



INFLUENCE OF 21ST CENTURY CORE SKILLS ON THE LEARNING OUTCOMES OF STUDENTS IN MATHEMATICS

Daphne M. Legaspino, LPT, Ph.D.^a, Noel T. Casocot, Ph.D.^b

St. Mary's College of Tagum, Inc., National Highway, Tagum City, 8100, Philippines
UM Tagum College, Arellano St., Tagum City, 8100, Philippines

ABSTRACT

This study aspired to determine what domain of 21st Century Core Skills of Students significantly influences the students' learning outcomes in Mathematics. The quantitative non-experimental design utilizing causal-effect was used in the study. The respondents of the study were 249 grade 10 students at selected schools in Tagum City of S.Y. 2018-2019. Mean, Pearson-r and Regression Analysis were used in interpreting the data gathered. Findings were, 21st century core skills of students in Mathematics significantly influences to their learning outcomes and three out of four domain of 21st Century Core Skills significantly influences to their learning outcomes. Findings also revealed that the level of 21st century core skills of students in Mathematics was high, the level of students' learning outcomes in Mathematics was developing and there was a significant relationship between the 21st Century Core Skills of students in Mathematics. Based on the findings, it would serve as an eye opener to the DepEd as well as to the school and other national organizations in giving more importance on interventions as to fuse the 21st century core skills of the students in Mathematics for a successful and effective in increasing the learning outcomes of the students.

KEYWORDS: Teaching Mathematics, 21st century skills, learning outcomes, Philippines

INTRODUCTION

Students' performance in Mathematics both internal and external examinations has remained considerably poor by Ale (as cited by Idowu, 2016). Since Mathematics is the cornerstone of development of any contemporary society, it is always a concern about the continued poor performance of students and increasing research to identify what possible factors contributing to the nose diving in students' performance (Avong, 2013). In the Philippines, Mathematics subject ranked two among the subjects in terms of low Mean Percentage Score (MPS) that is only 50.55 in 2015. As observed in the statistics, the MPS for the past years of the school were diminishing. The result is below the passing percentage which is 75%, this means that students had difficulty in dealing with the subject which is alarming and a recurring situation (Guita & Tan, 2018). Indeed, in global competitiveness indices, the Philippines have been rated poorly in terms of the quality of basic education, quality of science and mathematics education, a low collaboration between industry and the academe, and low in innovation (Luz, 2012)

In the Philippine context, education remains top priority. However, in implementing academic curricular changes specifically in Mathematics, many factors need to be considered. For one, there is a need for carefully planned programs of exchange in the curriculum. Also, there must be an examination of the place of formative process and summative evaluation of curriculum programs and of the practical materials for the actual process of installing new curricula in schools (as cited by Capate & Lapinid, 2015). Chang et al. confirmed and stated that the fact that students' performance in Mathematics has not improved significantly despite its importance, not even with the introduction and use of

technology in mathematics, nowadays, students make use of computer-assisted problem-solving systems to better learn and understand mathematics which remains an update (as cited by Idowu, 2016). It is believed that many of the students feel difficult and tiresome to handle the subject. Thus, it is a challenge for the teachers to have couple of solutions in coping with these problems in the classroom. One of these is, a teacher must incorporate cooperative learning in the class like reciprocal learning strategy (Guita & Tan, 2018). A need to promote 21st century skills and academic content knowledge as similarly important student outcomes. The cultivation of a broader set of skills and dispositions beyond core content knowledge is critical, and they merit the investment of more time in the classroom (Kwek, 2011). The Partnership of 21st Century Skills (P21) has been developed to give educational leaders in and out of the classroom additional tools to help more students recognize this common language so that all students develop skills to lead in the 21st century (Saltrick, et al., 2011). It is expected that the implementation of 21st century skills in mathematics is a challenge since, currently, mathematics education is mainly orientated on acquiring low-level cognitive processes, asks for students to work alone and in silence and does not stimulate students to develop deeper understanding in mathematics. Therefore, it is important to gain insight into the possibilities to implement these 21st century skills in mathematics education (Smit, 2016).

OBJECTIVES

1. To ascertain the level of the 21st Century Core Skills of students in Mathematics in terms of creativity and innovation, critical thinking and problem solving, communication and collaboration; and Information, Communication and Technology (ICT) literacy.



2. To determine the level of the learning outcomes of students.
3. To determine the significant relationship between the students' 21st Century Core Skills and learning outcomes in mathematics.
4. To determine what domain of 21st Century Core Skills of students in Mathematics significantly influences on learning outcomes.

METHODOLOGY

The research design of this study was quantitative non-experimental using causal effect technique. Quantitative data includes close-ended information such as that found to measure attitudes and performance instruments. While Non-experimental research is research that lacks the manipulation of an independent variable, random assignment of participants to conditions or orders of conditions, or both - characteristics pertinent to experimental designs (O'Dwyer & Bernauer, 2013).

Causal effect refers to a relationship between two phenomena in which one phenomenon is the reason behind the other. Most research's central goal is the identification of causal relationships or demonstrating that a particular independent variable (the cause) influences the dependent variable of interest (the effect). In this study, the design was adopted to determine the influence of 21st century core skills on the students' learning outcomes in Mathematics.

This study was conducted to selected schools in Tagum City. There were 49 respondents from School A and 100 from School B, a total of 249 grade 10 students. The questionnaires were distributed in accordance with permission by the school principal and instruction given by the mathematics teacher.

RESULTS

The level of the *21st century core skills of students in Mathematics* was high. This means that it is very evident. This is parallel to the study of Ramos (2014) where the 21st century core skills of students in Mathematics in a secondary school was much manifested. All the four indicators described as high that means that the level of *21st century core skills of students in Mathematics* is much evident to the students. The *Information, Communication and Technology (ICT) Literacy* has the highest mean followed by *Creativity and innovation* then *Critical Thinking and Problem Solving* and *Communication and Collaboration* as the lowest.

This study revealed the significance of providing the students with 21st century core skills Mathematics to increase the learning outcomes of the students in mathematics subject. A confirmation to the anchored proposition of Saltrick et al. (2011) that most important way to enable students achieve mastery is to fuse mathematical content and practices with the 21st Century Skills. Fusing a core subject like mathematics with 21st Century Skills makes teaching and learning more engaging, more relevant and more rigorous, ensuring that a greater number of students have an advanced level of understanding and ability in mathematics.

Furthermore, it was also revealed that the level of learning outcomes of the students was described as developing level of proficiency indicates that the students possess the minimum knowledge and core understandings that needs help throughout the performance of authentic tasks. Students' performance in Mathematics at both internal and external examinations has remained considerably poor according to Ale (as cited by Idowu, 2016).

The result is consonant to the findings of Nambatac (2011) that Filipinos performed poorly in Mathematics. Moreover, it is reported that Filipino students have poor performance in Science and Mathematics subjects. In fact, the National Mean Percentage Score in Math on 2012 was only 48.90 which is described as below the national standard. Moreover, Generalao concluded that Mathematics needs not to be stressed, even if it is not easy as perceived by the majority, this can still be appreciated. Enjoyment of the subject relies on its meaningfulness and dynamics of concept illustrated. It is the essential role of the teachers to guide and direct the students on getting knowledge, thus right ground on methods, strategies and techniques must be considered in giving a comprehensive environment which causes to arouse the interest and challenge the students to the higher level of learning mathematical (as cited by Guita, G. & Tan, D., 2018).

Moreover, the results of the study showed that there was a significant relationship between the 21st century core skills of the students in Mathematics and their learning outcomes. However, among the four domains only creativity and innovation showed the relationship to the learning outcomes of the students in mathematics. This is in congruence to the study of Bahar & Maker (2011), that The Mathematical Creativity (TMC) as part of pedagogy had a significant correlation with mathematics achievement. Results can support the belief that teachers can enhance their students' achievement by developing their creative thinking in mathematics.

Critical thinking skills and problem solving has no significant relationship to the students' learning outcomes in contradiction to the findings of Alcantara & Bacsa (2017) that the academic performance, critical thinking skills, and problem-solving skills as the mathematics performance of the students is positively correlated to their level of critical thinking skills and problem-solving skills.

Meanwhile, communication skills and collaboration also show no significant relationship to the learning outcomes of the students in Mathematics. The result was inconsistent to the study Cristobal & Lasaten (2018) that reveals the existence of significant relationship between the students' communication skills and academic performance in English, Mathematics and Science, the higher level of communication skills the likely to have higher academic performance. In congruence to the studies of et al. as cited by Veiring (2012) that collaboration also has powerful effects on student learning and engaging in collaborative learning opportunities with classmates can have a lasting impact on individual student learning as it increases students' social competency and academic self-concept.



For the *ICT literacy*, this study results having no significant relationship to the students' learning outcomes, it is affirmed by Basri et al. (2018) on their findings revealed that there exists a relationship between ICT adoption and academic performance in a conservative environment. However, students' IT major was found to be making no impact on students' academic achievement.

The regression analysis on the influence of the domains of 21st century core skills of students influence to their learning outcomes in Mathematics revealed that communication and collaboration, critical thinking and problem solving, and creativity and innovation have significant influence on the students' learning outcomes in Mathematics.

Communication and Collaboration significantly influences the students' learning outcomes in Mathematics. This is in congruence to the study of Fall et al. as cited by Veiring (2012) that collaboration has powerful effects on student learning in the form of higher scores on work completed collaboratively, even when students turn in separate products. In other words, after collaborating with others, a student's performance on subsequent, related tasks completed individually tends to be higher than the performance of similar-ability students who only work alone.

Moreover, *Critical Thinking and Problem Solving* also significantly influences the students' learning outcomes in Mathematics. This study is parallel to Alcantara & Bacsa (2017) assessed the academic performance, critical thinking skills, and problem solving skills of students in mathematics as the performance of the students is positively correlated to their level of critical thinking skills and problem solving skills.

Finally, *Creativity and innovation* significantly influences the students' learning outcomes in Mathematics. This is similar to the study of Bahar & Maker (2011), stating that mathematical creativity had a significant correlation with mathematics achievement.

This study showed that among the four domains only ICT literacy does not significantly influence the leaning outcomes of the students in Mathematics. This study is in consonance with the findings of Gano (2010) that showed that the use of implemented Self-study video (SSV), fitting it to the mathematics pedagogy does not affect students' academic

achievement. The performance of the students in the traditional method is the same as the student that undergo learning through the use of self-study video. The finding also emphasized that pedagogy with technology is equally effective as the traditional method of teaching, thus, it may concluded that SSV may be used in place of the traditional method and still having the same result on the student's academic achievement.

SUGGESTIONS

After a profound consideration on the possible implications of the findings and conclusion of this study, the researcher recommends in improving learning outcomes in Mathematics of the students from developing to advanced level by strengthening the skills to improve their learning outcomes. However, the school needs to be serious in targeting interventions and fusing the 21st century core skills of the students in Mathematics for a successful and effective in increasing the learning outcomes of the students.

Furthermore, there is a need for the teachers to help the students and providing interventions such as remediation programs to students in improving their learning outcomes for the following quarters and the students strengthen the 21st century skills that were already integrated in Mathematics subject to help them increase their learning outcomes.

CONCLUSIONS

Based on the results of the research objectives, the researcher has come up with the conclusion the 21st century core skills of students in Mathematics is high which means that it is much evident to the students. The findings also revealed that the students' learning outcomes in Mathematics is developing which means that the students possess the minimum knowledge and core understandings that needs help throughout the performance of authentic tasks. Also, there is a significant relationship between the 21st Century Core Skills of students in Mathematics and their learning outcomes. And there are domains of 21st Century Core Skills of students in Mathematics significantly influences to their learning outcomes.

Fusing a core subject like mathematics with 21st Century Skills makes teaching and learning more engaging, more relevant and more rigorous, ensuring that a greater number of students have an advanced level of understanding and ability in mathematics (Saltrick et al., 2011).

TABLES AND REFERENCES

Table 1. Level of 21st century core skills of students in Mathematics

Indicator	Mean	SD	Descriptive Equivalent
ICT literacy	3.87	0.76	High
Creativity and innovation	3.82	0.61	High
Critical thinking and problem solving	3.73	0.64	High
Communication and collaboration	3.71	0.65	High
Overall	3.78	0.55	High



Table 2. Level of students' learning outcomes in Mathematics

Indicator	Mean	SD	Description
Score	25.33	6.89	Developing

Table 3. Relationship between the 21st Century Core Skills of students in Mathematics and their learning outcomes

21 st Century Core Skills of students in Mathematics	Students' Learning Outcomes in Mathematics		Decision $\alpha=0.05$
	r – value	p-value	
Creativity and innovation	0.26*	0.001	Rejected
Critical thinking and problem solving	0.184*	0.004	Rejected
Communication and collaboration	0.132*	0.037	Rejected
ICT literacy	0.060	0.346	Accepted

Table 4. Regression Analysis on the Influence of 21st Century Core Skills of students in Mathematics to their learning outcomes

21 st Century Core Skills of students in Mathematics	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value	Decision On Ho $\alpha=0.05$
	B	SE	Beta			
(constant)	16.432	3.046				
Creativity and innovation	2.112	1.120	0.186	1.886	0.060	Accepted
Critical thinking and problem solving	1.114	1.070	0.109	1.097	0.274	Accepted
Communication and collaboration	-0.671	1.072	-0.064	-0.626	0.532	Accepted
ICT literacy	-0.272	0.653	-0.030	-0.417	0.677	Accepted
$r = 0.219$			$r^2 = 0.048$		Rejected	
$f - \text{ratio} = 3.087^*$			$p - \text{value} = 0.017$			

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