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ASSISTIVE E-MATH TOOLS: BOON OR BANE?

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ABSTRACT--*This study reinforced the use of handheld gadgets and applications designed to increase level of proficiency by making them more educational, that is, students and teachers integrate assistive electronic or e-math tools in deepening and elaborating discussions in Basic Calculus. Some of these tools composed of Geogebra, Mathway, and Photomath which made the instructions more interactive and comprehensive. Furthermore, it sought to find answers to the following (a). students' level of proficiency in the first grading period before using the assistive e-math tools, (b) the students' level of proficiency in the second grading period after using the assistive e-math tools, (c) significant difference between the students' level of proficiency before and after using the assistive e-math tools and (d) effect size of the difference of using the assistive e-math tools to the students' level of proficiency.Quantitative research design was employed particularly one-group pretest-posttest design wherein a pretest observation of the dependent variables is made before implementation of the treatment to the selected group, the treatment is administered, & finally a posttest observation of dependent variables is carried out to assess the effect of treatment on the group. One-hundred Nineteen (119) Grade 11 students for school year 2018-2019 formed the respondents of the study. Frequency, Percentage, and mean for descriptive analysis while ANOVA for single group likewise eta squared and Cohen's Guidelines were used for the interpretation of inferential question. Findings revealed that integrating the assistive e-math tools in the instructional delivery or in the teaching and learning process produced a moderate effect or difference. Students who were exposed to this intervention improved its academic performance or level of proficiency; thus, assistive e-math tools are considered Boon not Bane. This study finally concludes that teachers must positively use the available tools or technologies that students have in order to optimize learning outcomes.*

Keywords--*Assistive E-math Tools, Level of Performance, Learning Outcomes*

I. INTRODUCTION

Understanding Mathematics has always been feared by many students in the classroom. This notion is basically accounted from the different factors or critical issues that were not properly addressed years back. One of the identified reasons is the abstraction strategy that teachers applied in dealing with math ideas which is not supposedly be the case especially in the foundation levels like the elementary grades. Teaching mathematics always requires real-life or concrete presentation or explanation of knowledge or concepts. Thus, in the actual classroom situation, teachers must extend beyond the traditional practice by introducing an explorative and interactive strategy that is more accessible and user friendly to learners.

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Electronic Math tools or applications are software programs designed to assist students and teachers expand understanding and work through various mathematical concepts using the computer or cellular phone screen. It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students.

In a balanced mathematics program, the strategic use of technology strengthens mathematics teaching and learning (Dick & Hollebrands, 2011). Simply having access to technology is not sufficient. The teacher and the curriculum play critical roles in mediating the use of technological tools (King-Sears, 2009; Roschelle, et al., 2010; Suh, 2010). Teachers and curriculum developers must be knowledgeable decision makers, skilled in determining when and how technology can enhance students' learning appropriately and effectively (ISTE, 2008).

In addition to enriching students' experiences as learners of mathematics, use of these tools maximizes the possibilities afforded by students' increasing knowledge about and comfort with technology-driven means of communication and information retrieval (Gadanidis & Geiger, 2010; Project Tomorrow, 2011). Technological tools include those that are both content specific and content neutral. In mathematics education, content-specific technologies include computer algebra systems; dynamic geometry environments; interactive applets; handheld computation, data collection, and analysis devices; and computer-based applications. Findings from a number of studies have shown that the strategic use of technological tools can support both the learning of mathematical procedures and skills as well as the development of advanced mathematical proficiencies, such as problem solving, reasoning, and justifying (e.g., Gadanidis & Geiger, 2010; Kastberg & Leatham, 2005; Nelson, Christopher, & Mims, 2009; Pierce & Stacey, 2010; Roschelle, et al., 2009, 2010; Suh & Moyer, 2007).

Finally, it sought to find answers to the following (a). students’ level of proficiency during the first grading period before using the assistive e-math tools, (b) the students’ level of proficiency during the second grading period after using the assistive e-math tools, (c) significant difference between the students’ level of proficiency before and after using the assistive e-math tools and (d) effect size of the difference of using the assistive e-math tools to the students’ level of proficiency.

II. OBJECTIVES OF THE STUDY

This study mainly centered on the investigation on the usefulness of various gadgets or technologies like mobile phones, tablets or laptops in improving the leaning outcomes of students. It primarily dealt with how teachers and students transform the negative notion about these gadgets as a tool in helping/enhancing mathematical comprehension and visualization on certain math concepts. Moreover, this research sought to comprehensively discuss the immediate effect of whether or not the use of gadgets be allowed or regulated in the academe specially so that the there is a very evident proliferation of these gadgets in the school.

III. RESEARCH METHODOLOGY

Quantitative research design was employed particularly one-group pretest-posttest design wherein a pretest observation of the dependent variables is made before implementation of the treatment to the selected group, the treatment is administered, & finally a posttest observation of dependent variables is carried out to assess the effect of treatment on the group. One-hundred Nineteen (119) Grade 11 students for school year 2018-2019 formed the respondents of the study. Frequency, Percentage, and mean for descriptive analysis while ANOVA for single group likewise eta squared and Cohen's Guidelines were used for the interpretation of inferential question.

Since the sectioning employed heterogeneity, the three (3) sections of Grade 11 under the STEM strand were used as respondents. The intervention was implemented during the period of October 2018 through March 2019 to complete the Second Semester of the said learning area. The researcher determined the grades of students in the third and fourth grading periods in their Basic Calculus subject which constituted the pre and post observations.

IV. RESULTS AND DISCUSSIONS

Table 1 discusses the level of proficiency gained by the students during the third quarter in their Basic Calculus subject. Before the implementation of the assistive e-math tools in the cited learning area, findings revealed that 27 students or exactly 23% were found already outstanding, 48 students or 40% of the total Grade 11 students were identified very satisfactory and 44 learners or 37% were reported satisfactory. Surprisingly, none of them were recorded fairly satisfactory or did not meet expectations.

Further, the data showed that around 63% of the whole class have grades ranging from 89.00 to 100.00 which implies that most of the students have very satisfactorily to outstanding performance. In the context of STEM strand, students are expected to attain a grade of 85 or better in Math to ensure that mastery of learning competencies set in the Curriculum Guide is achieved, otherwise, the teacher develops a more interactive catch up plans to offset the competencies that were negligibly mastered.

Table 1: Students' Level of Proficiency Before Using Assistive E-Math Tools

Level of Proficiency	Total	Percentage
Outstanding (100.00 – 90.00)	27	23%
Very Satisfactory (89.00 – 85.00)	48	40%
Satisfactory (84.00 – 80.00)	44	37%
Fairly Satisfactory (79.00 – 75.00)	0	0%
Did Not Meet Expectations (Below 75.00)	0	0%
Total	**119**	**100%**

The data in table 2 show the effect of implementing the use of assistive electronic math tools such as Geogebra, Mathway and Photomath in some topics in Basic Calculus for the fourth quarter. Under this condition, students were exposed to the integration of the tools to aid and enhance better understanding of the lesson. Clearly, there were 41 students or 34% have a level of proficiency as outstanding, 63 or 53% for very satisfactory while 13% or 15 of the 119 students were observed as satisfactory.

It can be explained that 87% or 104 students have obtained improvement in terms of their proficiency in the said subject which suggests that giving intervention like assistive e-math tools can advance understanding by scoring better and above the threshold grade which is 85%. Moreover, the result indicates that e-math tools are really tools, when properly utilized, that helped enrich students' comprehension and mastery. According to King-Sears, (2009); Roschelle, et al., (2010); Suh, (2010) they assert that teacher and the curriculum play critical roles in mediating the use of technological tools. Also, this idea was further supported by Gadanidis & Geiger, (2010) saying that in addition to enriching students' experiences as learners of mathematics, use of these tools maximizes the possibilities afforded by students' increasing knowledge about and comfort with technology-driven means of communication and information retrieval.

Table 2: Students' Level of Proficiency After Using Assistive E-Math Tools

Level of Proficiency	Total	Percentage
Outstanding (100.00 – 90.00)	41	34%
Very Satisfactory (89.00 – 85.00)	63	53%
Satisfactory (84.00 – 80.00)	15	13%
Fairly Satisfactory (79.00 – 75.00)	0	0%
Did Not Meet Expectations (Below 75.00)	0	0%
Total	**119**	**100%**

Figures in table 3, Using Analysis of Variance for Bivariate Data, the F-value of 247.725 is found greater than the F-critical of 4.784 which means that there is a significant difference between the students' level of significance before and after the implementation of assistive e-math tools. This implies that the allowing the use of such technology or applications in the teaching and learning process commends a positive result to the achievement particularly the grades of the students and more importantly the mastery of the learning competencies. In fact, when teachers promote the utilization of handheld gadgets, with constant monitoring of its intended purpose, the delivery of abstract mathematical ideas such as figuring out the graphs of different functions and their behaviors becomes friendly and self-explanatory to learners.

Table 3: Significant Difference between the Students' Level of Proficiency Before and After Using the Assistive E-Math Tools

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups (Students)	2075.697	1	2075.697	247.725	3.14E-05	4.784
Within Groups (error)	1994.298	238	8.379	-	-	-
Total	4069.996	239				

Table 4 presents the mean improvement score of the students when allowed with the use of math tools thru technology. The average grade of the respondents before the intervention was 85.266 while 87.741 after using the identified e-math tools. In addition, a mean gained score of 2.474 was calculated which suggests that there is a significant effect to the understanding likewise on the level of proficiency of the students in the identified topics in the said subject. Hence, assistive e-math tools help students and teachers in increasing evidence of understanding.

Table 4: Mean of the Students' Grades Before and After the Implementation of the Assistive E-math tools.

Before	After	Mean Gained Score
85.26667	**87.74167**	**2.4749**

To determine the magnitude effect of using the intervention, eta square was used through ANOVA and then interpreted by Cohen's Guidelines. The computed eta value was 0.301 which falls under a moderate effect. This can be reported that assistive e-math tools have moderate effect to the ability of the students to comprehend and analyze problems in Basic Calculus. Kastberg & Leatham, (2005) et. al, elaborate that the strategic use of technological tools can support both the learning of mathematical procedures and skills as well as the development of advanced mathematical proficiencies, such as problem solving, reasoning, and justifying

Table 5: Effect size of the difference of using the assistive e-math tools to the students' level of proficiency

Source of Variation	SS	Eta^2 value	Magnitude
Between Groups (Students)	2075.697	0.51 or 51%	Moderate Effect
Within Groups (error)	1994.298		
Total	4069.996		

V. CONCLUSIONS

Findings revealed that integrating the assistive e-math tools in the instructional delivery or in the teaching and learning process produced a moderate effect or difference. Students who were exposed to this intervention improved its academic performance or level of proficiency; thus, assistive e-math tools are considered Boon not Bane. This study concludes that teachers must positively use these available tools or technologies that students have in order to optimize learning outcomes. However, it is highly encouraged that while teachers allow them in the classroom, there has to be a system to facilitate the intended use of the cellular applications. There must be an agreement for both teachers and students to observe while such policy on the utilization of gadgets is permitted.

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