



## **MATH IS LOVE: AN ANALYSIS ON THE IMPACT OF THE PROPOSED ENRICHMENT PROGRAM TO COLLEGE STUDENTS IN A PHILIPPINE UNIVERSITY**

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### **ABSTRACT**

Increasing access to enrichment and extended learning programs is vital because this help deepens and engages students to gain the appropriate competencies and strong foundation for success. Students need extra support to be academically successful and whatever happens before and after school can be as significant as what transpires during the normal class discussion. This qualitative, descriptive study was conducted to analyze the impact of the mathematics enrichment program on college students' self-efficacy and Math anxiety in a Philippine university. Data were obtained from pre-structured interviews of students who underwent varied activities such as talks and workshops, tutorials, peer mentoring, review classes, and other enhancement opportunities. Participants were chosen through purposive sampling and who established an extremely high anxiety level and very poor self-efficacy in dealing with math. Criteria were based on the result of the Mathematics Self – Efficacy and Anxiety Questionnaire. Thematic analysis was utilized resulting in emerged themes such as improvement to students' self-efficacy and a reduction to their math anxiety which was validated by the new result of the MSEAQ and thru focus group discussion. The investigation also posited that student-participants recognized the significance of Mathematics which helped them to deeply appreciate its importance and meaning to their life. Based on these results, to increase LOVE for math: (a) Learners should Learn to trust themselves; (b) Opportunities for the enrichment and extended learning activities must be reinforced by the academic leaders; (c) Version 2.0 of the enrichment program must be projected and offered, and (d) Educational researches must be continuously steered.

**Keywords – Mathematics, Self-efficacy, Math Anxiety, Impact, Enrichment Program, Philippines**



## INTRODUCTION

Students' anxiety in Mathematics has increasingly been recognized as a widespread problem in different educational settings. Students are at substantial risk for a higher level of anxiety leading to academic failures and weak foundation. Poor mathematics achievement is often indicative of anxiety, difficulties, and makes dropping out more likely to happen. These negative emotions interfere with solving Mathematics problems (Blazer, 2011, Kalaycioglu, 2015 and Mitchell, 2018). Fear of math stems primarily from student's anxiety influenced by several factors and demands. A stressful environment can adversely affect the success learners have in dealing with and solving mathematical problems and exercises (Beilock, 2008 & Beilock and Maloney, 2015). There is a need to combat such anxiety to help students better understand and achieve higher learning in Mathematics.

Correlated to this, coping with Math anxiety is likely associated with increased self-efficacy. Self-efficacy is the belief that one can complete a specific learning task effectively and successfully. It is of vital importance for students studying mathematics or any academic subjects. In prior research, increased self-efficacy has been correlated with enhanced learner motivation, positive attitude, very satisfactory academic performance, and overall achievement. Theoretically, learners' ability to self-assess their own strengths and limitations, and able to use their past failures during the learning process may be linked to overall self-efficacy (Etheridge, 2016 and Olango, 2016).

Mathematics self-efficacy and anxiety are closely related concepts. Personal efficacy expectations are thought to influence beginning behavior which includes strain and anxiety. It is also believed to affect how much effort will be applied to attain an outcome and the level of persistence needed to be applied (Bandura; Spaniol 2017). Varied factors or external demands may be evaluated as "anxiety" or a "challenge", and persons with high self-efficacy are most likely to evaluate the demands or factors as a challenge. Therefore, students who

feel confident about their competencies to handle math problems, even the hardest ones, may handle and turn any situations into a challenge and opportunities. Good grades are associated with low anxiety or high self-efficacy. This study finds self-efficacy and anxiety in Mathematics as predictors of effective enrichment programs that will help students (Barrows, et. al., 2013 and Pekic, Milovanovic, and Kodzopeljic, 2017).

Research on self-efficacy and mathematics anxiety has indicated that teachers and administrators should provide enriching and learning opportunities beyond the usual class discussion inside the classroom (Etheridge, 2016 and Olango, 2016). Also, schools aside from the use of standard-based Mathematics teaching practices must support innovations that will promote meaningful extended-learning experiences and appreciation activities. With this proposition, the researchers who were Math teachers themselves believe that to improve self-efficacy and reduce Math anxiety, an enrichment program must be implemented consistently, equipped with activities and opportunities that maximize and utilizes student's talents and hidden capabilities. Likewise, programs must be evaluated thoroughly through participants' sharing of feedbacks and experiences which may lead to suggestions for improvement. According to Schnell & Prediger (2016), there is a need to take into account many different facets that will develop not just students' intelligence but also other potentials and attributes including self-efficacy, interest, commitment, persistence, and creativity.

## OBJECTIVES OF THE STUDY

The study brought together Math teachers who were passionate to investigate the impact of an executed enrichment program on college learners in a Philippine University. With this study, a better analysis of students' experiences that contribute to lessen anxiety and increase self-efficacy can be articulated. An attempt was made to:



1. examine the impact of the enrichment program relative to student's Math anxiety;
2. analyze the effect of the enrichment activities on student's mathematics self-efficacy; and
3. evaluate the overall impact of the enrichment program.

## METHODOLOGY

The descriptive – qualitative design was utilized in analyzing the impact of an implemented mathematics enrichment program on students experiencing extremely high math anxiety and very low self-efficacy. Qualitative is an investigation and exploration that delivers depth understanding and produces descriptive data – peoples own written or spoken words and observable behaviors (Taylor, Bogdan & DeVault, 2015)

A qualitative approach requires a reasonably identical group of participants (Creswell, 2013). The participants were comprised of five (5) first-year college students taking Mathematics in the Modern World subject and were enrolled for S.Y 2019 – 2020 for the first semester. They were purposively identified with extremely low self-efficacy (mean=1.44) and severe level of anxiety (mean=4.79) based on the result of the Mathematics Self – Efficacy and Anxiety Questionnaire (MSEAQ) which was crafted by May (2009) and administered July 2019. Purposive sampling was used to provide information-rich for in-depth study analysis. Participants are enlisted conferring to pre-selected criteria related to the research objectives (Lopez & Whitehead, 2013). The MSEAQ was found to be reliable (Cronbach Alpha = .94), relatively valid, and efficient to administer since then. The instrument was used to check learner's belief about their ability to accomplish mathematics tasks and check if anxiety is severe or not. The higher self – efficacy and the lower Math anxiety means a predictive better academic performance of the students and successful implementation of enrichment program (Liu & Koirala, 2009 and Bataineh, 2013). Ensuring the participants' identity, each of

them was given pseudonyms. Student-participants gave their voluntary consent to participate in the study.

The role of the researchers was to ensure the successful and consistent implementation of the approved enrichment program. The conduct of activities was scheduled and monitored to make certain involvements among the student-participants. At the start, the researchers informed the student-participants on the rationale of the study. The researchers highly encouraged the student-participants to be opened, so they can give significant feedback on the different talks and workshops, activities, interventions, and reviews given to them and their overall experiences. The researchers, as interviewers, enabled the smooth flow of communication, recognizes cues, and the student-participants' sets of respondents at ease (Lopez, & Whitehead, 2013).

Information for this research was drawn from the participant's feedback on the different activities designed and executed to increase self-efficacy and decrease Math anxiety. Approved enrichment program dated July 2019 was expert validated by Math teachers in the college of arts and sciences and education and the basic education department. The program was based on the recommendations derived from the study MATH for Math: The Common Stressors and the Academic Performance in Mathematics of Students in a Philippine University (Robinos, 2017). It includes seminars and workshops, peer mentoring, tutorial class, talk on growth mindset, review class 101, and other extended learning opportunities. After the first semester, semi-structured interviews ranging in length from 1 to 2 hours were conducted by the research team. Questions were set in semi-structured interviews to ensure that the research objectives are covered. The interview queries were intended to prompt evaluative and experiential explanations of the participants' involvement in varied activities. Questions were made to assess the impact of the implemented enrichment program on student-participants' self-efficacy, math anxiety, and how they value mathematics after the implementation of the program. Questions were subjected to



validation from experts and associates accustomed to the given circumstances, with the established study objectives and are experienced with research considerations. The recorded interviews were transcribed verbatim by the researchers and were returned to student-participants for confirmation.

More so, research utilized thematic analysis, a method for systematically identifying, organizing, and understanding patterns of meaning across the obtained set of data was conducted. By focusing on implications through a dataset, it permits the researcher to realize make sense of collective and shared meanings from student-participants' answers (Vaismoradi & Snelgrove, 2019). The general procedures include preparing translated answers for the analysis, familiarizing with the data, reducing the data for initial codes, and uncovering the core from the answers using themes. Realized themes were validated through focus group discussion (FGD) and the result of the post-MSEAQ, which resulted in an improved self-efficacy (mean=3.85) and declined math anxiety (mean=2.14).

## RESULTS AND DISCUSSIONS

Student-participants were generally participative and motivated in attending different talks, workshops, tutorial sessions, review classes, homework support, and hands-on activities. Attendance and involvement were recorded and highly monitored. Student – participants were very engaged until interviews were conducted. Participants were never forced to attend all scheduled activities. Academic performances showed affirmative changes from prelim, midterm to finals. The following themes synthesized the answers to the set objectives and were validated through focus group discussion and post-survey last February 2020. Emerged themes given below include selected quotations from the student-participants to give support.

### 1. Impact of the enrichment program relative to student's Math anxiety

#### **Improved Mathematics Self-Efficacy.**

Overall, researchers found that all participants reported positive feedbacks to the given enrichment activities. Participants were thankful and became extra encouraged in dealing with mathematics. They realized that enrichment activities were important that their attendance became voluntary. All of them believed that the program helped them to increase their self-confidence in dealing with Math problems. They manifested affirmative self-efficacy and gained a better declaration of math understanding. Improved self-efficacy is closely intertwined with students' experiences and developmental tasks in different stages in life. Students with high self-efficacy are more self-confident and have more positive attitudes towards future undertakings (Guzeller & Akin, 2012; Sharma & Nasa, 2014; Koseoglu, 2015; and Robiños, 2017). Students' self-efficacy has a powerful effect on their actions. Students with high self-efficacy would not worry as much about examinations result and their overall academic performance (Barrows, et. al., 2013 and Pekic, Milovanovic, and Kodzopeljic, 2017). Participants emphasized the following points:

*"I'm thankful and blessed to be part of the enrichment program because it helped me to learn more about the step-by-step process. I believed, I had improved on solving math problems, and I guess my math efficacy as well." – Mark*

*"After attending the enrichment activities and intervention, I would say that I gained assurance and confidence. It is okay to try again until you finally get the correct answer. Before I was really afraid but after attending the enrichment, I gained confidence and was able to share to others what I've learned." – Shiela*

*"I get something more thoroughly if it was taught one-on-one. I love the tutorial intervention. The intervention helped me*



*to solve difficult problems and started to feel a better self-efficacy. I learned the processes, which I think is the most important." – Angel*

*"Before the intervention started there was no hope left in me. I assumed early that I will retake the subject but after Sir Robby's talk and workshops, there was a little hope that sparked in me, which helped me to believe that I will pass this subject. The program and activities helped me in some lessons that I didn't fully understand." – John*

*"I lack self-confidence before in all my answers. After attending the enrichment program for the whole semester, I started to understand the different lessons though I think I still need more focus. My self-confidence increases especially my ability in doing the step-by-step processes. I am more encouraged now to solve math problems." – May*

## 2. Effect of the enrichment activities on student's mathematics self-efficacy

**Reduced Math Anxiety.** Most participants emphasized that the enrichment program contributed a feeling of achievement and a sense of empowerment which exhibited reduced anxiety. Several participants were grateful for activities because it showed that researchers really put so much effort and time just to confirm that their stress in math will decline, if not totally removed. Students who received enrichment strategies for reducing math anxiety tend to feel more relaxed and perceived themselves to be more in control (Blazer, 2011; Guzeller & Akin, 2012; Beilock & Maloney, 2015; Robiños, 2017 and Mitchell, 2018). They explained that working with faculty on some challenging math exercises and listening to the facilitator's stories on math appreciation helped them to become more willing and have a better focus on solving

math problems. Participants elaborated the following:

*"My math anxiety reduces from 7.5 to 5, being 10 is the highest. The enrichment program helped me a lot, especially boosting my confidence in dealing with math problems. It also increases my skills in solving mathematical problems." – Mark*

*"Before, I get really anxious all the time we do the math, but now I am having this secured feeling that I will do well. During the examination, I would literally cry if I don't remember the things that I learned, but now I was able to remember some or most of the lessons, and whatever the outcome is fine for me because I know in myself that I did my best." - Shiela*

*"After the sessions of talks, workshops, and different enrichment programs, my confidence started to build up, especially solving mathematical problems. Although it is not 100% confidence, still my math anxiety decreases significantly." – Angel*

*"After the intervention, I was happy and I realized that there were still some professors who were open to their students and willing to sacrifice effort and time for students having difficulty in math. In that case, my anxiety about math is now zero because I know that there are professors who are willing to give support and help me in this matter." – John*

*"I don't have that much fear in math, but when it comes to numbers and complicated problems, I easily lose hope and get anxious. I'm not a fast learner so I can't easily remember all of the formulas and steps at once. This program helped me to have more focus, have less anxiety to learn, and more confidence in solving math problems." – May*



### 3. Overall impact of the enrichment program

#### Appreciating Mathematics as a Relevant Subject.

All participants expressed strong constructive responses as to the impact of the enrichment program. They appreciated the different activities, talks, and workshops conducted. They started to recognize the importance of math and of being positive in dealing with math problems. Participants recognized good effects of the program as compared to their previous too low self-efficacy and extreme math anxiety. They highlighted their changed thoughts and the value of math. High enrichment programs, activities, and experiences that were conducted beyond the classroom and curriculum, are designed to support students' learning and development. It provides great benefits and positive effects on student's socio-emotional, creativity, critical thinking, self-esteem, and firm foundation of success (Al-Zoubi, 2014; Kim, 2016; Blazer 2016). Better enhancement programs and strategies are associated with decreased anxiety levels and decreased risk for academic failure (Bataineh, 2013 and Robiños, 2017). There is much to learn from different nations that can balance math self-efficacy and anxiety levels to improve achievement and motivation to learn more (Kalaycioglu, 2015 and Olango, 2016). The following statements illustrate this perspective:

*"I may not be super good in math but at least after the enrichment program I started to appreciate math even better unlike in the past." - Mark*

*"After attending the series of interventions I learned to appreciate Math. It became possible because of those professors who were always willing to help and teach us passionately." - Shiela*

*"Learning the different ways in solving math problems and increasing my level of appreciation to Math were simple things that the enrichment program*

*taught me, especially after attending a one-on-one discussion (tutorial intervention) compared to normal classroom set-up." – Angel*

*"This intervention/enrichment program helped me to appreciate math and be able to know its deeper value. I learned that this subject is special. These interventions and the professors who handled and gave me techniques to compute, understand the formulation process, appreciate the process made me realized that Math is easy and fun." – John*

*"I can say that I started to LOVE math because of the interventions and activities given to me. I still encounter lesser anxiety about time management but generally, it lessens. Nevertheless, my interest increases, my appreciation was improved, and I learned to strive harder to learn." – May*

### CONCLUSIONS

The study highlighted the implementation of an enrichment program that provided engaging opportunities with talks, workshops, tutorials, extended learning time, and review classes to students with very low self-efficacy and suffering because of extreme anxiety while dealing with mathematics. The execution resulted in three positive impacts on participants: 1) Enrichment program improved student's self-efficacy and attitude towards mathematics and even to future math undertakings. Because of the different activities and interventions conducted, participants became more confident in dealing with Math; 2) The implementation of the different enrichment activities significantly reduced students' anxiety. Students tend to feel more secured, stress-free, and perceived to be more in control of their anxiety and fear of math; 3) Lastly, the enrichment program generally helped students to appreciate the importance and implications of mathematics in their life. This positive effect facilitated a better understanding



of Math and an increased love for its usefulness and applications in real life.

## RECOMMENDATIONS

Mathematics is significant to all courses and as society changes to a more complex realm, students must gain self-confidence, basic competencies, and deeper LOVE for the subject. Hence, the successful implementation of the Enrichment Program aimed at helping students to increase their self-efficacy and reduce math anxiety. This may lead them to a greater math appreciation and a resilient source of success. To deepen students' LOVE for Math, recommendations were as follows:

Learning to believe that you can always do math should be integrated fully – Students must recognize their strengths and abilities to use failures as an opportunity for them to become successful. Students must consider that the way to think and treat math problems is as simple as normal day-to-day encounters of varied challenges. Teachers and administrators should give constant support to the school's initiatives in promoting love for math.

Opportunities for the enrichment and other extended learning time must be given priority. School administrators and teachers must advance and expand student's access to engaging and collaborative programs and activities that will deliver a firm foundation, not just in Math, but more so for academic success. Programs must target helping students to achieve reduced math anxiety, improved self-efficacy, and acknowledged affirmative effects in their lives.

Version 2.0 of the Enrichment Program must be proposed. The study reported that the implemented enrichment program positively influenced student-participants' self-confidence and stress in dealing with Mathematics. Therefore, the researchers strongly recommend the revision and improvement of the Enrichment Program. The new version should include varied talks and workshops, practices, tutorials, intervention activities, consultation hours, one-to-one support, and promoting online materials and applications.

Educational research in math must be continuous. School researchers should consistently conduct a study that would promote love for math. Recommendations must be implemented and strictly monitored and evaluated. Research will not just promote progressive and significant impact; it can also be included as additional literature that will help future researchers to validate their study theses and support findings.

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**Jonabelle B. Pondang** is a full-time faculty member of the College of Arts & Sciences of the University of Perpetual Help Molino Campus. She has been teaching various Mathematics subjects for 15 years now. She had been the Faculty Club treasurer for four years in UPHM. She was a former faculty member of Pamantasan ng Lungsod ng Maynila. She also worked as a Statistician and Computer Programmer at the Bureau of Internal Revenue, National Office for 13 years, and as a high school mathematics teacher at Araneta University.

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