

# Predictors of Learning Difficulties in General Mathematics

Charlyn C. Satira, Rommel W. Otero\*

enchailygne@gmail.com, rwotero.deped@gmail.com

*DepEd Carcar City Division, Pob.III Nellas St., Carcar City Cebu 6019, Philippines  
Cebu Normal University, Osmeña Blvrd, Cebu City 6000, Philippines*

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## Abstract

This study aimed at determining the relationship of learning difficulties along with sex, age, parents'/guardians' highest educational attainment, SES, previous Mathematics grade and math anxiety.

Multiple regression was used to examine the predictive strength of the independent variables to learning difficulties. The respondents were purposively selected i.e. only those whose academic grade for the first quarter is below 80.

It is revealed that there is weak correlation between learning difficulties and the predictors. Each predictor did not also show significant correlation to learning difficulties. This study provided avenue to conduct another research looking into identifying some other variables and their predictive effects on the learners' learning difficulties.

Published by IJRP.ORG. Selection and/or peer-review under responsibility of International Journal of Research Publications (IJRP.ORG)

**Keywords:** Learning difficulties; mathematics anxiety; socioeconomic status; previous Mathematics grade

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## Introduction

Mathematics, through times, is still considered as one of the most feared subjects among students from elementary to tertiary level. Nevertheless, the subject continues to be an integral part of ones' success across many fields. In fact, this has been part of the mandatory subjects to get completed in all educational levels. Although, there are a lot of sad realities in any endeavor, Mathematics learning was never excused to it.

In an international assessment test, the Philippines showed a deteriorating performance in Mathematics with an average score of 378 out of 467. This is one appalling performance uncovered by the House of Senate in 2008.

Previous studies have identified some learning difficulties associated with the cognitive, affective and psychomotor domains as well the physical environmental factors.

Learning difficulty as defined by the Salvesen Mindroom System is a problem associated with difficulty understanding cognitions and emotions that hamper ones' capabilities to learn, join others and follow conventions, be it social or not. A lot of things can happen in a day that can make a learner lose his

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focus, attention or his sense to make meaning from what has been read and written - a fact that can also happen to anyone. However, when the unfavourable characteristic is becoming prominent already, it turns into a learning difficulty. A difficulty is merely an obstacle that hampers that normal process of processing things.

An article on mental health pointed that a person suffering from a learning difficulty has some problems processing information that do not necessarily have some bearing on one's IQ. However, some cases may confront making it hard to distinguish a learning difficulty from a learning disability, which pertains to general impairment on the learners' cognitive development.

On an article on learning difficulties published in Good Therapy, it is described as a brain issue to process information where learners may not be able to learn as quickly as the others, who may find some aspects of the learning material difficult to process and understand and whose development skills do not come as proceed normally as the others. If not cured, these difficulties could have a lasting impact on the individual's overall performance in the academic, workplace and even in fostering relationships with other people.

It is particularly mentioned that learning difficulty affects someone's reading, writing and math skills as the learners' cognitive brain functioning has been affected by some internal and external factors. Learning difficulties need alternative learning methods. While there are others that are mild, there are some that gives bigger impact on the overall academic performance of the learners. However, there are an ample behavioural teaching method that can be used or tailored specifically for the type of learning difficulty that the learner has and an intervention is very much important. And while the causes are not clear yet, many researchers believe that genetic influences, brain development and environment affect the likelihood for a learner to encounter some difficulties learning a particular subject.

A learning difficulty might be a term to refer to a hidden disability, as no person would announce his specific difficulties in grasping information. It can be verbal or nonverbal. Identifying the problems commonly faced by students is important for teachers to reduce or better eliminate them so that students can in a large and meaningful way achieve the competencies in mathematics as showcased in their improved performance.

Mathematics is cumulative by nature thus prior knowledge is viewed very much important. Its nature is very abstract that often demands for higher cognitive processes, challenging and engaging activities that will make a learner delve into challenging brain-based activities. As per Annual Status of Education Report (ASER, 2014), it is found out that those students who move to higher grades whose previous knowledge could not support much of the newly added knowledge perform worse.

Difficulty learning mathematics is found to be a common and perennial problem throughout the school years. As reflected in the NAT results in Maximino Noel Memorial National High School for the Grade 10 students of the school year 2012 - 2013, the average was 53.95% and 60.54% for 2014 - 2015 which is a lot lower than the benchmark MPS of 75%. The same lower percentage figures are presented in the Annual Status of Education Report (ASER, 2014) where 50% of standard fifth students did not achieve even the standards of grade two and 44% of eighth standard students did not achieve even basic skills in the arithmetic.

The trend in MNMNHS has been worrisome already. The same worry is reported in ASER on the trend that students' arithmetic skill has been dropping since 2010 from 68.3% to 44.1% in 2014. A figure that constitutes to nearly half of the population who still doesn't have the basic math skills.

Zan and Matino (2008, as mentioned by Capili 2012) said that students' perception towards mathematics as well their beliefs on the capacity to learn it are influencing the students learning. There are some factors external to the learner that influence them from learning the subject. Poor attitudes by both teachers and students are some major factors contributing to poor performance in mathematics education. Most students struggle in accomplishing their math task as influenced by their conception on how those concepts can be applied in the real world or their future job endeavours. It is a common question to teachers

from students as to how relevant mathematics is in the lives of the students in the future.

In his study on sex differences in relation to math performance, Ganley, et.al (2017) found that sex differences are cognitive and affective predictors of math achievement, including spatial skills and math attitudes. They added that it is important to determine whether there are sex differences not only in the predictors themselves, but also in the nature of their relation to math achievement. In a similar study conducted by Benson, et.al (2014), it is revealed that, despite similar levels of math performance for boys and girls, the significance of predictors varies as a function of sex. Specifically, spatial skills predicted math performance in boys, but not in girls. They suggested that sex differences in spatial reasoning in conjunction with the differential involvement of spatial reasoning in math problem solving may lead to later sex differences in math outcomes. On a different study conducted by Desarollo (2007), it is revealed that parental involvement and help from other family members has shown significant improvement in students' achievement.

In a study conducted by Clements (1979, as cited by Pomerantz, 2006) on sex differences in mathematical performance, it is suggested that mathematics don't generally appeal to most girls. However, in a similar study conducted by Pomerantz, et.al (2006) yield a somewhat opposing result where girls have the tendency to outperform boys since they approach schoolwork way different from those of the boys. It is revealed in the study that girl's learning strategies and self-efficacy in math were more likely to hold mastery over boys as it them who would often do away with showing disruptive behaviours in the classroom and often show effortful learning outputs. Therefore, girls have better average grades than boys.

Van Steenbrugge (2008) articulated that there is lack of research about Mathematics learning difficulties and the proven need to start early interventions to cope with related difficulties. More so, that there are only a few studies that give more concerns to the senior high school students. In this vein, the researcher felt the need to know the real score of Mathematics learning – the difficulties students faced in mastering it – to address some problems to it that have been grappling in the school.

## **Purpose of the Study**

This study focused on determining the predictive effects of sex, age, parents'/guardians' highest educational attainment, SES, previous Mathematics grade and math anxiety on the students' learning difficulties in General Mathematics. Most studies investigated the predictive capacity of some factors that do not include, specifically, math anxiety on a students' learning difficulty and even more on disability. Also, this study revisited the effectiveness of the curriculum to check whether the Grade 11 students are fit to learn all the competencies stipulated in it. Moreover, more studies have focused on the elementary and junior high school learners but very few on senior high school learners. Thus, this study could timely address some of the Grade 11 students' learning difficulties since the beginning of the implementation of the SHS curriculum.

## **Research Question**

What is the multiple correlation between the predictors (age, sex, parent/guardian's highest educational attainment, SES, previous Mathematics grade and math anxiety) and learning difficulties in General Mathematics?

## **Research Methodology**

### **Design**

This study took place in Maximino Noel Memorial National High School at Graje, Guadalupe, Carcar City, Cebu. This school offers complete junior and senior high school with a total population of 1009. 163 of them comprised the senior high school students where 86 of them are Grade 11 students. The senior high school department offers Technical-Vocational-Livelihood track with specializations on Shielded Metal Arc Welding, Bread and Pastry Production and Cookery.

This study is a multivariate study employing multiple regression analysis to determine whether the predictors (age, sex, parent/guardian's highest educational attainment, SES and math anxiety) predict the performance of the Grade 11 students in their final test.

The researcher purposively selected the students whose Midterm Final Grade in Mathematics is below 80 or whose grades did not reach mastery level. Of the 86 Grade 11 students, 16 of them qualify the criterion given.

### **Data Collection Procedures**

The respondents of the study were asked to participate voluntarily in this study. It is the result of the midterm test that was analysed with reference to the curriculum guide to elicit the needed information on students' learning difficulties. Another survey questionnaire was given to gather the students' data on age, sex, parents'/guardian's highest educational attainment and math anxiety.

### **Data Collection Measures**

Other than the demographic information that were asked to the respondents, a questionnaire on Math Anxiety was given. Items of which were rated using a 4-point scale. The Math Anxiety of the students was measured using a 15-item questionnaire with a Cronbach's alpha of 0.918. The mean score for each student were interpreted as follows: very low, low, high and very high anxiety.

Frequency counts and simple percentages were used to determine the learning difficulties of the Grade 11 students for the first quarter of the first semester SY 2018-2019. The midterm test items were examined and found to have a Cronbach's alpha of 0.789. Multiple linear regression analysis was used to determine the predictive capacity of the predictors (age, sex, parents'/guardian's highest educational attainment, SES and math anxiety) with respect to students' learning difficulties in General Mathematics.

## **Research Findings**

Table 1 showed the learning difficulties of the Grade 11 students on their final test for the first quarter in General Mathematics. Individual learning difficulties was measured by the number of incorrect responses the respondents got from the test. The highest of which, identified their learning difficulty of the subject. As was shown on the table, there are 4 students respectively or 25% of the respondents who had learning difficulties on graphing inverse functions and graphing exponential functions. Another two respondents had difficulty on rational functions, equations and inequalities while the rest have difficulty on evaluating functions, solving rational equations and inequalities, representing rational functions, distinguishing exponential functions, and equations and inequalities.

Consistent with other research findings on graphical analysis among the students in Maximino Noel Memorial National High School, it was revealed that students are not competent in their graphical analysis and comprehension on data presented in graphs.

Table 1: Learning Difficulties of the Grade 11 Students on the Final Test for the First Quarter in General Mathematics

| TOPICS                                            | No. of Students | Percent     |
|---------------------------------------------------|-----------------|-------------|
| Evaluating Functions                              | 1               | 6.25%       |
| Rational Functions, Equations and Inequalities    | 2               | 12.5%       |
| Solving Rational Equations                        | 1               | 6.25%       |
| Solving Rational Inequalities                     | 1               | 6.25%       |
| Representations of Rational Functions             | 1               | 6.25%       |
| Graphs of Inverse Functions                       | 4               | 25%         |
| Exponential Functions, Equations and Inequalities | 1               | 6.25%       |
| Solving Exponential Functions and Inequalities    | 1               | 6.25%       |
| Graphing Exponential Functions                    | 4               | 25%         |
| <b>TOTAL</b>                                      | <b>16</b>       | <b>100%</b> |

The Pearson Product-Moment Correlation Coefficients ( $r$ ) was conducted to determine whether there exists a relationship between the dependent variable - learning difficulties and the independent variables which are age, sex, parents' / guardian's highest educational attainment, socioeconomic status and Mathematics anxiety.

Table 2 showed weak positive correlation of  $n = 16$ ,  $r(16) = 0.156$  and  $p > 0.05$  between learning difficulties and age. This result did not show significant relationship between learning difficulties and age. Age does not have significant relationship or effect on the students' learning difficulties in learning the subject.

Table 2. Pearson Correlation of Learning Difficulties, Age, Sex, Parents'/Guardian's Highest Educational Attainment, Socioeconomic Status and Mathematics Anxiety

| Correlations              |                     |                           |       |     |                                                   |                              |                                    |                             |
|---------------------------|---------------------|---------------------------|-------|-----|---------------------------------------------------|------------------------------|------------------------------------|-----------------------------|
|                           |                     | Learning_<br>Difficulties | Age   | Sex | Parents_<br>Highest_<br>Educational<br>Attainment | Socioeco<br>nomic_<br>Status | Previous_<br>Mathematic<br>s_Grade | Mathemat<br>ics_<br>Anxiety |
| Learning_<br>Difficulties | Pearson Correlation | 1                         |       |     |                                                   |                              |                                    |                             |
|                           | Sig. (2-tailed)     |                           |       |     |                                                   |                              |                                    |                             |
|                           | N                   | 16                        |       |     |                                                   |                              |                                    |                             |
| Age                       | Pearson Correlation | .156                      | 1     |     |                                                   |                              |                                    |                             |
|                           | Sig. (2-tailed)     | .563                      |       |     |                                                   |                              |                                    |                             |
|                           | N                   | 16                        | 16    |     |                                                   |                              |                                    |                             |
| Sex                       | Pearson Correlation | -.488                     | -.448 | 1   |                                                   |                              |                                    |                             |
|                           | Sig. (2-tailed)     | .055                      | .082  |     |                                                   |                              |                                    |                             |
|                           | N                   | 16                        | 16    | 16  |                                                   |                              |                                    |                             |

|                                                              |                     |       |       |       |        |       |       |    |
|--------------------------------------------------------------|---------------------|-------|-------|-------|--------|-------|-------|----|
| Parents_<br>Highest_<br>Educational_<br>Attainment           | Pearson Correlation | -.110 | -.283 | .342  | 1      |       |       |    |
|                                                              | Sig. (2-tailed)     | .684  | .288  | .195  |        |       |       |    |
|                                                              | N                   | 16    | 16    | 16    | 16     |       |       |    |
| Socio-<br>economic_<br>Status                                | Pearson Correlation | .488  | -.465 | -.238 | .219   | 1     |       |    |
|                                                              | Sig. (2-tailed)     | .055  | .070  | .375  | .415   |       |       |    |
|                                                              | N                   | 16    | 16    | 16    | 16     | 16    |       |    |
| Previous_<br>Mathematics_<br>Grade                           | Pearson Correlation | .033  | -.143 | .397  | .705** | -.015 | 1     |    |
|                                                              | Sig. (2-tailed)     | .902  | .596  | .128  | .002   | .957  |       |    |
|                                                              | N                   | 16    | 16    | 16    | 16     | 16    | 16    |    |
| Mathematics_<br>Anxiety                                      | Pearson Correlation | .167  | .428  | -.346 | -.086  | .015  | -.196 | 1  |
|                                                              | Sig. (2-tailed)     | .536  | .098  | .189  | .752   | .955  | .467  |    |
|                                                              | N                   | 16    | 16    | 16    | 16     | 16    | 16    | 16 |
| **. Correlation is significant at the 0.01 level (2-tailed). |                     |       |       |       |        |       |       |    |

On a study conducted by Kidspot, it was found out that age isn't a significant factor in diagnosing a learning difficulty of a learner as learners learn at different pace, at different age. Mental cognition develops distinctively among learners.

It is also shown in table 2 that there is moderate negative correlation of  $n = 16$ ,  $r(16) = -.488$  and  $p > 0.05$  between learning difficulties and sex. This result showed no significant correlation between learning difficulties and sex.

Consistent with other research finding conducted by Liukkonen (2017), it is revealed that there is no significant trend of change in performance of students along with sex.

Also, there is low negative correlation of  $n = 16$ ,  $r(16) = -.110$  and  $p > 0.05$  between learning difficulties and parents' or guardian's highest educational attainment. This result showed no significant correlation between learning difficulties and parents' or guardian's highest educational attainment.

On a study conducted by McNeal (2014), it is revealed that there is inconsistent relationship between parents' or guardian's educational highest educational attainment to a child's academic performance.

On the significant correlation between learning difficulties and socioeconomic status, it is revealed that at  $n = 16$ ,  $r(16) = .488$  and  $p > 0.05$ , there is moderate positive correlation between the two, However, this result isn't significant.

This result contradicted the result as stated in White (1982) where SES is substantially correlated with academic performance and learning difficulties. This is supported by Dahie (2016) on his study that revealed SES had positive significant influence on a child's performance.

The table also showed low positive correlation of  $n = 16$ ,  $r(16) = .033$  and  $p > 0.05$  between learning difficulties and previous Mathematics grade. This result showed no significant correlation between learning difficulties and previous Mathematics grade.

Contradictory to a study conducted by Seery (2009), it is revealed that prior knowledge as gauged on the learners' previous grades has significant effect on the learners learning difficulties. On a related study conducted by Akaraka (2015), it is also revealed that prior knowledge on a lesson that progresses through levels has significant effect on the performance of the learners.

Finally, on the significant correlation between learning difficulties and Mathematics anxiety, it is revealed that at  $n = 16$ ,  $r(16) = .167$  and  $p > 0.05$ , there is low positive correlation between the two, However, this result isn't significant. On a study conducted by Sinajonon (2013), it is revealed that students with high anxiety level performs the lowest in the subject. Also, in Estonato (2017), it is revealed that math anxiety is

often associated with poor students' performance in mathematics.

The model analysis included the 6 independent variables namely, Mathematics anxiety, socioeconomic status, previous Mathematics grade, sex, parents' / guardian's highest educational attainment and age. The combination of the seven independent variables was not significantly related to the dependent variable (learning difficulties) with R squared = 0.559, adjusted R squared of 0.265, F = 1.901 and P = 0.185 (table 3).

Table 3: Multiple Regression for a Single Set of Predictors: Model Summary

| <b>Model Summary</b>                                                                                                                               |                   |          |                   |                            |                   |          |     |     |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|
| Model                                                                                                                                              | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |               |
|                                                                                                                                                    |                   |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. F Change |
| 1                                                                                                                                                  | .748 <sup>a</sup> | .559     | .265              | 4.256                      | .559              | 1.901    | 6   | 9   | .185          |
| a. Predictors: (Constant), Mathematics_Anxiety, Socioeconomic_Status, Previous_Mathematics_Grade, Sex, Parents_Highest_Educational_Attainment, Age |                   |          |                   |                            |                   |          |     |     |               |

| <b>ANOVA<sup>b</sup></b>                                                                                                                           |            |                |    |             |       |                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|----|-------------|-------|-------------------|
| Model                                                                                                                                              |            | Sum of Squares | Df | Mean Square | F     | Sig.              |
| 1                                                                                                                                                  | Regression | 206.696        | 6  | 34.449      | 1.901 | .185 <sup>a</sup> |
|                                                                                                                                                    | Residual   | 163.054        | 9  | 18.117      |       |                   |
|                                                                                                                                                    | Total      | 369.750        | 15 |             |       |                   |
| a. Predictors: (Constant), Mathematics_Anxiety, Socioeconomic_Status, Previous_Mathematics_Grade, Sex, Parents_Highest_Educational_Attainment, Age |            |                |    |             |       |                   |
| b. Dependent Variable: Learning_Difficulties                                                                                                       |            |                |    |             |       |                   |

As indicated in Table 4, the 6 predictors – Mathematics anxiety, socioeconomic status, previous Mathematics grade, sex, parents'/guardians' highest educational attainment and age were not significantly related to learning difficulties. This can be accounted to the fact that the bivariate correlation between learning difficulties and the predictors range from moderate negative to moderate positive correlation. All statistical computations yielded to a p value greater than 0.05 and thus exhibited no significant relationships.

Table 4: Multiple Linear Regressions for a Single Set of Predictors: Coefficients

| <b>Coefficients<sup>a</sup></b>        |                             |            |                           |        |      |
|----------------------------------------|-----------------------------|------------|---------------------------|--------|------|
| Independent Variables                  | Unstandardized Coefficients |            | Standardized Coefficients |        |      |
|                                        | B                           | Std. Error | Beta                      | t      | Sig. |
| 1 (Constant)                           | -61.556                     | 43.057     |                           | -1.430 | .187 |
| Age                                    | 1.595                       | 1.789      | .321                      | .891   | .396 |
| Sex                                    | -2.185                      | 3.195      | -.225                     | -.684  | .511 |
| Parents_Highest_Educational_Attainment | -2.326                      | 1.821      | -.435                     | -1.278 | .233 |

|                                              |       |       |      |       |      |
|----------------------------------------------|-------|-------|------|-------|------|
| Socioeconomic_Status                         | 6.646 | 3.132 | .686 | 2.122 | .063 |
| Previous_Mathematics_Grade                   | .545  | .375  | .486 | 1.451 | .181 |
| Mathematics_Anxiety                          | -.005 | 1.761 | .000 | -.003 | .998 |
| a. Dependent Variable: Learning_Difficulties |       |       |      |       |      |

This study provided avenue to conduct further research looking into the importance of identifying the roots of the students' learning difficulties in General Mathematics. It provided more evidence that results can vary depending on the respondents' individual characteristics and circumstances.

## Summary and Concluding Remarks

The findings revealed that there was weak correlation between learning difficulties and the predictors age, sex, socioeconomic status, parents'/guardian's highest educational attainment, previous Mathematics grade and Mathematics anxiety with an adjusted  $r$  squared equal to 0.265. This means that the 6 variables explain nearly 27% of the variation in the dependent variable which is learning difficulties. The model analysis showed no significant correlation between learning difficulties and the predictors at 0.185 which is greater than 0.05. The individual independent variable resulted in values greater than 0.05, thus not significant.

Although there had been a couple of studies that resulted otherwise, this study provided evidence that the predictors can vary in effect significantly depending on the respondents' individual profile and circumstances. The multiple regressions performed showed no significant relationship between learning difficulties and the predictors. Socioeconomic which bears the highest  $r$  point couldn't even suffice to establish strong relationship between it and learning difficulties.

One of the major implications why a study of this sort arose was the observed learning difficulties that the researcher herself had seen among the students. This study further paved way to identifying more predictors that have some effects on their learning difficulties.

One important finding to note is the respondents' learning difficulty particularly focused on graphing functions. Graphing is one of the skills that must have been developed by the learners. Also, graphical analysis is one important mental cognition that the learners must have acquired through constant practice and exposure to some learning areas where data aren't limited to one single form but presented in many other forms, say, graphical or visual representations.

Also, it is important to consider the test type that the respondents must have been exposed all throughout junior high school days. Teaching styles per learning styles can be investigated to give a different perspective on addressing the problem.

Recommendations for future research is to identify different predictors that might have some effects on the learners' learning difficulties. The identified learning difficulty in this study can be used as a subject for another research which focuses on looking into the graphical analysis or comprehension of graphical representations among students. While it is true that the predictors identified in this study do not play significant effect or bearing on the learners' learning difficulties, it is still recommended to provide aid to those students whose socioeconomic status are low since it showed moderate correlation to learning difficulties. A separate program or study can also be made for this matter.



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