

Relationship between mathematics performance in an admission test and mathematics anxiety among grade 11 senior high school

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Abstract

It has been an alarming scenario in school or even outside of classroom that most students seemed avoiding and even openly expressed dislike or hatred towards mathematics as evident in fewer number of students specializing in this field of studies. Consequently, this study was conducted mainly relating student's previous performance in a mathematics test to their mathematics anxiety involving 57 grade 11 senior high school students. Specifically, it sought to find students' gender difference as well as variation in student parent's highest educational attainment in terms of their mathematics anxiety level, and to determine the relationship between students' mathematics performance in an admission test and mathematics anxiety. This study was a cross-sectional descriptive research obtaining data once at a particular period in time. Data analysis indicated a significant gender difference in terms of their mathematics anxiety which could be attributed to gender preferences and propensity in mathematics learning. On the other hand, the student parent's highest educational attainment did not significantly vary students' mathematics anxiety which could stem from student incognizant take normalizing any connection between their parent's educational state and their developing mathematics anxiousness. Results also revealed the non-existence of significant relationship between mathematics performance with which students previously engaged and their mathematics anxiety which findings could be inferred as due to student's predisposition in disintegrating the could-be effect of previous mathematics experience to their mathematics anxiety. In conclusion, there is a significant difference in mathematics anxiety between male and female students indicating female as more anxious mathematically; there is no significant difference in students' mathematics anxiety when related to their parent's highest educational attainment, and there is no significant relationship between students' mathematics performance in a test and their

mathematics anxiety. A parallel study suggesting an increase in number of respondents involving various grade levels in different schools or location may be pursued.

Keywords: Mathematics Performance, Mathematics Anxiety, Gender, Parent's Highest Educational Attainment

Introduction

As a faculty of education handling mathematics, one would wonder why were there number of students in a class, male or female, who were outspoken about their aversion towards mathematics. This feeling of mathematics uneasiness became more apparent in and outside of the classroom as many students tended to depreciate the values and usefulness of mathematics resulting into fewer enrollees specializing in this field. Richardson & Suinn (1972) as cited in Rampersad (2003) viewed mathematics anxiety as the general lack of comfort that someone might experience, along with the feeling of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of life and academic situations. Ma (1999) in Rampersad (2003) further explained that mathematics anxiety may be caused by negative mathematics experience and lack of parental encouragement. These observations alongside existing related literatures and studies built an interest in pursuing this study about student's mathematics performance in a senior high school admission test and its relationship to their anxiety levels in mathematics as they undertake grade 11 in the senior high school program.

This research attempted to determine the significant difference between male and female students in view of students' mathematics anxiety; the significant difference between students whose parents' education has reached high school level only and those finishing up to graduate programs in terms of students' mathematics anxiety, and the significant relationship between students' mathematics performance in an admission test and their mathematics anxiety;

This study is anchored on a deficit theory that explains mathematics anxiety may arise from difficulties met in the past experience surrounding mathematics, and that poor performance in mathematics could lead to a high increase in mathematics anxiety. This theory suggests that people who start with poorer math performance are more likely to develop anxiety about math. It indicates that there is an inverse relationship between previous test performance in mathematics and state of mathematics anxiety (Carey, E. et. al, 2016)

Previous studies found that gender was one of the factors differentiating student's mathematics anxiety (Ajogbeje, 2013); Khatoon (2010); Luo (2009); Yuksel (2008); Preis (2001); Mckean (2000) as cited in Yeo (2015); students especially females were seen to enjoy less in learning

mathematics processes which resulted to lack of confidence affecting abilities in mathematics (Ashcraft, 2002) in Yeo (2015); negative attitude normally existed mostly in females because of their shy personality, whereas, males were considered more active (Pourmostemi, 2013, Khatoon, 2010; McKean, 2000) as cited by yeo (2015). However, other studies have indicated the inexistence of significant difference in the student' mathematics anxiety level between gender (Ozgur, 2014) in Yeo (2015) ; Pourmostemi (2013) and Zakaria (2012) in Yeo (2015) further construed that the existence of no significant difference can be traced from circumstances that student's mathematics knowledge and background were paralleled; parental education level was considerably one of the major causes of students' developing mathematics anxiety (Mahigir, 2012) in Yeo (2015); that parental attitude was also deemed important as their thinking and perceptions towards mathematics will have an effect on the students' impression towards mathematics (McAllen, 2010; Zakaria, 2012) in Yeo (2015); parents as model to students, their thinking and experiences towards mathematics shall affect student' attitudes upon mathematics (Scarpello, 2007) in Yeo (2015); parental support and motivation were also important in determining students' success in mathematics performance (Schuartz, 2000) in Yeo (2015); that there is a negative correlation between mathematics anxiety and achievement (Zakaria ,2008) in Yeo (2015); standardized test scores and math anxiety level had a moderate, negative relationship (Brown, 2014); reason of student anxiety towards mathematics was because of past experience of failure in mathematics (Yuksel, 2008) in Yeo (2015). As some existing literatures and studies manifested poor relationship between past experience with mathematics and mathematics anxiety opposing to what deficit theory is proposing and that student gender and parent's level of education may or may not differentiate student's mathematics anxiety, hence, this study was conducted.

Guided with the aligned literature and studies, it was hypothesized that prior engagement with mathematics shows connection towards students' developing feeling of nervousness or anxiousness when dealing with mathematics as part of a curriculum unit; that male and female students when engaged in mathematics learning activities react or associate differently and therefore significantly vary in terms of their fearsomeness when expose to mathematics content and further, parent's educational background reflects in ways they support their children education and hence difference in student's parent's highest educational attainment can influence student's impressions or feelings towards mathematics learning.

This study was carried out by firstly seeking permission from the director-designate for senior high school department through a letter of intent. Then met and asked permission from the mathematics teacher in grade 11. After which, conducted orientation with the prospective

participants in the presence of the subject teacher. Following, the researcher talked about the purpose in conducting the study, participants' roles, studies benefits, risk remedies and other important considerations in regards to anonymity of the participant's identity and information confidentiality. During the meeting, participants were encouraged to ask questions, clarifications and make suggestions regarding research protocols and processes. Letter requesting parental consent and student assent was distributed; On the next day, consent notes were collected; mathematics test results were secured from the admission office, afterward, followed the administration of a survey questionnaire on mathematics anxiety to student-respondents for about 15 minutes, and then, words of gratitude were expressed to students, parents, teachers, principal and everyone who participated during the data collection stages. Immediately, data were tallied according to student's list, name initials, gender, state of parental education, mathematics test results and mathematics anxiety basing from the adapted mathematics anxiety instrument. Finally, gathered information were statistically analyzed according to the enunciated research problems deriving at findings, generating conclusions and formulating appropriate recommendations. Finally, results of study were presented before a panel of experts in the presence of graduate school students in a university. The data analyses revealed that there existed a significant gender difference in student's mathematics anxiety showing that female were more anxious than male students when mathematically involved. But both sexes indicated an average fearsomeness towards mathematics. On matter of parent's highest educational attainment, student-respondents manifested likely equal feelings towards mathematics signifying that regardless of which level of schooling their parents may have reached, their anxiousness towards mathematics closely resembled. Finally, in relating test performance in mathematics to mathematics anxiety, the data proved a weak relationship expressing the inexistence of significant relationship which further implying that students' previous experience with mathematics did not necessarily relate into their anxiety condition towards mathematics.

It can be concluded from data analyses and findings that both sexes significantly differed in terms of anxiety feelings in relation to mathematics learning; that student's parent's highest educational attainment did not differentiate student's anxiety feelings for mathematics and that students' past experience in mathematics test did not influence any feeling of anxiousness when studying mathematics.

Methods & Materials

This study is a cross-sectional descriptive research. The information were secured once at particular time which were used and analyzed to describe a relationship between student's test performance in

mathematics and their anxiety mathematically. Also, it aimed to describe if gender difference relates to mathematics anxiety. Finally, it sought to explain if difference in parent's highest educational attainment likely varies student's mathematics anxiety.

In relation to the foregoing research purposes, a student profile on gender and a questionnaire checklist on Mathematics Anxiety Rating Scale (MARS) developed by Carey, E. et. al. (2017) were utilized to obtain data about mathematics anxiety between male and female. A student profile on parents' highest educational attainment and a questionnaire checklist on Mathematics Anxiety Rating Scale (MARS) were used to gather information on students' mathematics anxiety relative to their parents' highest educational attainment. Student's mathematics scores in an admission test and a questionnaire checklist on Mathematics Anxiety Rating Scale (MARS) were adopted to secure data on mathematics performance in an admission test in relation to their anxiety on mathematics.

Procedurally, this study was conceptualized based on the interest of the researcher starting with a big question on why do majority of students hate math as this has been perennial in almost all math classes in schools or universities. Then to be more focus, it was trimmed down into studying mathematics anxiety with a belief that such anxiety might be bringing the labeled "hate" feelings. Afterwards, it was thought that such anxiety could also be resulting from previous experience with content. Then, engaged in reading literatures and studies on the same orientation and dimension of the study. Consequently, the inclusion of student's gender and parent's highest educational attainment as factors were supposed to have been differentiating mathematics anxiety among the learners. After the concept paper reflecting the rationale, nature and scope of study, identification of participants, data gathering instrument, data analyses, and some other considerations, were presented and approved by the adviser/subject-professor, this study then proceeded.

Initially, in the data gathering phase, a letter of intent was sent to the director of the senior high school in a university in order to obtain needed information about grade 11 sections for purpose of eventual randomization. Upon approval, the researcher met with the subject-teacher of the classes being chosen, and eventually, faced with the prospective student-respondents for orientation about the conduct of study. After students verbally agreed to be part of the study, this was followed by the distribution of the letter of parental consent and student-assent form which were accomplished by student-respondents and their parents, respectively, to signify approval of their children's participation in the study. Having sought parental and student's support to this research activity, immediately, on the next day, test results on mathematics were secured from the university testing center, then

facilitated a 5-likert scale questionnaire on mathematics anxiety as modified and validated for use by Carey, E. et. al (2017) to student-respondents. This data gathering instrument was consisted of two parts. Part one entailed student profile such as name, subject and section, gender, and parent's highest educational attainment and part two included ten (10) statements focusing on mathematics anxiety feelings which option ranged from as low as 1 and as high as 5. Respondents' participation was gratefully acknowledged ending data gathering with an impressive success.

Quickly, data on mathematics anxiety between male and female students were tallied using student's initials (family, given and middle initials) and analyzed using the t-test for independent sample means in determining gender difference in view of mathematics anxiety; data between levels of parent's highest educational attainment which were categorized into two groups, one group consisting of parents having no schooling, reached elementary, or high school graders, and another group of parents obtaining college, graduate or post-graduate studies were recorded and analyzed in answering difference in mathematics anxiety based on parental education, and data on test performance in mathematics and mathematics anxiety were accounted and correlated to find out any significant relationship between these two correlated variables.

Results

Data analysis on gender difference in terms of mathematics anxiety revealed that:

Male =25, Mean = 2.6480, Standard Deviation = .56134, Standard Error Mean= .11227; Female = 32, Mean = 2.9656, Standard Deviation = .57339, Standard Error Mean= .10136

Statistics on means showed that female have higher mathematics anxiety than male students. This implies girls were more anxious, tense, or uneasy than boys when encountering activities involving mathematics. Statistics on standard deviation manifested that female responses on mathematics anxiety were a little more dispersed than male responses. This is an indication of slight variability in emotional aspects among females compared to males when both inclined to mathematics experiences.

The independent Sample t-test between male and female mathematics anxiety is reported as follows:

Levene's Test for Equality of Variances (F) = .028, Sig. =.867, t-test for equality of means (t) = -2.094,

df =55, Sig. (2-tailed) = 0.041, Mean Difference = -0.31763, Std. Er. Dif = .15166.

This revealed a statistically significant difference regarding mathematics anxiety between male and female students as independent sample t-test would dictate. This indicated that female were more mathematically anxious implying that whenever they are cued to be in a mathematics class, they anticipated feeling of nervousness especially about what may happen, what they will be asked to do mathematically or what activities in math shall they be performing, those that created fearsomeness and uneasiness as they contemplated to what it is like to be mathematically engrossed. Under specific mathematics activities, girls reacted nervously on a surprise math quiz, while watching the teacher works out a math problem on the board, when a new topic in math started, whenever asked to complete a worksheet by herself, being given math homework with lots of difficult questions, at times listening to another child in their class explaining a math problem, listening to the teacher talk for a long time in math, thinking about a math test the day before taking it, taking a math test, looking through the pages in a math book among other anxiety-grounding circumstances.

Data pertaining to parent's highest educational attainment on students' mathematics anxiety are reported as follows:

Group 1 - No schooling/Elementary/High School: N = 28, Mean = 2.8286, Std. Deviation = .61153,

Std. Error Mean = 0.11557;

Group 2 - College/Graduate/Post Graduate: N = 29, Mean = 2.8241, Std. Deviation = .56924

Std. Error Mean = 0.10571

The results on the computed means showed that mathematics anxiety among students whose parents lacked a formal education, or achieved only elementary or high school diploma is minimally higher to as little as thousandths place compared to students whose parents obtained college or graduate or post-graduate education. This manifested that regardless of any educational attainment of parents, students displayed a similar anxiety feeling in dealing mathematics. It further indicated that students in both groups, whether parental academic status is high or low, moderately felt uneasiness on instances like a conduct of surprise math quiz, while watching the teacher works out a math problem on the board, when a new topic in math started, whenever asked to complete a worksheet by herself, being given math homework with lots of difficult questions, at times listening to another child in their class explaining a math problem, listening to the teacher talk for a long time in math, thinking about a math test the day before taking it, taking a math test and whenever looking through the pages in a math book among others.

However, students of low parental education divulged a bit anxiousness towards mathematics learning in comparison to students whose parent's educational attainment is high. Analysis also reflected that students, whose parental education is utmost high school level, demonstrated a little diverse response upon mathematics anxiety levels compared to students with parents' highest educational attainment as low as tertiary or collegiate ranking. This exhibited an unstable mathematics apprehension among students having low compared to students of high parental education.

The independent Sample t-test between students with parent's highest educational attainment such as no schooling, elementary or high school compared to whose parents gained collegiate, graduate or post graduate education is reported as follows:

Levene's Test for Equality of Variances (F) = .419, Sig. = .520 t-test for equality of means, t = .028,

df = 55, Sig. (2-tailed) = 0.977, Mean Difference = 0.00443, Std. Er. Dif = .15642.

This revealed a statistically no significant difference in the mathematics anxiety as related to student parent's highest educational attainment as t-test for independent samples would dictate.

This indicated that anxiety feeling over mathematics did not vary according to parent education. It further implied that students, whose parent's level of schooling ranging from elementary or high school or completely no formal education, developed equally likely mathematics anxiety with those students of whose parental education had reached college or beyond. Furthermore, regardless of parent education, students felt moderately nervous and worried over mathematics involvement.

Data on relating students' mathematics performance in an admission test and mathematics anxiety are viewed as follows:

Pearson-Product Moment Correlation: $N = 57$, $r = .206$, Sig. (2-tailed) = .125.

Statistics expressed a correlation coefficient value of 0.206 implying a statistically poor or weak positive relationship between mathematics test performance and mathematics anxiety among senior high students. This described a no significant relationship between students' mathematics performance in an admission test and mathematics anxiety among grade 11 senior high school students as Pearson-Product Moment Correlation would dictate.

It further conveyed that regardless of student previous exposures and experiences in a mathematics test, it has no significant bearing or explanation to their existing anxiety feeling towards mathematics

learning. Furthermore, particular anxiety emotions, when students were mathematically attached in terms of a surprise math quiz, while watching the teacher works out a math problem on the board, when a new topic in math started, whenever asked to complete a worksheet by herself, being given math homework with lots of difficult questions, at times listening to another child in their class explaining a math problem, listening to the teacher talk for a long time in math, thinking about a math test the day before taking it, taking a math test, looking through the pages in a math book to consider a few, were not results of students' previous performances in a mathematics test.

During the conduct of the study, it was observed considering gender difference in mathematics anxiety, boys were more composed than girls in answering the instrument, and girls had varied reactions. Though data limited its scope on two classes composing of 25 males and 32 females, this observation manifested in the outcome of the study relating gender to mathematics anxiety among senior high school students. On aspect of student parents' education, when students found out that their parent's highest educational attainment were obtained and be related to their mathematics anxiety, their reactions implied of their being clueless about any existing connection between the two variables and much more showing inability to integrate parental education to their negative attitude or feeling towards mathematics. These data were taken from 28 students whose parent education belonged to a group of elementary, high school and no formal education, and 29 others who belonged to college, graduate and post-graduate levels. In fostering relationship of students' test performance in mathematics to their anxiety towards mathematics, their reactions reflected disappointment about themselves due to their performances in the test. As a response, they were subsequently cheered and motivated with words talking about failure or success as means to alleviate consciousness on the path which would take these students to any beautiful journey; that they should persist to learn more, for even those learned had their trying times conquered first before they became successful and adding that it would take good attitude and positive outlook to appreciate life to become more persistent and motivated. Hence, this study was conducted for the students to become fully aware that mathematics anxiety needs to be watched out and be regulated as some literature acknowledge it to be affecting student ability to learn mathematics and thereby, enable them to appreciate and practice mathematical aesthetics and applicability.

Discussion

In determining data normality, a shapiro-wilk test was used in analyzing data on mathematics anxiety between male and female as well as between parent's highest educational attainment are all indicating normality with no outliers. Thus, t-test is used to significantly determine

gender difference and parent's education in relation to mathematics anxiety among senior high school students. The Pearson-product moment correlation is also applied to determine the significant relationship between students' test scores in mathematics and their anxiety level towards mathematics.

This study found the significant existence of gender difference in students' mathematics anxiety revealing female students' more anxious feelings and portrayal of varied anxiety levels. However, the study also derived a nonexistence of significant difference in student's mathematics anxiety when analyzed according to parent's highest educational attainment signifying a similarly moderate anxious feeling towards mathematics learning. In addition, this study established a no significant relationship between students' mathematics performance in an admission test and their mathematics anxiety showing a poor or weak connection between these variables. Relative to these findings, results revealed an agreement with some previous findings that gender was one of the factors differentiating student's mathematics anxiety (Ajogbeje, 2013); Khatoon (2010); Luo (2009); Yuksel (2008); Preis (2001); McKean (2000) as cited by Yeo (2015); students especially females were observed to enjoy less in learning mathematics processes resulting into lack of confidence affecting abilities in mathematics (Ashcraft, 2002) in Yeo (2015); negative attitude normally existed mostly in females as they had the characteristics of being reluctant towards mathematics, whereas, males were considered to be more active (Khatoon, 2010; McKean, 2000; Pourmostemi, 2013) as cited by Yeo (2015). Therefore, the presence of significant difference in mathematics anxiety with respect to gender could be explained that students may be coming from different junior high schools, formerly in different sections, and still in their period of transition from junior high school to grade 11 in senior high school and so gender difference could manifest. Likewise, it could be attributed to the old belief that mathematics is a male thing, thus exhibiting a moderately lower nervousness in classroom mathematics activities compared to female, and in effect, female tended to feel the mathematics tenses, insecurities and anxiousness. However, these finding on gender difference contradicted with some other studies findings indicating a no significant difference in the student's mathematics anxiety level between gender (Ozgur, 2014) in Yeo (2015). Pourmostemi (2013) and Zakaria (2012) in Yeo (2015) further opined that the existence of no significant difference was relatable to the notion that student's mathematics knowledge and curriculum background was one and similar. These disagreements in findings could be results of unequal number of respondents, unlikeness in parent education levels, diverse in terms of research locale, time distance among other considerable factors.

Another major revelation of this study was that parental issue particularly parent's highest educational attainment did not significantly

alter students' mathematics anxiety. This major finding ran contrary to previously similar studies implying that socio-economic background such as parent education level, parent income were major causes of students having mathematics anxiety (Mahigir, 2012); that parental attitude was also important as their thinking and perceptions towards mathematics will have an effect towards the students' impression about mathematics (McAllen, 2010; Zakaria, 2012); parents as model to students, their thinking and experiences towards mathematics could affect student' attitudes in mathematics (Scarpello, 2007); parent's support and motivation were also important in determining students' success in mathematics performance (Schuartz, 2000). This finding of no significant difference in students' mathematics anxiety when related to their parent's highest educational attainment can be lifted from a viewpoint that student-respondents may not give high credit to their parent's highest educational attainment as a basis for any feeling of uneasiness towards mathematics and therefore, consider less connection to their gained mathematics anxiety in their course of learning mathematics. Contradictions in findings could be due to respondents' age and educational ranges, differences in geographical location and time element among others.

Finally, the inexistence of significant relationship between students' mathematics performance in an admission test and their mathematics anxiety levels indicating a low positive correlation which result still closely settled with the previous finding that there was a negative correlation between mathematics anxiety and achievement (Zakaria, 2008) in Yeo (2015); that standardized test scores and math anxiety level had a moderate, negative relationship (Brown, 2014). However, the result was contradicting some classroom existing literatures embodying that anxiety is due to unforgettable past experience towards mathematics as well as parent's high expectation towards student's achievement in mathematics (Arem, 2009) in Yeo (2015); reason of student anxiety towards mathematics is because of past experience of failure in mathematics (Yuksel, 2008) in Yeo (2015).; the major causes of mathematics anxiety could be environmental which includes student's mathematics experience (Baloglu, 2006) in Yeo (2015). This result in no significant relationship between students' test performance in mathematics and their mathematics anxiety can be attributed to the positive attitude students were manifesting. Their previous mathematics engagement, even in failure or success, did not significantly manifest into how they regarded and reacted upon mathematics encounters. However, this does not necessarily imply that positive attitude converts into low mathematics anxiety or high performance in mathematics among students. It is confined to their being unaffected by their previous experiences with mathematics test.

Conclusion

In conclusion, the results derived from this study indicated that there existed a significant difference in mathematics anxiety between male and female among grade 11 students showing that female were more mathematically anxious compared to male students as data submitted to parametric t-test analysis would explain and many existing theories and studies would support; that parent's highest educational attainment did not significantly differ students' mathematics anxiety as data analysis using t-test for independent sample means would provide and many existing related theories would adhere; that there is a non-existence of significant relationship between students' mathematics scores in an entrance test and their mathematics anxiety as data would justify using the Pearson Product-Moment Correlation and number of related literatures would uphold.

The results of this research study could be beneficial to mathematics teachers in consideration of the condition of mathematics anxiousness of female from male students and may devise classroom strategies to reduce the possible influences of such anxiety sensitivities in terms of a gender difference in order to achieve optimum enthusiasm, classroom participation, and increased mathematics test performances; to parents, their highest educational attainment may inspire children to combat any feeling of fearsomeness and apathy that would enable these students to use it positively acknowledging self-worth and innate capabilities necessary to developing transformative appreciation and creative usefulness of mathematical knowledge and skills for improved performances in mathematics in preparation for a daily life mathematics activities; To teachers and students, to become more informed and innovative that mathematical experiences can be made more meaningful and enjoyable in a mathematics learning environment to become more productive individuals as teachers and students contributing equally in creating a world of fun and excitement for free mathematics anxiety and sound mathematical judgment over all things, dilemma and circumstances.

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