



# BIOLOGICAL AND PSYCHOLOGICAL FACTORS THAT AFFECT THE STUDENTS' PERFORMANCE OF GRADE 11 LEARNERS IN GENERAL MATHEMATICS

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## Abstract

Mathematics is one of the difficult subjects that most student got afraid, nervous, fear and the like. What are the techniques, strategies of teachers will implement for a diverse students in one class. This research endeavor aimed to find out the factors that affect the performance of Grade 11 learners in General Mathematics per strand. They study utilized adopt questionnaire for 385 respondents. Mean, Spearman Rho Correlation and Stepwise Regression Analysis were the statistical tools employed. The study revealed that different strand has different factors that affect the performance in General Mathematics. For ABM only sex ( $t = -2.332$ ,  $p < .022$ ). Sex explains only 4.3% of the variance in Math grades, but the explanatory model is significant at  $F = 5.440$ ,  $p < .022$ , Math anxiety ( $t = -2.851$ ,  $p < .005$ ) is a significant predictor of Mathematics performance. For GAS Mathematics anxiety ( $t = -2.224$ ,  $p < .032$ ) among the psychological factors. Whilst ICT age ( $t = -2.147$ ,  $p < .004$ ). It indicates that age with 7.5 % variance on their math grade but an predictive model  $F = 8.864$ ,  $p < .004$ . While Mathematics anxiety ( $t = -2.224$ ,  $p < .032$ ). For STEM Mathematics anxiety ( $t = -2.509$ ,  $p < .018$ ) among the psychological factors was found to have a predictive relationship with the said academic performance. The predictive model was significant at  $F = 6.295$ ,  $p < .018$ . Lastly, HUMSS strand has no predictive significant.

**Keywords** Polytechnic University of the Philippines, Master of Science in Mathematics Education, biological and psychological factors, mathematics performance, strand.

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## 1. Introduction

Mathematics is one subject that most students don't like despite it teaching us may important and useful skills in our human life. Without the knowledge of mathematics, we are nothing in this world. Now-a-day's, it is very useful in our daily living, everything we do it involves mathematics. It has been accepted as an important component of formal

education from the ancient period to the present day. (Salvador et al., 2018). History shows that ancient scholars developed mathematics by practically being obliged by day-to-day problems. It emphasized language to communicate with other people, giving information and the like. Learning is an infinite process that requires time, effort, mind, and innovation (Dapitan et al, 2019). The Department of



Education is aiming for the quality of education where no child will be left behind. From the 20th century to the 21st century, the evolution of curriculum has been noticed. According to Republic Act, 10533 also called the Enhanced Basic Education Act of 2013 mandates the Department of Education to another two years of basic education and compulsory kindergarten. Way back to 2012 DepEd was implementing the K-12 program under the new Enhanced Basic Education which requires a Filipino child to undergo Kindergarten, Elementary, Junior High School, and an additional two years in Senior High School. Section 2 Article IV of the Code of Ethics for Professional Teachers mandates that as a teacher it is a must to do all the best preparation for every aspect of teaching. Thus, low performance in mathematics has evidence in our NAT result as the record attests of the National Achievement Test (NAT) of the last three years. According to the Department of Education or DepEd (2015), the new curriculum provides a solid foundation and deeper understanding in mathematics to students. More with secondary school students also stated that students with a positive attitude achieved better grades or performance in math than those with negative attitude who achieved poorer mathematics performance. From investigations, most secondary schools record the same pattern of poor mathematics performances year in, year out. The exit assessment of Senior High School testifies the poor performance in mathematics as record attests. In the National Achievement test of Kasiglahan Village Senior High School for the last three years in math, the result for the year 2017-2018 is 33.82% MPS only. For the school year 2017-2018, mathematics NAT result in KVSHS is the lowest of all other fields. The National performance of the Fourth year (Grade 10) public high school in National Achievement Test in terms of Mean Percentage Score (MPS) are 45.56% (2009-2010), 47.92%, (2010-2011), 48.90% (2011-2012) respectively. The result of the NAT exam got a very low mean percentage; it signifies that students have poor performance and retention levels in mathematics. Bawas and Cagas et al (2018) found out that the level of a problem-solving skills of Senior High School (SHS) students in General

importantly, it prepares students for the Global future and provides them the best possible tools and career choices after High School. It pertains to pave way necessary concepts and skills in life necessary for every Filipino learner as their preparation to the next stage in their life as life-long learners and responsible citizens of the country. The Department of Education Senior High School students are required to take two mathematics subjects. These subjects are General mathematics which is offered in the first semester, and Statistics and Probability offered in the second semester. All strands are required to take General mathematics. Strengthening mathematics learning among the students' in secondary schools is necessary as it brings about national progress and development.

According to Mata, and Monteiro et al. (2012), attitude is a reflection and students acquire positive attitudes towards mathematics as an effect of them of grade and achievement in math. Mato and De La Torre [4] in a study

mathematics is not satisfactory. The students as respondents have less mastery of the topics/competencies in General mathematics thereby reflecting a very poor problem-solving ability. The Philippines participated in Trends in mathematics and Science Studies (TIMSS), and out of 45 countries, based on the average scores of High school students that were tested in mathematics, the Philippines ranked 41 in the year 2003. The Philippines had a lower average compared to the international average in both math and Science. The different factors affecting the progress and development of students are the primary concern of Educators; the society in which these students live determines their purpose in pursuing a higher degree of education. The demands on technically skilled workers, the employability of graduates in different fields of expertise, and the nature of the country's industry are the factors considered in choosing a major course in college.

Geist (2010) stated that math anxiety and negative attitudes combined towards mathematics are serious problems for children in all levels of schooling. The negative attitude toward



mathematics is a big difference between levels of mathematics achievement. Several studies focus on biological factors only and other studies on psychological factors with different variables used as predictors in mathematics performance.

This study combined both biological and psychological factors with selected variables and applied them to five strands ABM, ICT, GAS, HUMSS, and STEM to determine the variables that affect the performance in General mathematics of Grade 11 Learners of the public Senior High School in Rodriguez, Rizal.

### 1.1 Objective of the Study.

The study aims to determine the following:

1. To determine what biological and Psychological factors that are significant predictors on their mathematics performance of Grade 11 Learners.
2. To identify the biological and Psychological factors that affects their mathematics performance per strand.

### 1.2 Theoretical Framework

The Theory of Individuality by Gordon Allport, states that every individual is Unique thus it varies in the combination and organization of traits that constitute the pattern, the strength of different traits, the core of pattern, self-concept. Allport referred to as "never repeated phenomena" as an individual. He stressed that the highest characteristics of man in his individuality. This theory of individuality is manifested by students who have different level of performance in mathematics. The first cognitive theorist, George Kelly he further explained this individuality theory that all human beings bear the same general mental abilities and capacities however there are individual's qualitative and quantitative differences in the development of abilities and capacities.

The second theory that supports this study is the cognitive learning theory by David Ausubel, states the individual learning is based upon what the individual already knows: the individual difference variable is

the cognitive structure or mental gap of existing knowledge. This is the belief of the students that they are able to acquire more knowledge if the new information is meaningful.

The third theory is "Gagne's Theory" (1985) the level of pre-requisite skills by the students may differ from one another, moreover, instruction must meet the needs of individual learners. This theory explains why students perform differently in mathematics even they are given the same instructions and topics in the class some are performing well others are not. Furthermore, Skinner Theory states that individual differences coming from the fact, each student comes from the different environments in which their learning behavior shaped and reinforced in diverse ways. Therefore, what may be considered positive reinforcement for one student may not promote the same learning for others? Teachers must adjust their instruction and create an environment which commensurate to the needs of the individual learner. The last theory that supports this study is the "Social Learning Theory as cited by Albert Bandura. He explains that self-efficacy influences an individual's choice, persistence, self-esteem. Self-efficacy is merely an individual concept. There are many levels of efficacy in every learning process. Self-efficacy describes how an individual reacts, feels, the response on her/his abilities or capabilities for every task.

### 1.3 Conceptual Framework

The concept of this study focused on the students' biological and psychological factors that affect students' mathematics performance in Kasiglahan Village Senior High School. The paradigm below consists of dependent and independent variables. The independent variables are Biological Factors such as age, sex and number of a sibling, sleep hour per day, birth order, weight, height, and nutritional status while Psychological Factors are math anxiety, attitude, self-efficacy, stress, depression, and suicidal behavior.



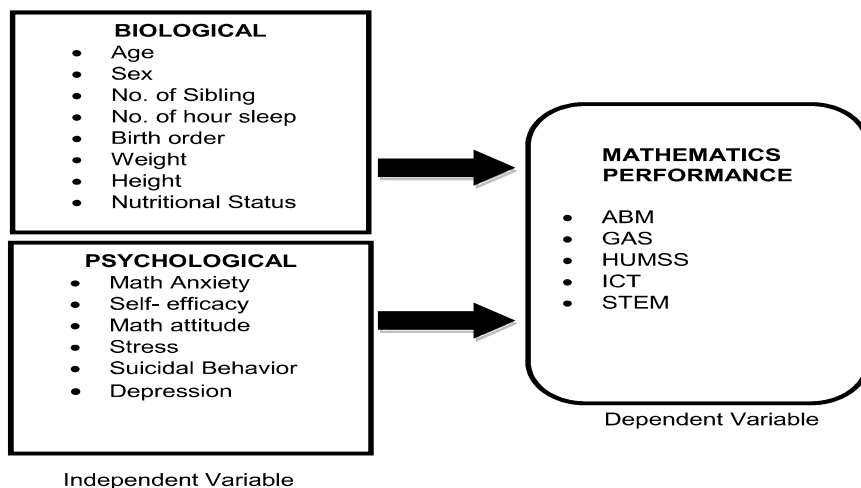


Fig.1 Schematic Diagrams of Independent and Dependent Variables of Different Strand

The dependent variable is the mathematics performance of the students per strand namely Accountancy and Business Management (ABM), Information and Communication Technology (ICT), General Academic Strand (GAS), Humanities and Social Sciences (HUMSS) and Science,

#### 1.4 Statement of the Problem

This study aims to determine the Biological and Psychological Factors that affects students' Performance in General Mathematics.

Specifically, the study aims to address the following questions:

1. What is the Mathematics Performance of Grade 11 learner in General Mathematics per strand?
2. What is the Biological assessment of Grade 11 learners in terms of:
  - 2.1 Age
  - 2.2 Sex
  - 2.3 Number of Sibling
  - 2.4 Blood type
  - 2.8 Sleep (Average no. of hour/day)
  - 2.9 Nutrition Status
3. What is the Psychological assessment of Grade 11 learners in terms of:
  - 3.1 Math Anxiety
  - 3.2 Self-Efficacy
  - 3.3 Attitude
  - 3.4 Stress
  - 3.5 Suicidal Behavior
  - 3.6 Depression
4. Is there a significant effect of Biological and Psychological Factors on the students' performance of Grade 11 in General Mathematics per strand?

Technology and Engineering Management (STEM). The respondents answered the adopted questionnaire for both public Senior High School in Rodriguez Rizal. The researcher comes up with the following paradigm to illustrate the problem

performance of Grade 11 in General Mathematics per strand?

#### 1.5 Scope and Delimitation of the study

The present study Biological and Psychological Factors that affects students' Performance in General Mathematics of Grade 11, limits to students in Kasiglahan Village Senior High School and San Jose Litex Senior High School who are officially enrolled. The study is limited to to the Final Grade in General Mathematics for two public Senior High School of Rodriguez Rizal, namely Kasiglahan Village Senior High School, and San Jose Litex Senior High School during the school year 2019-2020.

The instrument was limited only to the teacher adapted test survey questionnaire which was evaluated by the subject group head and school head for reliability and competency and will be given to the respondent to answer. The performance of students in General Mathematics and their factors that affect student's performance are among the subject matter under investigation.

#### Significance of the Study

The study intends and great significance to the following stakeholders:

Students. The outcome of this study may



provide a good development of attitude and belief in mathematics. It will also help the students to develop their interest and appreciate the importance of mathematics into their lives in terms of integrating the best modalities used by mathematics teachers.

**Teachers.** The result of the study will benefit the teachers to become more aware and skillfully in terms of teaching strategies and methodologies in a variety of students to help and assist them in their direct supervision and evaluation to encourage and motivate students to be interested in mathematics.

**School Administrator.** The result of the study will be of great help to decide on what kind of seminars and workshops are to be must be conducted to increase the teaching effectiveness and methodologies on teaching mathematics.

**Researchers.** The findings of this study will serve as a reference and primary resource for future researchers who will conduct a study related to the present topic.

## II. Review Literatures and Studies

This chapter presents a review of related literature and studies that gave the researcher background information about the study. Several literature and studies, both foreign and local, are discussed in this chapter which amplified the researcher's appreciation and understanding of the direction of the study.

### Mathematics

Mathematics is an academic subject that is often avoided if not feared by students. However, Mathematics as a difficult subject must be learned comprehensively and with much deep understanding. In the Philippines the Department of Education (DepEd) recognizes that the use of appropriate tools is necessary for teaching mathematics. These include manipulative objects, measuring devices, calculators and computers, smartphones and PCs, and the internet. (DepEd 2013 K-12 Mathematics Curriculum

Guide)

Maglonzo and Herrera (2011) have discussed some tips on how to make mathematics lessons fun and enjoyable. According to them, the teachers may start the lesson with Math songs or game activities and use a variety of manipulative materials. Let the children experience hands-on activities that will make the lessons more meaningful and enjoyable.

### Self-Efficacy

Male students are significantly more motivated in any situation. The study concluded that the findings prove the importance of self-concept and motivation to academic achievement. The concept of self-efficacy has its roots in Bandura's Social Cognitive Theory and rests on the premise that individuals' beliefs about themselves propel them to act in ways to either overcome obstacles in pursuit of desired goals or cave into them. It is a belief or pinion of individual to perform successfully to produce the outcome (Bandura, 1977). Self-Efficacy: Toward a Unifying Theory of Behavioral Change. Every individual acquires different self-efficacy claim motive in his or her capacity and ability to learn. The foundation to reach the goal of individual relies on his or her self-efficacy. If he believes that he can learn new behaviors, you will be much more successful in doing so (Fritscher, 2009, p. 1). When students achieve success, they develop self-efficacy. But if they have failure experiences, they tend to undermine their belief. Schunk (2008) noted that low achievers acquire low self-efficacy, whilst high self-efficacy are evident in high achievers. According to Riopel (2019), self- efficacy has a huge impact on those students bearing this biological factor states a positive motivation for behavior. It is the ability to succeed in how one thinks and feels, what goals he set, and how he accomplishes those goals. Strong self-efficacy, means strong resolve to face problems, deep interest to participate and commitment to any activities, and easier recovery from depression, disappointment, or



setback. Low-efficacy on the other hand, means avoiding challenging tasks, believing that difficult task is beyond one's control and capabilities, and focusing on negative outcome or personal belief, and sometimes lack personal faith of abilities and quickly lose self-confidence.

Sai Leela k. (2012) states that the study was the comparison between the self-regulation scale, self-efficacy scale and attitude towards mathematics scale concerning achievement test in mathematics. This study reveals that there is an achievement in mathematics of boys that is significantly greater than girls and there exists a positive and significant correlation between achievement and self-efficacy.

Panc, Mihalcea et al. (2011), emphasize in their study that self-efficacy is the most predictive under psychological factors. It is one way of measuring and validating how an accomplished his or her task in different areas of life.

### **Math anxiety**

Ngirande, Hlanganipai's study (2014), focused on mathematics anxiety levels at tertiary institutions in South Africa. The result shows a high level of mathematics anxiety among female students. Based on the result it worth noting that mathematics anxiety is one psychological factor that affects the student's achievement.

Parvathamma and Sharanamma's study (2010), focused on the relationship between the level of anxiety and level of academic achievement of IX students and to determine the level of anxiety between boys and girls. The result shows that there is a significant difference between the anxiety level of boys and girls and there is a significant difference between the self-confidence level of boys and girls.

Lai, Zhu, Chen et al. (2015), found that a high level of math anxiety performed poor in mathematics performance and vice versa. According to Divine and Fawcett (2012), girls showed a higher level of math anxiety compare to boys and yet the poor level of

mathematics performance. According to their study, math anxiety might develop during their primary years. This study also emphasized that girls have a higher level of math anxiety than boys which results in poor performance on mathematics.

Math skills are very important in our everyday life as we participate in our society and to struggle every aspect of our life (Maloney et al., 2010)

### **Attitude towards Math**

There are three categories of attitude responses that are classified into affecting, cognition and behavior. These three components capture the meaning of attitudes accurately (Brown, et.al 2012). A positive attitude towards Mathematics among the student has a big impact on math education. In Mathematics, an individual who has a positive attitude has the interest to learn more effectively. A student performs better if they like Mathematics. Contrary to that, negative attitude affects and has difficulty in learning Mathematics. To develop positive attitude the following behavior should develop in students: (a) Practicality, in mathematics a positive response considered as a tool in using Mathematics (b) Self-esteem to apply Mathematics in real-life situations, (c) Interest and desired to work cooperatively with others and to value the contribution of others (d) Determination to persist when solving problems and the different methods of attack and, (e) Willingness and determination in the pursuit of Mathematical knowledge.

The purpose of mathematics education is to pave fear or balance opportunities; the chance for individuals to acquire knowledge, rational skills for any individual and positive attitude is required to attain excellent performance in science and Mathematics education (Masafumi et.al, 2007)

Hamza, (2013) studied about the effect of lack of explanation on mathematics processes especially if poor step by step procedures in tacking the lesson. Results to additional difficulties came to





be the sequential nature of mathematics instruction as it becomes more contiguous and difficult. According to this, teachers must ask questions to assess understanding of the current topic, and allow them to have group activities with manipulative so the students could prepare and relaxed and that students won't be afraid to be called on to answer questions in front of their peers if they performed collaborative works with their peers.

### **Depression/ Stress**

Khurshid, Parveen, Yousuf, & Chaudhry, (2015) states that practice and good treatment correspond to a good mood of the learner and it helps in facing complex cognitive problems and has a big impact in memory, it strengthens confidence, smoothens learning process and negative mood it reflects depression and poor performance in mathematics. If training and treatment are provided to a learner's stress tolerance and good impulse control strategies it paves the way to the personality of the learner to deal with different unexpected occurrences it helps to increase academic performance if they can control and manage time. Students who are depressed while studying cannot focus properly and ignore doing coursework. The result showed that there is a significant difference in students with low, medium, and high levels of depression in academic performance.

Mandale (2010) noted that if the learners are provided training and practice in dealing with stress and they can control and manage their stress it results in the best way academic processing exists.

### **Sleep**

According to McGill University, a good night's sleep or quality of sleep has a better performance by school children in math and languages subject. According to the researchers reported the "sleep efficiency" has a higher performance in those key subjects.

University of Granada (2011) states that

Adolescents who sleep better score higher in Math and Physical Education. The researcher found out information with sleep latency is very significant. It was found out that sleep patterns influence academic performance because adolescents with less daytime sleepiness got a higher mark than their classmates. According to this study, those who sleep between six to ten hours got a significantly better score than those with 6 hours or less per night.

Rina Bhattacharya and Dr. Bhattacharya (2015) found out that cognitive and non-cognitive affect the performance of the students particularly the GPA (Grade Point Average) Stress of the students can be classified into emotional example are fear, anxiety, worry, guilt, grief, or depression, while cognitive reactions example are an appraisal of stressful situations and strategies, for behavioral example crying, abuse of self or others, smoking and irritability and physiological example are sweating, trembling, stuttering, headaches, weight loss or gain, body aches

Manjuvani and Anuradha (2011) compared single-parent and two-parent families which among can support motivation. It revealed that children of single-parent families differed significantly in achievement motivation from the children of two-parent families. It was also found out that parental guidance developed the need for high achievement.

Bahago (2011) studied the achievement motivation and demographic characteristics of how it influences the academic performance of Fulani girls in Adamawa state. The study results that students with high achievement motivation performed higher in academics that revealed a significant relationship between achievement motivation and academic achievement. The level of education by the parents is a big factor in the achievement of learner's motivation towards their performance.

Sharma and Tahira (2011) researched in



western Uttar Pradesh in India the parental education, parental occupation, and family size on the science achievement of secondary school students. The results of the study found out that family variables including parental education had a significant relationship with the achievement of their children.

### Sex

Rajni (2009) investigated the relationship between cross-gender identity and Mathematics anxiety. It was found out High masculine females exhibited low mathematics anxiety as compared to low masculine females. It was found out on mathematics anxiety no significant difference between high and low feminine males. The result of Cross-Gender Identification for mathematics performance and gender differences was explained the advantages.

Kiwanuka et al (2015) state that parental support is associated positively with students' performance in Mathematics. One of the Uganda study as for gender concluded that boys perform better in Mathematics (Ochwo, 2013) However, Namusisi (2010) noted that girls outperform boys in primary schools, likewise, teachers themselves are amazed if a girl performs well in the subject, because they have their notion traditionally the girls have been taken to be poor in Mathematics which inconsistent observation.

Asante (2010) according to his studies that sex has differences in mathematics performance. It revealed in his study that in favor of male has a big difference than female. Also, the great size effect corresponds to sex differences. It concluded that there is a significant sex difference between boys and girls in Senior High School in Ghana in mathematics performance.

### Height

Gorry (2016), states that height is related to the better academic labor market and health outcomes. Yet tall individual excels not thoroughly understood.

This study provides new evidence that differential treatment across stature may also contribute to the disparity in academic outcomes. This study provides evidence that through a height premium in several academic outcomes that only exists in large schools. However, the tall students are better able to acquire human capital building resources in large school settings as evidence proved.

### Blood Type

Kim and Yi (Seoul University of Venture & Information, 2015) according to light topography that persons with blood type O are stress-resistant and it concluded that different blood types of a person in the different activated brains of the human beings.

From Wikipedia (2015), Blood type O signifies confident, self-determined, ambitious, strong-willed, intuitive, agreeable, competitive, and athletic. The following traits such as unpredictable, spiteful, self-centered, cold, aggressive, arrogant, envious, and ruthless are reflection for the worst trait. Whilst Blood Type A deals with warm, reserved, sensible, patient, responsible, perfectionists, wise, and cautious. Studies suggest that there is a significant relationship between personality and blood type. Medical hypotheses support blood personality theory.

### Nutrition Status

Ross (2010) focuses on nutrition and its relationship to brain function, cognition, learning, and social behaviors. According to this study that nutrition has a direct effect on the performance and school behavior of a person. Based on the literature I reviewed nutrition has a direct effect on neurotransmitters which transfer messages to the brain. Lack of food for children has a direct effect on cognitive development and social suicide Behavior

Brickel and Associate (2015) state that this is a topic most people should aware of since it is a scary subject matter and how to help those people underlying this situation. Suicide is not rare, in fact,

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ages from 10 to 24 it is the second cause of death. Many people plan and tell other to hurt themselves before they die by suicide according to American Society for Suicide Prevention. Most Teens and young adults if they have difficulties condition they can't handle their feelings and emotion because their brain is still underdeveloped the capacity range they can afford to tolerate. According to psychologist Daniel Siegel, "emotional spark" of adolescence wherein emotions increased rapidly and intensely that people during adolescence are susceptible to suicide ideation than other points of life.

### III. Methodology

It deals with the systematic procedure towards a solution to the problem.

To get sample size was determined using the Cochran's

The formula is as follows

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:  $e$  is the estimated level of precision (margin of error)

$p$  is the estimated proportion of the population

$$q = 1 - p$$

$Z$  selected critical value of desired confidence level

$n_0$

is

the

sample

so, 
$$n_0 = \frac{(1.95)^2 (0.5)(0.5)}{(0.05)^2} = 384.16 \approx 385$$

Therefore,

$$n = \frac{385}{1 + \frac{385-1}{1221}} = 292.8 \sim 293$$

The sample obtained was 293. However, the researcher opted to include 385 respondents to attain a more valid result. Furthermore, Stratified Random Sampling was used in determining the distribution of respondents per strand to make sure that there will be a proportional representative from each strand.

### Research Instrument

This includes the locale of the study, research design, the respondents of the study, the data gathering procedure that was used in collecting data, the procedure for data analysis and the statistical measures that were used in the study. This study used the descriptive method of research. The researcher aimed to describe the Biological and Psychological Factors that affect the students' Performance in General Mathematics of grade 11 students. The researcher used five strands who are taking General Mathematics and random sampling in every strand. The researcher adopted a set of questionnaires to determine the factors that affect the students' performance in General mathematics., ICT-6 sections, and STEM -3 sections.

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

The researcher adopted sets of questionnaires. It was used to determine the assessment, and relationship on Biological and Psychological factors that affects the students' performance in General Mathematics per strand. The Mathematics Attitude Instrument (Modified Fennema-Sherman Attitude Instrument) was adopted from the study of Costoy



(2012). It was 30 items made up of 21 positively worded and 9 negatively worded statements in which the respondents were expected to respond expressing their agreement or disagreement on a five-point scale of Strongly disagree, Agree, Undecided, Disagree and Strongly disagree.

Mathematics Anxiety Rating Scale (MARS) developed by Richardson and Suinn (1972) is a much-utilized instrument for measuring math anxiety, used the method of Likert's technique, and Fennema-Sharman (1976) Scoring. Math Anxiety instrument from Mahmood and Khatoon (2011) from their study of Development and Validation of math Anxiety Scale.

While instrument of Self-Efficacy Scale (SSES) by Tsai, Chaichanasakul, Zhao, Flores and Lopez (2014). It consists of 8 statements to answer by the respondents.

The study utilized descriptive measures. Likert-type scales used to describe the attitude, math anxiety, self-efficacy of students toward mathematics. The respondents were asked to respond to the statements by marking a scale of "strongly agree", "agree", "undecided", "disagree" and "strongly disagree" Positively worded statement responses were scored as 5 = strongly agree, 4= agree, 3 =

Undecided, 2= disagree, 1=strongly disagree.

### Data-Gathering Procedure

Foremost step, a letter of request to the DepEd superintendent, principal, and parents of participants to conduct a study was sent. The researcher made a letter of request to conduct for a pilot test for other public senior high schools in Rodriguez Rizal for almost two weeks namely Southville 8B Senior High School and San Isidro Senior High School and have 285 participants for the pilot test. The results were analyzed and some unnecessary question was deleted. In this study, the researcher asked Grade 11 students to be the respondents among 22 sections as follows, ICT -6 sections, GAS-2, ABM-5, HUMSS-6, STEM-4 sections, who are taking General Mathematics subject under the supervision of the researcher and other teachers in two different schools which is the common strand for both school. Another two weeks was allowed to gathered data for the respondents. The participants are a random selection on a different strand. Proper validation of the adapt test questionnaire thru parallel examinations subjected to the expert persons, Principal, STEM Subject Group Head

### Statistical Treatment of Data

1. **Mean.** Mean was used to describe the profile of the respondents with continuous data, e.g. Number of siblings, height, weight, and the number of sleeping hours: And to describe some psychological

$$\bar{x} = \frac{\sum x}{N}$$

where:

$\bar{x}$  is the mean of the data

X is the given data

N is the number of all given data

variables such as mathematics anxiety, self-efficacy, and attitudes towards math. Mean which is equal to the sum of all values in the data set divided by the number of values in the data set.



2. **Frequency and Percentage Distributions.** Frequency and Percentage Distributions were used to describe the profile of respondents with categorical variables, e.g. strand, sex, blood type, nutritional status, etc. This was also used to describe the level of stress, suicidal risk behavior, and level of depression
3. **Stepwise Regression Analysis.** To determine which among the biological and psychological factors and their combination (composite factors) are significant predictors of General Mathematics performance of students grouped by strand.

The formula for Stepwise Regression Analysis:

$$b_{jstd} = b_j \left( \frac{S_{X_j}}{S_y} \right)$$

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where  $s_y$  and  $s_{x_j}$  are the standard deviations for the dependent variable and the corresponding  $j$ th independent variable

#### IV. Result and Discussion

The table illustrate the results of the multiple regressions, analyzed per strand using the Stepwise method, to determine which among the biological and the psychological factors are considered as significant predictors of Mathematics performance.

#### Significant Predictors of General Mathematics Performance among ABM Students

Table 1

Predictor (s)	$\beta$	$t$	$p$	Adj. $R^2$	$F$	$p$
Sex	-2.571	-2.332*	.022	.043	5.440*	.022
Math anxiety	-2.400	-2.851**	.005	.068	8.127* *	.005
Math anxiety Suicidal behavior	-2.209 -0.426	-2.686** -2.548*	.009 .012	.118	7.541* *	.001

\*\* Significant at the  $p < .01$ ; \* Significant at the  $p < .05$

Table 1 shows the significant predictors of grades in General Mathematics among ABM students. It could be seen from the table that among the biological variables, only sex ( $t = -2.332$ ,  $p < .022$ ) is found to be a significant predictor of Mathematics grades for this student group. Dummy variable was used to code sex (1 = male, 2 = female). The negative

value depicts that lower number of females the higher positive effect on Mathematics performance. This could mean that males (with the lower code number) performed better than females. Sex explains only 4.3% of the variance in Math grades, but the explanatory model is significant at  $F = 5.440$ ,  $p < .022$ .



On psychological factors, Math anxiety ( $t = -2.851, p < .005$ ) is a significant predictor of Mathematics performance. The negative value depicts that lower Math anxiety has a positive effect on Math performance. Math anxiety explains 6.8% of the variance in the dependent variable and the regression model is significant at  $F = 8.127, p < .005$ . When suicidal behavior was added in the model, the adjusted  $R^2$  has increased to 11.8%. The negative value suggests that lower suicidal behavior tendency is associated with higher Mathematics performance. Results revealed that Mathematics anxiety ( $t = -2.686, p < .009$ ) and suicidal behavior ( $t = -2.548, p < .012$ ) have a collective significant effect on Mathematics achievement. This predictive model is found to be significant at  $F = 7.541, p < .001$ .

It signifies that among the Biological factors only sex has significant in mathematics performance of grade 11 learners and on Psychological Factors only Math anxiety and suicidal behavior have significant in general mathematics performance as

data presented above. According to the study of Asante (2010) and the Center for Diseases Control and Prevention (2011) every year high percentage died in suicidal and ranked 11th for the cause of death and the third leading cause among young people anywhere in the world.

Arthur and Sam (2019) both female and male under the ABM strand result in average performances in Mathematics as passing marks. However, performance is not highly competitive in terms of a higher level of education. According to Biliran (2018), students under this strand are expected to have numerical, leadership, interpersonal, and communication skills wherein these skills help to how to manage a company and how to interpret financial statements and decision making. Matthew (2019), based on his research said that senior high school students showed that math performance is affected by math anxiety.

**Significant Predictor of General Mathematics Performance among GAS Students**

Table 2

Predictor(s)	$\beta$	$t$	$p$	Adj. $R^2$	$F$	$p$
Math anxiety	-1.636	-2.224*	.032	.090	4.945*	.032

\* Significant at the  $p < .05$

It portrays the significant predictor of Mathematics performance among GAS students. Stepwise regression revealed that no biological factors while only Mathematics anxiety ( $t = -2.224, p < .032$ ) among the psychological factors was found to have a predictive relationship with the said academic performance. The predictive model was significant at  $F = 4.945, p < .032$ . The GAS students' scores in

Mathematics anxiety explained 9.0% of the variance in their grades in General Mathematics. Results showed that lower Mathematics anxiety contributes to higher grades in Mathematics among GAS students.

According to Biliran (2018) students under this stand are still not so sure what they will take in college. Therefore, the students are called "jack of all trades"



it means that students are skilled in different subjects and possess strength from STEM, ABM, and HUMSS. For the HUMSS students, not one among biological and psychological variables did not significantly predict their Mathematical performance. It indicates that HUMSS strands overall mean of 84.09% in mathematics performance fall on a qualitative description of fairly satisfactory which signifies none predictors on their mathematics performance.

According to Biliran (2018), students under the HUMSS strand are expected to be excellent in communication and interpersonal skill and a challenge to faced is reading and writing and another output like poems, painting, and speeches since HUMSS is not inclined to mathematics. Those activities require communication skills, creative and analytical. This strand learners are aiming to take journalism, liberal art, and other science which little mathematics subject. It establishes and contributes

self-confidence, self-esteem, and communication to a lot of people through the activities offered in this strand since HUMSS stands for public service. However, they can also understand numbers but that is not their priority. "We can deal with anything, it's just a matter of priorities"

Mamolo (2019), found in this study that HUMSS strand focuses on theoretical aspects, hands-on experiences, and molding liberal arts foundation. Students with math anxiety chose this strand because it offered minimal math subjects on their curriculum compared to other strands. The result showed fair competency of senior high school in General Mathematics. It signifies that learners are not mastered yet the competencies implemented by the Department of Education.

**Significant Predictor of General Mathematics Performance among ICT Students**

Table 3

Predictor(s)	$\beta$	$t$	$p$	$Adj. R^2$	$F$	$p$
Age	-2.147	-2.977	.004	.075	8.864**	.004
Math-anxiety	-1.636	-2.224*	.032	.090	4.945*	.032

\*

Significant at the  $p < .05$

Table portrays the significant predictor of Mathematics performance among ICT students. Stepwise regression revealed that only one biological factors age ( $t=-2.147, p < .004$ ). It indicates that age with a 7.5 % variance in their math grade but a predictive model  $F= 8.864, p < .004$ . While Mathematics anxiety ( $t = -2.224, p < .032$ ) among the psychological factors was found to have a predictive

relationship with the said academic performance. The predictive model was significant at  $F = 4.945, p < .032$ . The ICT students' scores in Mathematics anxiety explained 9.0% of the variance in their grades in General Mathematics. Results show that lower Mathematics anxiety contributes to a higher grade in Mathematics among ICT students.

Pena (2017), and Patalay (2015) states that



success differed from the ability due to difference in maturation whilst the oldest children have an advantage over those of youngest children as reported on different score performances was

indicated different levels of maturity.

Albion (2011) says that students showed confidence using computer technology more confidence according to age.

### Significant Predictor of General Mathematics Performance among STEM Students

Table 4

Predictor(s)	$\beta$	$t$	$p$	Adj. $R^2$	$F$	$p$
Math anxiety	-0.509	-2.509*	.018	.142	6.295*	.018

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\* Significant at the  $p < .05$

Table presents the significant predictor of Mathematics performance among STEM students. Stepwise regression revealed that no biological factors while only Mathematics anxiety ( $t = -2.509$ ,  $p < .018$ ) among the psychological factors was found to have a predictive relationship with the said academic performance. The predictive model was significant at  $F = 6.295$ ,  $p < .018$ . The STEM students' scores in Mathematics anxiety explained 14.2 % of the variance in their grades in General Mathematics. Results show that lower Mathematics anxiety contributes to a higher grade in Mathematics among STEM students who garnered the highest percentage among the five-strand.

Among the five strands, four stands (ABM, GAS, ICT, STEM) have common psychological factors that have significant predictors on their math performance which is Math Anxiety. It only shows that it is normal for every respondent per strand to have fear in math and how they respond to math in different areas of life in different teachers and situations. According to the theory of Taylor and Brooks (2011) that many students have a negative feeling on math which result in anxiety and subsequently result in low performance in math. However, they stressed that this feeling can be taken

from negative classroom experiences, from parents' attitudes towards math and societal stereotyping of mathematics. They believe that learning math is developmental and it takes time and practice. According to them, the negative notion can be changed if there is a classroom supportive environment and have concrete manipulative materials to bridge the gap between concrete and variety of teaching, abstract learning.

Biliran (2018), noted that students under the STEM strand must adept in memorizing formulas, computing numbers and analyzing problems and expected to conduct experiment and research to apply and test the theories they learned.

### V. Conclusion and Recommendation

Based on the findings of the study, the following conclusions were drawn:

1. Senior High School public respondents both Kasiglahan Village Senior High School and San Jose Litex Senior High School, STEM strand have outstanding performance in General Mathematics. This indicates that Mathematics Teachers have more or less the same strategies, perception in giving grades to the students. Furthermore, Mathematics teachers have strong assessment in





giving grades for the performance of the students.

2. Among the Biological Factors, only sex has significant to predict on their mathematics performance for the strand of ABM, and age for ICT strand. On other hand HUMSS strand has no one among the factors has significantly predict to their mathematics performance.
3. On Psychological Factors, only Math Anxiety and Suicidal Behavior have significant to predict their mathematics performance for ABM. Four strand which are ABM, GAS, ICT and STEM have common significant predictors which is math anxiety. However, the HUMSS strand that has no among psychological variables did predict to their mathematics performance.
4. Among the Biological and Psychological Factor used in this study, it is concluded that the only factors have significantly predict their performance in mathematics are sex, age, math anxiety and suicidal behavior in different strand. But among the four stand they have common psychological factor that predict significant which is math anxiety

### Recommendations

In view on the analysis of the data and the conclusions drawn, the following recommendations are offered:

1. Mathematics teachers and, parents may encourage and to motivate their students to have good study habits, positive self-concept, and attitude. Teachers have direct supervision and may know the variety of learners' strategies to adopt and learning materials suited to their level of abilities and capacities.
2. Principals and, Subject group heads may choose seminar, workshop, and rigid training for mathematics teachers to increase effectiveness and methodologies in teaching mathematics that may appropriate for the variety of learners
3. Curriculum and instruction specialists may develop a program that may strengthen the curriculum in Mathematics that help students' opportunities in different strand to explore their mathematical ideas and obtain skills and help teachers' competence to succeed in 21st-century society.
4. Future researchers may have further studies investigating biological and psychological factors that

can predict their performance in General Mathematics. They may consider other variables for the variety of learners in order to identify predictors in mathematics performance of HUMSS strand.

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