has been proven in daily life, there are factors that adversely affect the students' ability to understand and apply mathematical concepts.

The Philippines, having ranked second lowest in mathematics in the results of the educational achievement test administered through the Program for International Student Assessment (PISA) in 2018, has to do something about enhancing the teaching of mathematics. As Filipino learners move on to the ASEAN integration, providing mastery of concepts in mathematics is essential. Calma, as quoted by Hallare (2020), stressed, "Subjects like mathematics and the sciences involve an understanding of processes, and they need to be visually illustrated for kids to understand…." Thus, the *MathDali Research Project,* funded by Knowledge Channel Foundation, Incorporated (KCFI), has been conceived. It involves an intervention through videos and games presented through tablets. Creating an impact on the new learning design, *MathDali Intervention Program* can be a contributing factor in addressing and attaining the K to 12 curriculum implementation.

KCFI is an educational transmedia corporation that aims to contribute to the government's goal of alleviating poverty through education. For the past seventeen years, KCFI has provided learners with access to "multimedia learning materials on air through K-Channel television, online through KCh, and on-demand through KCh Portable Media Library" ("Knowledge Channel," n.d., par. 2). As a foundation that aims to provide holistic and systemic programs, it trains teachers on teaching pedagogies and methods. It likewise arms principals with additional skills through its leadership enhancement programs. It continues to form partnerships with generous donors and universities, schools, and other organizations who share the same vision of an educated Philippines.

Given its years of experience in the field of education, KCFI is no stranger to the challenges besetting the educational system of the country. As a transmedia company, it strives to tell the story of each and every curious Filipino student who is hungry for knowledge, thirsting for additional skills, perfectly absorbent for a change in attitudes, and openly accepting of positive values. By allowing students to access the learning materials provided by the foundation, KCFI journeys with its Filipino students who are willing to gain more knowledge, skills, values, and attitudes that help them in achieving their dream of success.

Theoretical Framework

Carol Dweck (2006) believes that developing a love for learning, an interest for challenges, and an ability to thrive on obstacles are the key factors to succeeding in life. Dweck refers to these as "characteristics of an individual who

adheres to a growth mindset as opposed to a fixed mindset." Individuals with a growth mindset are not afraid to make mistakes and consider failures as opportunities for learning. They are resilient and they believe that success requires much effort with learning.

Similarly, by borrowing heavily from Carol Dweck's principles, Jo Boaler (2015) believes that consistent effort with learning and the resilience to learn from mistakes and failures are the keys to developing a math mindset. Believing that there is no such thing as a math brain, Boaler espouses that no person is born being innately good or innately bad at math. Due to the brain's plasticity, new neural connections are formed every time a new learning is discovered by a person and every time a mistake is committed and reviewed. It is this continuous physiological growth of neural connections that becomes the key to developing a growth mindset.

Statement of the Problem

The general objective of the study is to determine the effectiveness of the Mathdali intervention program in increasing the mathematical performance of the learners. Specifically, it aims to answer the following questions:

1. Is there a significant difference in the performance of Grade 4 students from pretest to posttest after the implementation of the Mathdali intervention program?

2. How may the *mathtitudes* of grade four math learners be described?

3. How is the Mathdali intervention program perceived by the learners and their teacher?

Method

Research Design and Analysis of Data

The research design of the study used both the quantitative and the qualitative methods. For the *quantitative method*, an experimental study was conducted using two classes of grade four students. The two classes were given the following intervention strategy: the use of MathDali videos, and games thru the use of a tablet. Prior to the intervention, the teacher was given a special training on how to use the tablet as her teaching device. Data were collected using validated tests in mathematics, Grade 4 level, to determine the performance of the students. Analysis of the data was done through the use of SPSS. For the *qualitative method,* a formal interview of the participants was conducted through focus group discussion (FGD). In addition, monitoring of classes was done through field observations.

Participants

The student respondents came from the Baliuag University Basic Education Department which is located along Gil Carlos St., Baliwag, Bulacan. Two classes in grade four were identified as participants in this study.

The teacher who handled the two classes is a grade school faculty of Baliuag University Basic Education Department. She is a graduate of Bachelor of Elementary Education. She has not majored in mathematics; nevertheless, she has been a teacher in mathematics for 15 years. She has attended seminars/ trainings in mathematics to enrich and update her knowledge in teaching the subject. She believes in student-centered learning, and she makes use of classroom activities like brainstorming, games, role plays, small-group discussions, and other activities which are inquiry-based or project-based. The training she had with KCFI all the more equipped her with the necessary techniques in using education technologies, particularly in the use of tablets, videos and games in her classes.

Instruments

1. Validated math tests from the division office of Bulacan were used.

2. Survey questionnaires composed of twenty items were given to the respondents regarding their attitudes toward mathematics (*mathtitudes*) before and after the intervention period aside from another questionnaire on the use of the tablet device. Another set of questionnaires was given composed of 13 items regarding their per formance using the tablet device.

3. Seven interview questions were likewise given to the learners and another seven to their teacher regarding their perceptions of the intervention program that they experienced.

Results and Discussion

SOP1. Is there a significant difference in the performance of Grade 4 students from pretest to posttest after the implementation of the Mathdali Intervention Program ?

Table 1. Individual scores of the students during the first quarter

Range	Equi-valent	SECTION A				SECTION B				
		Pretest		Posttest		Pretest		Posttest		
		F	*E*	*F*	*E*	*F*	*E*	*F*	*E*	
28-34	5	-	-	7	35	1	5	5	25	
21-27	4	8	32	7	28	6	24	9	36	
14-20	3	13	39	7	21	11	33	8	24	
8-13	2	1	2	1	2	4	8	-	-	
0-7	1	-	-	-	-	-	-	-	-	
		Total	73	Total	86	Total	70	Total	85	
		WM	3.32	*WM*	3.90 (+.58)	*WM*	3.18	*WM*	3.86 (+.68)	*OWM*
		VI	*P*		*AA*		*P*		*AA*	3.57
		WM		3.61	*AA*			3.52	*AA*	*(AA)*

Legend: F – Frequency; *B* – Beginning (1.00 – 1.80); *E* – Equivalent; *WM* – Weighted Mean; *VI* – Verbal Interpretation; *OWM* - Overall Weighted Mean; *AP* – Approaching Proficiency (1.81 – 2.40); *P* – Proficiency (2.41 – 3.60); *AA* – Approaching Advanced (3.61 – 4.20); A – Advanced (4.20 – 5.00).

Table 1 presents the results obtained from the preliminary analysis of individual scores of the students during the first quarter in mathematics. It was revealed that there is a significant increase in the performance of Grade 4 students in the combined data from pretest (*WM*=3.61 or Approaching Advanced) to posttest (*WM*=3.62 or Approaching Advanced) of the two sections, while 3.57 *(AA)* is the overall weighted mean for this quarter. This means that the intervention program (Mathdali videos and games) significantly helped the students to improve their performance in the mathematics subject.

Table 2. Comparison of the pretest and posttest scores of the students in sections A and B during the first quarter

Paired Samples Test

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Pair 1 First Quarter Pretest SecA - First Quarter Pretest SecB	-1.529	2.513	.431	-2.406	-.652	-3.548	21	.001
Pair 2 First Quarter Posttest SecA - First Quarter Posttest SecB	.824	4.079	.699	-.600	2.247	1.177	21	.247

continued

Table 2. continuation

Paired Samples Statistics					
		Mean	*N*	Std. Deviation	Std. Error Mean
Pair 1	First Quarter Pretest SecA	8.29	22	5.078	.871
	First Quarter Pretest SecB	9.82	22	5.208	.893
Pair 2	First Quarter Posttest SecA	10.41	22	4.540	.779
	First Quarter Posttest SecB	9.59	22	5.106	.876

Table 2 provides the comparison of the pretest and posttest scores of the students in Sections A and B during the first quarter. The results from the paired samples *t-test* shows sufficient evidence that the posttest scores (M=2.04545, SD=11.76333) are significantly higher than their pretest (M= -1.529, SD=2.513), since the computed t (21) = .001 (pre) and .247 (post) are greater than p>0.05. The 95% confidence interval for this paired difference shows that on the average, the posttest exceeds the pretest scores by at least -.600 to 2.247. This means that there is an increase in the scores and performance of the students who took the posttests.

Table 3. Difficulty of items during the first quarter

Summary	**Section A**		**Section B**	
	Pretest	Posttest	Pretest	Posttest
Total	14.99	18.73	14.91	18.2
GWA	0.44	0.55	0.43	0.53
V.I.	*A*	*A*	*A*	*A*
Com		0.50 *A*		0.48 *A*
OCom		0.49 *(A)*		

Legend: D.I. – Difficulty Index ; *VD*–Very Difficult (0.00 – 0.20); *D* – Difficult (0.21 – 0.40); *A* – Average (0.41 – 0.60); *E* – Easy (0.61 – 0.80); *VE* – Very Easy (0.81 – 1.00); *VI* –Verbal Interpretation; *GWA* – General Weighted Average; *Com*- Combined Scores; *OCom*- Overall Combined Scores

Table 3 shows the results obtained from the analysis of the difficulty index of items during the first quarter. It was noted that there is a significant improvement on the performance of Grade 4 students for both sections A (0.50) and B (0.48). The overall combined results showed that there is an equal representation of the two sections (0.49) on the difficulty index from the items included in the tests. This means that after taking the pretest and having implemented the intervention program (Mathdali videos and games), an increase in knowledge and improvement in the performance in mathematics posttest had been exhibited by the students.

Table 4. individual scores of the students during the second quarter

		SECTION A				**SECTION B**				
Range	**Equi-valent**	Pretest		Posttest		Pretest		Posttest		
		F	*E*	*F*	*E*	*F*	*E*	*F*	*E*	
41 – 50	5	-	-	3	15	-	-	4	20	
31 – 40	4	-	-	7	28	15	60	5	20	
21 – 30	3	16	48	12	36	6	18	13	39	
11 – 20	2	5	10	-	-	1	2	-	-	
0 – 10	1	1	1	-	-	-	-	-	-	
		Total	59	Total	79	Total	80	Total	79	
		WM	2.68	*WM*	3.59	*WM*	3.63	*WM*	3.59	*OWM* 3.38
		VI	*P*		*P*		*AA*		*P*	*(P)*
		WM		3.14	*P*			3.61	*AA*	

Table 4 provides the results obtained from the analysis of the individual scores of the students during the second quarter in mathematics. A significant increase was observed in the performance of grade four students in the combined data from pretest (*WM* =3.14 or Proficiency) to posttest (*WM*=3.61 or Approaching Advanced) of the two sections, with a 3.38 *(P)* as the overall weighted mean for this quarter. This means that the implementation of the intervention program has a significant role in the improvement of the students' performance in mathematics.

Table 5. Comparison of the pretest and posttest scores of the students of sections A and B during the second quarter

Paired Samples Test

		Paired Differences					*t*	*df*	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Second Quarter Pretest SecA – Second Quarter Pretest secB	-1.13636	6.69254	1.42685	-4.10367	1.83094	-.796	21	.435
Pair 2	Second Quarter Posttest SecA – Second Quarter Posttest SecB	.68182	9.47370	2.01980	-3.51859	4.88222	.338	21	.739

Paired Samples Statistics

		Mean	*N*	Std. Deviation	Std. Error Mean
Pair 1	Second Quarter Pretest SecA	26.8636	22	4.42176	.94272
	Second Quarter Pretest secB	28.0000	22	4.97613	1.06092
Pair 2	Second Quarter Posttest SecA	32.1818	22	5.95728	1.27010
	Second Quarter Posttest SecB	31.5000	22	7.19623	1.53424

Table 5 provides the comparison of the pretest and posttest scores of the students in Sections A and B during the second quarter. The results from the paired samples *t*-test shows sufficient evidence that the posttest scores (M=0.68182, SD=9.47370) are slightly higher than their pretest (M= -1.13636, SD=6.69254), since the computed t (21) = -.796 (pre) and .338 (post) are greater than p>0.05. The 95% confidence interval for this paired difference shows that on the average, the posttest exceeds the pretest scores by at least 3.51859 to 4.88222. This means that the students' scores and performance increased in the posttest.

Table 6. Difficulty index of the items during the second quarter

Summary	Section A		Section B	
	Pretest	Posttest	Pretest	Posttest
Total	20.95	33.39	19.74	33.23
GWA	0.42	0.67	0.40	0.66
V.I	*A*	*E*	*D*	*E*
Com		0.55 *A*		0.53 *A*
OCom			0.54 *(A)*	

Table 6 shows the results obtained from the analysis of the difficulty index of the items during the second quarter. It can be noted that there is a slight significant improvement in the performance of Grade 4 students in the combined results of sections A (0.55) and B (0.53). The overall combined results shows that there is an equal representation of the two sections (0.54 or A) on the difficulty index from the items included in the tests. This means that after taking the pretest and having implemented the intervention program (Mathdali videos and games), students indeed showed positive increase in their performance in mathematics in the posttest.

Table 7. Individual scores of the students during the third quarter

Range	Equi-valent	SECTION A				SECTION B				
		Pretest		Posttest		Pretest		Posttest		
		F	*E*	*F*	*E*	*F*	*E*	*F*	*E*	
41 –50	5	-	-	4	20	-	-	2	10	
31 –40	4	4	16	9	36	1	4	5	20	
21 –30	3	8	24	6	18	3	9	9	27	
11 –20	2	10	20	1	2	15	30	6	12	
0 – 10	1	-	-	2	2	3	3	-	-	
		Total	60	Total	78	Total	46	Total	69	
		WM	2.73	*WM*	3.55	*WM*	2.09	*WM*	3.14	*OWM*
		VI	*P*		*P*		*AP*		*P*	2.88
				3.14	*P*			2.62	*P*	*(P)*

Table 7 provides the results obtained from the analysis of the individual scores of the students during the third quarter in mathematics. It is evident that there is a significant increase in the scores of Grade 4 students in the combined data from pretest (*WM*=3.14 or Proficiency) to posttest (*WM*=2.62 or Proficiency) of the two sections. It can be noted that 2.88 (*P*) is the overall weighted mean for this quarter. This means that the implementation of the intervention program has a significant role in the improvement of the students' performance in mathematics.

Table 8. Comparison of the pretest and posttest scores of sections A and B during the third quarter

Paired Samples Test

		Paired Differences					*t*	*df*	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Third Quarter Pretest SecA - Third Quarter Pretest SecB	6.27273	9.84732	2.09946	1.90667	10.63878	2.988	21	.007
Pair 2	Third Quarter Posttest SecA - Third Quarter Posttest SecB	4.77273	13.11463	2.79605	-1.04197	10.58743	1.707	21	.103

Paired Samples Statistics

		Mean	*N*	Std. Deviation	Std. Error Mean
Pair 1	Third Quarter Pretest SecA	23.0000	22	7.69044	1.63961
	Third Quarter Pretest SecB	16.7273	22	6.99103	1.49049
Pair 2	Third Quarter Posttest SecA	29.7273	22	10.04837	2.14232
	Third Quarter Posttest SecB	24.9545	22	9.31193	1.98531

Table 8 provides the comparison of the pretest and posttest scores of the students in sections A and B during the second quarter. The results from the paired samples *t*-test indicate that the third quarter scores of the two groups (sections A and B) are not statistically equal with regard to their pretest (*M*= 6.27273, *SD*=9.84732) results since the computed *p*-value is less than 0.05, but their posttest (*M*= 4.77273, *SD*=13.11463) results are statistically equal since the computed *p*-value is greater than 0.05. The difference of 6.2727 on the means of their pretest results is significant. The pretest scores of Section A is statistically higher than the pretest scores of Section B. The 95% confidence interval for this paired difference shows that on the average, the posttest exceeds the pretest scores by at least 1.04197 to 10.58743. This means that the students' scores and performance increased in the posttest.

Table 9. Difficulty of the items during the third quarter

Summary	Section A		Section B	
	Pretest	Posttest	Pretest	Posttest
Total	22.19	28.32	13.99	25.43
GWA	0.44	0.57	0.28	0.51
V.I	*A*	*A*	*D*	*A*
Com		0.51 *A*		0.40 *A*
Ocom			0.46 *(A)*	

Table 9 shows the results obtained from the analysis of the difficulty index of the items during the third quarter. It is noted that there is a slight to equal significant improvement on the performance of Grade 4 students in the combined score-results of sections A (0.51) and B (0.40). What is interesting about the data is that Section B shows a higher performance than Section A during the posttest (0.51 or A). The overall combined results show that there is an equal representation of the two sections (0.46 or A) on the difficulty index from the items included in the tests. This means that after taking the pretest and having implemented the intervention program (Mathdali videos and games), students indeed showed a positive increase in their performance in mathematics on the posttest.

Table 10. Individual scores of the students during the fourth quarter

Range	Equi-valent	SECTION A				SECTION B				
		Pretest		Posttest		Pretest		Posttest		
		F	*E*	*F*	*E*	*F*	*E*	*F*	*E*	
29-34	5	-	-	3	15	-	-	3	15	
21-28	4	9	36	13	52	3	12	15	60	
14-20	3	12	36	6	18	15	45	4	12	
8-13	2	1	2	-	-	4	8	-	-	
0-7	1	-	-	-	-	-	-	-	-	
		Total	74	Total	85	Total	65	Total	87	
		WM	3.36	*WM*	3.86	*WM*	2.95	*WM*	3.95	*OWM*
		VI	*P*		*AA*		*P*		*AA*	3.53 *(P)*
		WM		3.61	*AA*			3.45	*P*	

Table 10 provides the results obtained from the analysis of the individual scores of the students during the fourth quarter in mathematics. It was found out that there is a significant increase in the scores of Grade 4 students in the combined data from pretest (*WM*=3.61 or Proficiency) to posttest (*WM*=3.45 or Proficiency) of the two sections. Closer inspection of the table shows that Section B posttest scores (3.95) have increased compared to the pretest scores (+1.0), and that 3.53 (*P*) is the overall weighted mean obtained for this quarter. This means that the implementation of the intervention plan has a significant role in the improvement of the students' performance in mathematics.

Table 11. Comparison of the pretest and posttest scores of sections A and B during the fourth quarter

Paired Samples Test

		Paired Differences					*t*	*df*	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Fourth Quarter Pretest Number of Correct A - Fourth Quarter Pretest Number of Correct B	-.561	3.788	.592	-1.757	.635	-.948	21	.349
Pair 2	Fourth Quarter Posttest Number of Correct A - Fourth Quarter Posttest Number of Correct B	-.585	3.376	.527	-1.651	.480	-1.110	21	.274

Paired Samples Statistics

		Mean	*N*	Std. Deviation	Std. Error Mean
Pair 1	Fourth Quarter Pretest Number of Correct A	7.51	22	3.709	.579
	Fourth Quarter Pretest Number of Correct B	8.07	22	4.782	.747
Pair 2	Fourth Quarter Posttest Number of Correct A	9.00	22	3.202	.500
	Fourth Quarter Posttest Number of Correct B	9.59	22	4.123	.644

Table 11 provides the comparison of the pretest and posttest scores of the students in sections A and B during the fourth quarter. The results from the paired samples *t*-test indicate that the fourth quarter scores of the two groups (sections A and B) are not statistically equal with regard to their pretest (*M*= -.561, *SD*=3.788) results since the computed *p*-value is higher than 0.05, but their posttest (*M*= -.585, *SD*=3.376) results are statistically equal since the computed *p*-value is greater than 0.05. The difference of 0.024 on the means of their pretest results is significant. This means that the pretest scores of the students from section A is statistically higher than the pretest scores of the students from Section B.

Table 12. Difficulty index of the items during the fourth quarter

Summary	**Section A**		**Section B**	
	Pretest	Posttest	Pretest	Posttest
Total	14.03	12.51	13.84	17.84
GWA	0.34	0.31	0.34	0.43
V.I	*D*	*D*	*D*	*A*
Com	0.33 *D*		0.39 *D*	
OCom	0.36 *(D)*			

Table 12 shows the results obtained from the analysis of the difficulty index of the items during the fourth quarter. It can be noted that there is an equal significant movement on the performance of Grade 4 students in the combined score-results of sections A (0.33) and B (0.39). The overall combined results show that there is an equal representation of the two sections (0.36 or D) on the difficulty index from the items included in the tests. This means that after taking the pretest and posttest and having implemented the Mathdali videos and games, indeed students showed positive slight increase in their performance in mathematics for the last period.

SOP2. How may the mathtitudes of grade four math learners be described?

Table 13. Pre- and post-weighted mean scores of the students' mathtitudes

Mga Pahayag	Pretest		Posttest	
	WAM	*VI*	*WAM*	*VI*
1. Natataranta ako pag nakakakita ako ng math problem na mukhang mahirap.	1.66	*LHS*	2.48	*HS*
2. May kumpiyansa ako sa aking sarili pag sumasagot sa math.	3.66	*LS*	3.84	*LS*
3. Pakiramdam ko'y malikhain ako sa paghahanap ng iba't ibang paraan para mag-solve ng math.	2.89	*S*	2.84	*S*
4. Madali para sa akin ang magsolve para sa math.	2.98	*S*	3.07	*S*
5. Matataas ang mga nakukuha kong score sa math.	3.07	*S*	2.98	*S*
6. Tumataas ang antas ng katalinuhan kapag nagsusumikap ang isang tao sa math.	3.52	*LS*	3.34	*LS*
7. Maraming natutunan ang isang tao mula sa kanyang mga pagkakamali sa pag-solve ng math.	2.45	*HS*	2.52	*S*
8. Di ako titigil sa pag-solve ng isang math problem hangga't di ko nakukuha ang sagot.	3.11	*S*	3.34	*LS*
9. Kapag hindi ko ma-solve ang math problem, susuko na lang ako.	1.55	*LHS*	1.09	*LHS*
10. Kapag sinasauli ng guro ko ang mga test paper, tinitingnan ko kung saan ako nagkamali at aaralin ko kung bakit mali ang pag-solve ko.	3.34	*LS*	3.30	*LS*
11. Nag-aaral ako ng math para lamang makakuha ng mataas na grade sa exam.	3.14	*S*	3.23	*LS*
12. Nagagamit ko ang mga pinag-aralan namin sa math kahit ako'y nasa labas ng paaralan.	3.00	*S*	3.39	*LS*
13. Dahil sa math, mas mabilis na akong mag-isip at sumagot ng mga tanong.	2.93	*S*	3.20	*S*
14. Hindi ko na kailangan ang math pagkatapos kong mag-aral.	1.61	*LHS*	1.48	*LHS*
15. Ginagamit ang math sa lahat ng uri ng trabaho.	2.84	*S*	3.25	*S*
16. Natutuwa ako kapag ako'y nagsasagot ng assignment sa math.	3.18	*S*	3.57	*LS*
17. Gusto kong matututo ng iba pang mga bagay tungkol sa math.	3.43	*LS*	3.50	*LS*
18. Hindi ako interesado sa mga lesson na tinuturo sa amin sa math.	1.57	*LHS*	1.39	*LHS*
19. Ang math ang isa sa pinaka-paborito kong subject.	3.34	*LS*	3.70	*LS*
20. Gusto kong pinag-uusapan ang math kasama ang aking mga kaibigan at kaklase.	3.45	*LS*	3.41	*LS*
Weighted Mean	2.84	*S*	2.99	*S*
Overall Weighted Mean	2.92 *(S)*			

Legend: F – Frequency; *WAM* – Weighted Average Mean; *VI* –Verbal Interpretation; *LS* – Lubos na Sang-ayon (3.26 – 4.00); *S* – Sang-ayon (2.51 – 3.25); *HS* – Hindi Sang-ayon (1.76 – 2.50); *LHS* – Lubos na Hindi Sang-ayon (1.00 – 1.75); *GWA* – General Weighted Average

Paired Samples Test

Table 13 presents the results obtained from the pre- and post- weighted mean scores of the students' mathtitudes (attitudes toward mathematics). Most students expressed their mathtitudes before and after taking the survey. Overall, this area was rated 2.92 or *(S)* which is supported by the students' answers in the interview. They said that they became creative in finding ways to solve problems and get high grades in math(R3).They also said that they don't stop solving until they get the correct answer (R9). Furthermore, they said that they study hard to get high grades in the subject (R11) and to use math in every practical work (R15), even if it is not in school. They tried their best to think fast while answering mathematical questions (R15). They also expressed that they feel happy every time they answer their assignments and submit them on time (R16).

The satisfactory ratings of the students are likewise supported by the teacher's responses during the interview: "*Yes, my students became more active and participative with the use of their tablet* (Q5). Her answer gave an implication that it was difficult for her to get the motivation of her students prior to the use of the tablets and videos. When she introduced the use of these tablets, they became more interested in their lessons. Their attitude changed, and it was no longer difficult for her to get their attention. Thus, the posttest scores of the students became higher as compared to their pretest scores.

Table 14. Pre- and post-mathtitude scores of the students in sections A and B

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	*t*	*df*	**Sig. (2-tailed)**
Pair 1	Pre-and Post-Math Attitudes	-.11000	.28318	.06332	-.24253	.02253	-1.737	19	.099

Table 14 provides the comparison between the pre-and post-*Mathtitude* scores of the students in sections A and B. The results show that there is no significant effect of the treatment (use of *MathDali*) on the attitude of students since the *p*-value of 0.099 is greater than 0.05. Although the participants' attitude became somewhat better after the implementation of *MathDali*, this difference is not statistically significant. This also implies that *MathDali* does not appear to have influenced greatly the *Mathtitudes* of the students.

Table 15. Evaluation of the MathDali Gadget as perceived by grade 4 students

Statements / Items	Section A		Section B		Combined	
	WAM	*VI*	*WAM*	*VI*	*WAM*	*VI*
1. Using the tablet device during mathematics class has an added value.	4.68	*SA*	4.82	*SA*	4.75	*SA*
2. By using the tablet device, I achieve better in my mathematics class.	4.68	*SA*	4.73	*SA*	4.71	*SA*
3. By using the tablet device, it is easier for me to catch up with the math lessons.	4.82	*SA*	4.73	*SA*	4.78	*SA*
4. By using the tablet device, it is fun to learn and participate in mathematics.	4.82	*SA*	4.82	*SA*	4.82	*SA*
5. By using the tablet device, I work more collaboratively with my classmates.	4.64	*SA*	4.64	*SA*	4.64	*SA*
6. Tablet device should be introduced in every school for students to be more engaged in mathematics.	4.55	*SA*	4.68	*SA*	4.62	*SA*
7. I can learn mathematics from the tablet device without the need for print out learning materials.	4.68	*SA*	4.73	*SA*	4.71	*SA*
8. The tablet I use is useful for my everyday class in mathematics.	4.73	*SA*	4.73	*SA*	4.73	*SA*
9. The tablet device I have in learning mathematics is easy to use.	4.86	*SA*	4.82	*SA*	4.84	*SA*
10. The content in the tablet device can be easily comprehended.	4.68	*SA*	4.55	*SA*	4.62	*SA*
11. I feel confident in using my tablet device in my mathematics class.	4.77	*SA*	4.77	*SA*	4.77	*SA*
12. I feel comfortable in using the tablet device for mathematical problems.	4.82	*SA*	4.68	*SA*	4.75	*SA*
13. Mathematics becomes interesting because of the use of a tablet device.	4.86	*SA*	4.73	*SA*	4.80	*SA*
Overall *WAM*	4.74	*SA*	4.73	*SA*	4.73	*SA*

Legend: F – Frequency; *WAM* – Weighted Average Mean; *VI* –Verbal Interpretation; *SA* – Strongly Agree (4.21 – 5.00); *MA* – Mostly Agree (3.41 – 4 20); *MDA* – Mostly Disagree (2.61 – 3.40); *SDA* – Strongly Disagree (1.81 – 2.60); *NS* – Not Sure (1.00 – 1.80); *GWA* – General Weighted Average

SOP3. How is the Mathdali Intervention Program (MIP) perceived by the learners and their teacher?

Table 15 presents the results obtained from the evaluation of the MIS using a tablet as perceived by the grade four students in improving their performance and interest in math. The overall weighted mean of 4.74 *(SA)* is well supported by the interview responses of both the teacher and the students. It is noted that students from both sections strongly agreed that the *MathDali* gadget used in their subject in Math 4 really helped them to understand the lessons and exercises provided them (R1), (R2), (R3), (R7), (R9), and (R10). It was manifested in sections A (*WAM*=4.74 or *SA*) and B (*WAM*=4.73 or *SA*) that mathematics becomes an interesting subject because of the use of the tablet making the learning of mathematics easier (R3), (R4), (R9) , (R10) and (R13). They easily catch up with the math lessons (R3), and they feel comfortable in using the tablet device (R12). Moreover, they feel confident in using the tablet (R11), and they expressed the usefulness of the gadget in their everyday mathematics class (R8). They achieve better in their mathematics class (R2), they can easily comprehend their lessons (R10) , and the gadget has an added value in learning mathematics (R1) and (R8). Finally, they could work collaboratively with their classmates (R5). They strongly recommend that a tablet device be introduced in every school so that learners would be more engaged in learning mathematics (R6).

The interview from the classroom teacher gave a strong support as well to the quantitative results bearing an overall weighted mean of 4.74 (*SA*). She expressed, "*Naging madali ang pagpapaintindi sa mga bata lalo na sa mga araling kumplikado* (Q3)… *Yes, my students became more active and participative with the use of their tablet* (Q5)… and *I really noticed that my students, if not all, at least 99% enjoyed their math subject."*

Themes Derived From the Interview Results

Themes were gleaned from the responses of the learners and the teacher in the interviews which gave support to the quantitative results of the study. These are (1) usefulness of mathematics in one's daily life, (2) motivation in learning and teaching mathematics, (3) ease in understanding mathematics, (4) improvement in math performance, (5) teaching mathematics as a learning experience, (6) training as beneficial for math teachers, and (7) Mathdali Intervention Program to be continued in the classroom.

I. Grade 4 Learners

Having experienced the use of videos and games through a tablet device, the Grade 4 learners were able to express their honest feelings in the way they learned mathematics in a more sophisticated manner compared to what they traditionally had. The following questions were asked:

1. *After several months of learning mathematics using the tablet device, how do you like your subject now? Why?*

2. *Did the tablet device help you to improve in your math subject? Did it make your performance better or not and in what way?*

3. *What were your grades in your math subject? Did you get a high or low score/grade? In your opinion, why do you think did you get high or low scores?*

4. *What particular topic in math did you like best? Why? What was the most difficult for you?*

5. *Can math help you in your daily life? Will you please give an example?*

6. *Do you want to have this kind of Math Program next year for Grade 5? Why do you like it? Why not?*

7. *Do you have any recommendation or suggestion regarding the Math Program?*

Theme A. Motivation in learning mathematics through the tablet device

1. *The tablet device motivated me in learning mathematics* (See Questions1 and 4). *Math became my favorite subject* (R1A and R11A).

2. *I had fun answering the exercises* (R5A, R5B, R8A, R10A, and R11A).

3. *I enjoyed the activities* (R17A, R13B).

4. 4. *I got interested in answering topics in addition* (R1B, R11B, R12B, R20B). *However, division was most difficult, as well as fractions and computation for areas* (R11B, R3A, R9A, and R10A).

The theme on motivation was reflected when the students responded to Question No. 1.Since the students enjoyed the activities, it implies that they were more engaged in their math activities and that they understood their lessons better and faster than when they were not taught using games and videos.

Theme B. Improvement in math performance through the tablets

1. *Through the tablet, I can perform the four basic operations in math more easily* (R4A, R3A, & R6A, R18A).

2. *I can understand math much better* (R22A, R10B).

3. *I am encouraged to get high grades* (R26A, R18A).

4. *My grades went up since I understood my lessons better* (R22A, R26A).

In Questions 2 and 3, the learners were interviewed about their performance. They testified that their grades increased because they understood their lessons with the use of the tablets. Their posttest scores were higher than their pretest scores. This is an implication that the tablets were effective in teaching the math lessons.

Theme C. The tablet as a teacher's useful teaching aid

1. *Math games which are downloadable in the tablet makes our lessons interesting* (R15A, R18A, R16A).

2. *My ability to compute becomes easier* (R14A, R18A, R7B).

3. *I can master subtraction and division* (R14A, R18A).

4. *The tablet provides answers to teacher's questions* (R24A).

5. *It helps me remember my previous lessons* (R21A and R24A).

Question 2 reveals that the tablet was very useful to the learners. Their skill in computing improved; this could be a great factor why they had better scores in their performance in the posttest.

Theme D. Mathematics being useful in one's daily life

This theme is reflected in Question 5.

1. *Math is useful when counting money* (R1B & R4A).

2. *It would help me in my studies, especially other mathematics lessons* (R2B, R3B, R8B, R10A, & 18B).

3. *It is useful in business such as in selling goods* (R6A, R7B, & R12A).

4. *It is necessary when I need help in computation* (R19A).

Since the learners find mathematics useful in their lives, they are all the more motivated to study their lessons. Thus, they have to maintain their grades or strive to make them better.

Theme E. The desire to continue with the current Math Program

Questions 6 and 7 reveal the students' reasons to continue with the use of tablets.

1. *Ease of learning* (R1A, R13A, & R18B).

2. *Greater understanding of mathematics* (R1B, R19B, R16B, & R14A).

3. *Fun with the activities included in the lessons* (R5A, R5B, R8A, & R10A).

It would be great if the Mathdali Intervention Strategy be continued since it has been found to be effective with the Grade 4 learners.

II. Grade 4 Teacher

The following questions were asked from the grade 4 teacher.

Q1. What problems have you experienced as a teacher of math following the Math Program?

Q2. Were all the lessons included in the mathematics Grade 4 curriculum taught? If not, what are the reasons

Q3. Do you think that using the tablet device helped increase the knowledge of your students in math? If yes, how?

Q4. Did you observe active participation from your students while they were using the tablet device? How?

Q5. Have you observed great and positive changes in teaching math? What are these changes?

Q6. If given a chance to have a continuation of this project or program, would you still consider to be the teacher in-charge under Math program? Why?

Q7. Do you have any recommendations or suggestions for better improvement and success of the Math Program?

Theme A. Motivation in teaching

1. *It was easier to get the attention of the students* (Q3).

2. *They became more active and participative in the discussions with the use of their tablets.* (Q4)

3. *They were excited and motivated about our next meeting's lesson .* (Q5)

4. *My students, if not all, at least 99% enjoyed their math subject.* (Q4)

5. *I would still consider to be the teacher in-charge because I enjoyed teaching my students….* (Q6)

The theme gives an implication that it was difficult for the teacher to get the motivation of her students prior to the use of the tablets and videos. When she introduced the use of these gadgets, they became more interested in their lessons. Their attitude had changed, and it was no longer difficult for the teacher to get their attention.

Theme B. Ease in making students understand mathematics

It was easier for the students to understand the lessons, most especially with the difficult ones. (Q3)

The theme implies that even with the most difficult lessons, the teacher observed that her students were already learning fast. Thus, the posttest scores of the students became higher as compared to their pretest scores.

Theme C. Teaching mathematics as a learning experience as well

I also learned new concepts and techniques in teaching the subject. (Q6)

The teacher was not just teaching but also learning with the students. The new concepts and techniques in teaching the subject after her training made her more skillful in teaching her subject.

Theme D. Training as beneficial for teachers handling mathematics

The intervention strategy, including the training that I have attended, helped me a lot in handling the subject. (Q7)

The training attended by the teacher prior to the intervention program was indeed beneficial.

Summary of Findings

It was noted in the performance of the Grade 4 learners that most of them became more proficient in mathematics. In the comparison of their prestest and posttest scores, most of their scores in the posttest exceeded their scores in the pretest. There was a significant increase in the posttest performance of the Grade 4 learners in their quarterly exams.

Most of the learners showed positive impressions on their *Mathtitudes* before and after taking the math subject and the *Mathdali Intervention* Program. Most of the students strongly agreed that mathematics became an interesting subject.

The learners showed positive feedback on the use of the tablet during the interview. The gadget helped them improve in their performance in the subject; they received high grades; they enjoyed the subject; and the subject became easy for them. Most of them also agreed that they learned a lot from the program.

For the teacher, she agreed that the training helped her to become more competent and positive in teaching the subject. She learned new concepts and strategies which can be used for her teaching methods. She felt that she became more motivated and interested in helping her students to learn mathematics.

Conclusions

Based on the findings, Mathdali Intervention Program has improved learner's skills in conceptual understanding, critical thinking, and problem solving in mathematics. It helped the learners perform well in class especially in understanding concepts and techniques used in the subject.

The program improved the attitudes of the learners. They became more active and participative in class discussions as compared with their previous traditional classes. They were motivated in studying their math lessons.

The program using the tablet device was a great factor in improving the performance of the students. Both the learners and the teacher were able to enrich their experiences in their mathematics classes.

Recommendations

The following recommendations are being presented:

1. Test items included in the pretest and posttest should be improved. Validated tests from the division office of Bulacan should consider revision of the content and revalidation of the test items.

2. Interactive and innovative teachers' training should be given to the mathematics facilitators.

3. All lessons/topics should be included in the tablet device for the alignment in the grade four curriculum guide.

4. Inclusion of the competencies required for the Grade 4 math curriculum should be considered.

5. Assistance and guidance on the use of the tablet device should be considered especially for those students who are not familiar with the gadget.

6. Monitoring and supervision on the implementation of the program should be undertaken for the whole year.

7. A follow up of the Mathdali Intervention Program should be done in every grade level.

8. An improved version of the tablet device may have to be considered.

9. Future researchers are encouraged to make use of the same intervention strategy and see if it works effectively with their mathematics learners.

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