Maths Anxiety in College Students across Majors: A Cross-Cultural Study

Eid G. Abo Hamza and Ahmed M. Helal, Tanta University, Egypt

Corresponding author: Eid G. Abo Hamza

Email: eidhamza@gmail.com

Abstract

This study used survey data collected from two countries, Egypt and The United States of America (USA). There were 330 participants (162 males and 168 females), all of whom were undergraduate students. 169 participants were studying at Tanta University, Egypt, and 161 participants at the University of Arkansas, USA. The study aimed to investigate maths anxiety in undergraduates with different main subjects of study and across cultures. A 4x2 ANOVA was conducted to evaluate the effects of the student's country and main subject of study (major) on maths anxiety. The results of the 4x2 ANOVA indicated a significant main effect for country, a non-significant effect for major, and a non-significant interaction effect between country and major. Furthermore, the study used a two-way ANOVA between two factors (gender and country and maths anxiety). The analysis revealed a significant main effect for country, a significant effect for gender, and a non-significant interaction effect between country and gender.

Key Words: maths anxiety, cross-cultural, achievement, college students, gender, majors.

Introduction

The current research focuses on maths anxiety in college students with different main subjects of study, or majors, at the University of Arkansas in the USA and the University of Tanta in Egypt. The questions that frame this research are (a) Is there is any difference between levels of maths anxiety in students in Egypt and the USA? (b) Is maths anxiety equally distributed across undergraduates with different majors (grouped into social sciences, hard sciences, arts, and health sciences) in Egypt and the USA? (c) Does gender play any role in levels of maths anxiety across those two cultures?

Maths anxiety is a complex problem which can be defined in various ways. Bisse (1994) conducted several interviews, and described maths anxiety as a state of panic that takes control of person's thoughts when presented with mathematics problems. Fiore (1999) defined maths anxiety as the panic, helplessness, paralysis, and mental

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disorganization that arises among some people when they are required to solve a mathematical problem.

Other studies such as those of Faust, Ashcraft and Fleck (1996), Ashcraft (2002), Aschraft and Kirk (2001), and Brady and Bowd (2005) defined maths anxiety as a form of state anxiety as it is manifested in certain situations. The range of descriptions mentioned above comes about because maths anxiety is a broad term used by many individuals to cover a wide range of observed characteristics in students. For example, some use it to describe the supposed cause of physiological symptoms when encountering maths, such as sweaty palms, nausea, heart palpitations, a hot tingling feeling, stomach aches or stomach cramps, and/or tightening muscles (Godbey, 1997; Perry, 2004). Others use this term to classify the psychological symptoms that manifest themselves in situations involving mathematical tasks.

These symptoms include a difficulty in thinking, extreme nervousness, an inability to focus on the instructor, a difficulty in concentrating, negative self-talk, and/or a general sense of uneasiness (Ashcraft & Kirk, 2001; Haralson, 2003; Godbey, 1997; Perry, 2004; Sheffield & Hunt, 2006). Some individuals evidence a mixture of these characteristics. Furthermore, many researchers believe that test anxiety, which is defined as “an otherwise confident student’s state of panic during a test where self-doubt leads to a failure to realize potential in a testing environment” (Perry, 2004, p. 321) is closely related to and/or a component of maths anxiety.

As in previous literature, the use of “maths anxiety” in this work will be applied to individuals who evidence the responses and characteristics discussed above when they are engaged in maths-related activities. Sheffield and Hunt (2006) supported the notion that maths anxiety has a direct impact on the performance of maths tasks. Therefore, maths anxiety can be defined as an emotional reaction to situations requiring or involving mathematics, which interferes with the ability to perform mathematical operations successfully. It involves several abilities, including test anxiety, but is an aspirate construct.

Maths anxiety has been widely considered as one of the key reasons for students’ weakness in mathematics. There are several pieces of statistical evidence that reveal US students’ anxiety in mathematics. Two thirds of adults in the USA report a fear of mathematics (Burns, 1998), and in another study only 7% of Americans said that they had had positive experiences in mathematics during their school years (Jackson & Leffingwell, 1999).

Causes of Maths Anxiety

Maths anxiety is usually linked to prior negative maths experience. This could include being punished by present or past teachers for failing to solve or understand mathematical concepts, having a bad grade in maths at school, a lack of

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encouragement from parents or teachers, and/or a lack of positive role models. These prior negative experiences with maths are often transferred and result in a lack of understanding of mathematics. Sheila (1981) suggested that millions of adults are blocked from professional and personal opportunities because they fear or perform poorly in mathematics. For many, these negative experiences remain throughout their adult lives.

Bisse (1994) and Haralson (2003) stated that few maths classes are structured in such a way as to relieve anxiety. There will always be time limits, right answers, competition and the fear of looking or feeling "stupid" in front of others. The far-reaching effects of maths anxiety are evident in common teaching practices in today's classrooms. It is believed that certain instructional techniques, such as directly following textbook examples, lecturing, and emphasizing only one way to solve a problem are among the main causes of maths anxiety (Gresham, 2007). Since maths anxiety impacts on so many individuals, we must expect it to impact on at least some students in nearly every discipline, leaving us to ask what happens if the students affected by this condition are future teachers, or, more specifically, individuals who will go on to teach mathematics? Cornell (1999) listed several ways of teaching that contributed to maths anxiety.

These were (a) Teachers' assumptions about students' knowledge, (b) Teachers' use of obscure vocabulary related to maths without enough explanation of the meaning of the terminology being used, such as divisors, integers, quotients, multipliers, etc., (c) Incomplete instruction. Students often feel frustration because of the lack of explanation of the sub-steps of mathematical procedures. Additionally, too many skills and drill exercises contribute to frustration and anxiety, which in turn leads to frustration at not being able to keep up with the class. The sequential nature of mathematics instruction becomes difficult if a student does not immediately grasp the procedures or concepts being taught at a specific point in time (Brady & Bowd, 2005). Therefore, issues such as the overemphasis on rote memory and the fact that maths instruction is often presented in isolation, as an end in itself, and with little connection to real life, contribute to maths anxiety and subsequent maths failure.

Jackson and Leffingwell (1999) studied the role of instruction in creating maths anxiety in students from kindergarten. The study found that 16% of the participants had negative experiences with maths teaching as early as grades three and four For instance, students stated that they experienced difficulty in areas such as working with parts of numbers that is fractions, rather than whole numbers. Moreover, some maths instructors were characterized as being either hostile or insensitive. Behaviour included exhibiting anger when students asked for extra assistance, or pointing out student errors to the entire class. Gender bias also contributed, in that some instructors stated that girls did not need maths, and girls were ridiculed more often than boys and received less additional assistance when they encountered difficulty. Additionally, Jackson and Leffingwell (1999) reported that 26% of the students surveyed at high school level stated that they encountered many of the same problems. These included angry behaviour from teachers, gender bias, communication and language barriers, and

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the quality of instruction, as some teachers depended completely on the work sheets, explained quickly or gave poor explanations and expected every student to grasp concepts easily. In Jackson and Leffingwell's (1999) study only 7% of Americans answered that they had had positive experiences in mathematics during their school years.

In Egypt, Khatoon and Mahmood (2010) reported that nearly half (44.98%) of the secondary school students who participated in their study experienced moderate levels of maths anxiety, while 17.91% of their sample demonstrated high maths anxiety. Even more alarming were the findings of Perry (2004), who stated that approximately 85% of college students enrolled in introductory mathematics courses reported at least moderate maths anxiety. Regardless of the exact number of affected students, it is evident that maths anxiety is prevalent on college campuses (Khatoon & Mahmood, 2010).

Gender and Maths Anxiety

The relationship between gender and levels of maths anxiety has been investigated for decades, and to this date no consensus has been reached. For example, Haynes, Mullins and Stein (2004) report no significant differences in maths anxiety levels in male and female college students, however they identify different factors affecting male and female levels of maths anxiety. More specifically, maths anxiety levels for males were significantly related to general test anxiety. On the other hand, females' maths anxiety was most strongly affected by perceived maths ability, perceptions of college maths teachers' teaching ability, as well as general test anxiety (Haynes et al., 2004).

Some studies report that female college students experience significantly more maths anxiety than their male counterparts (Khatoon & Mahmood, 2010; Malinsky, Ross, Pannells & McJunkin, 2006). However, inconsistencies regarding the effects of gender on maths anxiety are present even in these findings. Student maths preparedness level is one of the facets affecting the relationship between gender and maths anxiety. However, for a sample of men and women with similar backgrounds in mathematics, there was no significant difference in the maths anxiety experienced. In addition, Dew, Galassi and Galassi (1983) suggested that gender differences in maths anxiety are related to other factors affecting these experiences.

Woodward (2004) acknowledged that women report more maths anxiety than men. This finding is in agreement with Hembree (1990). However, these outcomes are not accompanied, as might be expected, by more negative attitudes toward mathematics, poorer performance, or avoidance behaviour by female students. This contradiction may be explained by Hembree's assumption that "females may be more willing than males to admit their anxiety, in which case their higher levels are no more than a reflection of societal mores;" and that "females may cope with anxiety better" (Hembree, 1990, p. 45).

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That gender affects maths anxiety in conjunction with other factors is also suggested by a study by Wigfield and Meece (1988). While there was no significant difference in maths anxiety in male and female elementary and secondary school students, female students did acknowledge more negative reactions towards mathematics. These negative reactions may be one of the causes of the differences in the maths avoidance behaviour of males and females, as well as maths anxiety in later years, especially in college. Similar to these results are those of a study by Malinsky et al. (2006), which reported that no significant differences in maths anxiety levels in males and females were noted in early grades, but that females experienced more maths anxiety in college. These research outcomes imply that future research may investigate the possible causes of maths anxiety in the transition period between the early grades and college.
Differences in maths anxiety levels as a function of gender are also affected by other aspects of life, such as social desirability. While overall scores on maths anxiety measures do not differ significantly for females and males, maths anxiety levels for males seem to be highly correlated with measures of social desirability (Zettle & Houghton, 1998). Furthermore, gender has been found to moderate the relationship between maths anxiety and maths performance (Miller & Bichsel, 2004). Maths anxiety levels were found by Miller and Bichsel to be predictive of female performance in basic and applied mathematics tasks, while they were only a statistically significant predictor in basic mathematics tasks for males (Miller & Bichsel, 2004). This further strengthens the proposition that gender needs to be seen as a function of multiple factors, and not as a uni-faceted predictor of maths anxiety.

Egyptian and American Educational Systems

There is a big difference between the American and Egyptian educational systems. In Egypt, students in the second year of high school have to decide to take a section of either scientific or social studies. If a student selects the social section, they only have to study a few short maths or statistics courses. Furthermore, if students are admitted into a college of education in the social majors, they will not take any maths courses until they graduate. However, if a student selects the science section in high school, they have to take several maths courses such as algebra, geometry, maths 1 and maths 2. Those students have to take maths courses to be admitted into a scientific program in college. The majority of the undergraduate students in the School of Education at Tanta University (who made up the study sample) came from the social section of their high school.

The American education system is completely different at both the high school and undergraduate levels. The American educational system allows students to select their majors at any time. American students can change majors at will, regardless of what they selected at the entry level of college. Moreover, the American educational system offers more maths and statistics courses during high school and at undergraduate level. The differences between the Egyptian and American educational systems may be a significant factor in why Egyptian students scored higher on maths anxiety than American students. Additionally, according to the American educational system,

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students should have a major and minor. A major is the main interest and focus of study, while the minor is a secondary interest or focus. For example, a student may major in Psychology and minor in History. This option is not available in the Egyptian educational system.

The Research Hypothesis

- *The First Hypothesis:* Maths anxiety does not differ depending on undergraduate major (groups were divided into hard science, social science, health science, and fine arts) in college students in the USA and Egypt.
- *The second hypothesis:* Maths anxiety does not differ depending on gender in college students in the USA and Egypt.

Methodology

This study used a survey research design. A survey is a formalized set of questions for obtaining information from respondents. It is the main means of collecting quantitative primary data and it enables quantitative data to be collected in a standardized way so that the data are internally consistent and coherent for analysis. The use of survey as a method of data collection in research has increased in recent years (Rattray, Johnston & Wildsmith, 2004; Waltz & Jenkins, 2001).

Nowadays, in several social science disciplines, the use of survey studies has emerged as the method of choice for collecting data on both attitudes and behaviours, with surveys constituting the primary method for collecting self-report data (Hutchinson, 2004). The attractiveness of survey research is due in large part to its utility in countless research situations. Surveys are used for such purposes as needs assessment, programmer evaluation, attitude assessment, political opinion polling, and policy analysis, as well as for simple descriptions of behaviours, activities, and population characteristics (Hutchinson, 2004).

The extent of surveys ranges from large-scale national surveys such as the country census or ministry surveys to smaller surveys limited to a classroom, type of school, or certain institution. In some cases, surveys are used just to evaluate the status quo; in others, they are used to test complicated theoretical relationships amongst various variables.

Hutchinson (2004) acknowledged that the second reason for the attractiveness of survey research is its applicability in situations where the direct manipulation of variables is either unfeasible or unethical. For example, researchers like to test relationships involving such extant characteristics as physical attractiveness, perceived social support, ethnicity, and gender, which cannot be readily manipulated. However, the possible significance of studying these concepts should not be diminished by the impossibility of influencing them experimentally.

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This study is designed to answer the following research questions:

1. Is there are any difference between maths anxiety in Egypt and the USA?
2. Is maths anxiety equally distributed across undergraduate majors (grouped as social science, hard sciences, arts, and health science) in Egypt and the USA?
3. Does gender play any role in maths anxiety across those two cultures?
4.

Sample

The sample in this study consisted of undergraduate students at the University of Tanta, Egypt and the University of Arkansas, USA. Participants were not restricted to particular majors, and not restricted to a particular grade. To provide a representative sample from the target population of undergraduate students at the University of Tanta, the researchers would have had to follow a sampling method such as the stratified or cluster sampling methods. However, the researchers failed to do that. The current sample is a convenient sample made up either of students being taught by the researchers at the University of Tanta or students of other instructors in other majors. The data was collected over a three-week period during regularly scheduled class sessions in the colleges of education, arts and sciences, and languages. The total sample from Tanta University, Egypt consisted of 169 undergraduate students (84 males and 85 females), and the total sample from the University of Arkansas, USA consisted of 161 undergraduate students (78 males and 83 females).

The students' majors were divided into social science, which included journalism, history, psychology, education and foreign language studies; hard science, which included biology, chemistry, mathematics, and engineering; fine arts, which included music, creative writing, theatre arts, architecture, and art; and health science, which included communication disorders, kinesiology, nursing, special education and health sciences.

Instrument

In order to collect data for this study, the researchers designed a questionnaire based on the literature about maths anxiety, maths achievement, physiological responses to anxiety, and learning disabilities. The questionnaire comprises two parts. The first part is a demographic form. It has information about the student such as gender, stage of study, major, if the student is a home or international student, native language and whether or not another language is spoken, which semester in college the student took their first maths course, experiences of maths in high school and college, and experiences of maths in college.

The second part consists of 25 items that ask about maths achievement, maths anxiety, physiological responses to maths, and other issues related to language and learning difficulties that can impact on student performance. In summary, these items constitute a three-part assessment: maths anxiety, maths achievement and other general items, which were used to assess the validity of the assessment with regard to psychological

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and physiological symptoms. Moreover, the questionnaire contained items that assess the general symptoms of anxiety.

The questionnaire was designed in a Likert format, using the scale Not at all – Sometimes – More than other – Less than other students – All the time. Student participants were asked to indicate the extent to which each of the statements on the scale applied to them. The instrument included 18 items to assess maths anxiety, three items to assess maths achievement (1, 6, and 25), and the remaining four items (5, 8, 10, and 16) for verbal production and language processing. Students were asked for subjective ratings, on a 1-5 scale (1= Not at all, 5= All the time). This meant that the maximum maths anxiety score was 90, and a score above 45 points was considered high. The maths achievement and verbal production and language processing survey items were included to provide a counterbalance to the maths anxiety questions.

Translation of the Survey into Arabic

The first part of the study was conducted in the USA and the instrument was created in the English language. When the researchers conducted the other part of the study in Egypt, they had to use the same questionnaire in the Arabic language (Egyptian dialect), and take into consideration the Egyptian culture and Egyptian educational system. Geisinger (1994) determined some steps for translating and adapting a test. These were used in the translation of the survey for this study.

The procedure was as follows:

1. The first step was to translate the instrument items from English to Arabic, then translate the same test back into English. Both translations were done by a translator fluent in both languages. The second English version was then compared with the original one to ensure accuracy. Local dialect was taken into consideration in the final translation. Moreover, the translators did not know the purpose and aims of the test because if the translators were aware of these things, they may have tried to capture the meaning of the test.
2. The new translated version was reviewed by a panel of bilingual and bicultural experts. These experts reviewed the quality of translation, the items, and the adaptation, then wrote comments about it. Geisinger (1994) recommended that the panel individuals “(a) review the items and react in writing, (b) share their comments with one another, and (c) meet to consider the points made by each other and to reconcile any differences of opinion” (p. 306).
3. According to what the panel recommended, the translators adapted the instrument.
4. The instrument was piloted with a small group of typical participants from the target population in the Faculty of Education, Tanta University, Egypt.

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5. An essential step was validation. It was important to decide whether the translated version measured the same qualities and the same construct as the original version, and whether the construct had meaning for the target population and their culture.
6. The final step was collecting the feedback from the users. This feedback helped to adjust or revise the instrument, and to uncover any possible misuse or misinterpretation of the instrument.

Validity and Reliability

The instrument was initially reviewed by three faculty members from the department of educational psychology, Faculty of Education, Tanta University, Egypt in order to ensure the face validity of the questionnaire. The survey was also reviewed by two experts in education to ensure content validity, which refers not to what the instrument was actually testing. The educational experts were provided with a four-point content validity index: (1) not relevant, (2) item needs some revision, (3) relevant but needs minor revision, and (4) very relevant (Waltz & Bausell, 1983). Some changes were made to the original questionnaire based on the experts' review and comments. In addition, because the survey was going to be used with students from the Egyptian culture, the survey was reviewed by three cultural experts. The cultural experts' reviews focused on the face and cultural validity of the survey and decided whether or not it fit with the Egyptian cultural and educational systems.
The reviewers decided to delete the following four demographic questions, which did not fit with the Egyptian educational system:

1. Are you an international student?
2. Which (if any) maths class are you enrolled in now?
3. What semester in college did you enrol in your first maths course?
4. What is your first language?

Data Analysis

Data was analysed using the SPSS package software, version 17. Demographic information was compiled and the descriptive statistics are represented by tables1and 2.

Table 1

Descriptive Statistic for maths anxiety in the USA and Egypt

Variables	*n*	*M*	*SD.*
Maths anxiety at Egypt	169	47.55	16.43
Maths anxiety at USA	161	38.05	14.20

Table 2

Descriptive Statistic for Majors in Egypt

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Variables	n	M	SD.
Social Science	48	46.43	16.88
Hard sciences	41	47.57	17.20
Arts	43	47.23	16.29
Health sciences	37	52.57	15.03

The descriptive statistics that were compiled include means and standard deviation. Furthermore, a two way ANOVA was used to test the null hypotheses. The frequency of maths anxiety for the Egyptian and American samples is presented in a histogram (Figure 1 and Figure 2).

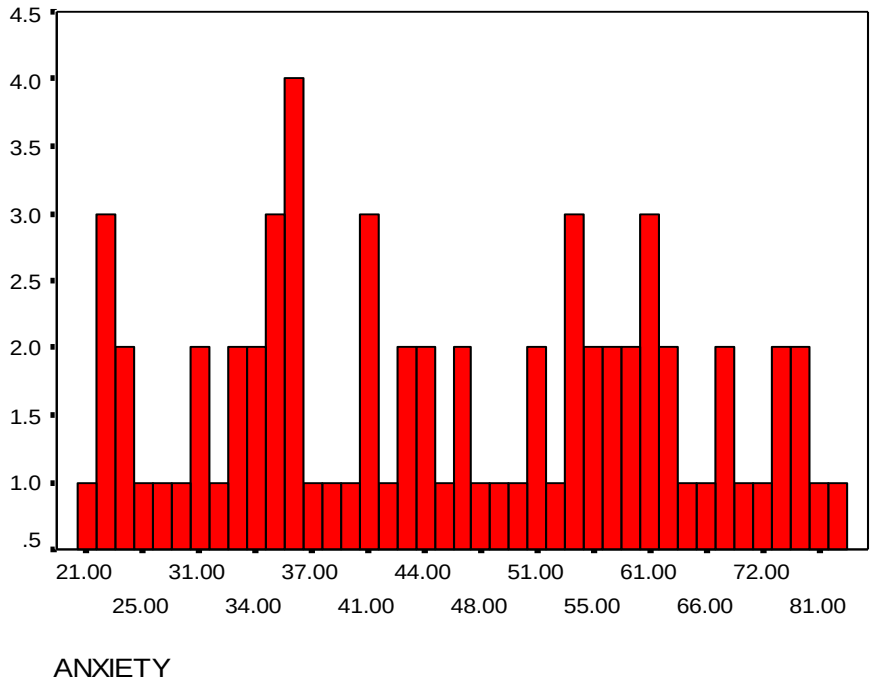

Figure 1. Frequency of maths anxiety for Egypt sample.

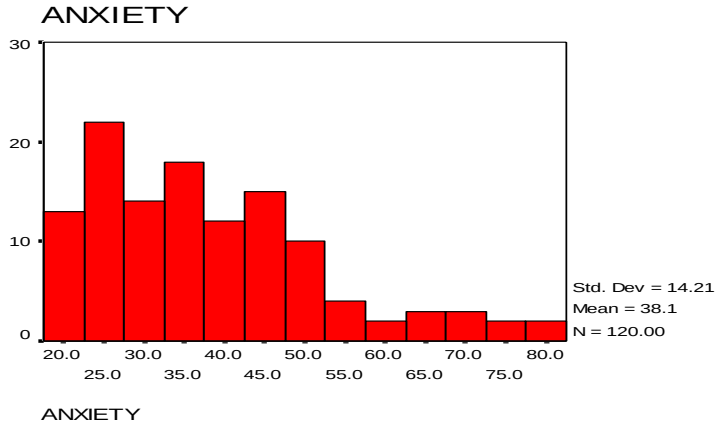

Figure 2. Frequency of maths anxiety for USA sample.

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Results

The first Hypothesis: Maths anxiety does not differ depending on undergraduate major (groups were divided into hard science, social science, health science, and fine arts) in college students in the USA and Egypt.

A 4x2 ANOVA was conducted to evaluate the effects of the four different majors and two countries on maths anxiety. The means and standard deviations for maths anxiety are presented in table 1, the means and standard deviations for the different majors in Egypt are presented in table 2, and the means and standard deviations for the different majors in the USA are presented in table 3.

Table 3

Descriptive Statistic *for Majors in the USA*

Variables	n	M	SD.
Social science	34	43.36	17.63
Hard sciences	51	11.97	11.97
Arts	38	34.00	16.06
Health sciences	46	39.03	15.05

The results for the ANOVA indicated a significant main effect for country, F (1,328) = 11.41, p < .001, partial _ η^2=.06, a non-significant effect for major, F (4,329) = .55, p =.70, partial _ η^2=.01, and a non-significant interaction effect between country and major, F (3,328) =.89, p = .45, partial _ η^2 =.02.

In the analysis, *R-Square* was computed as 10.7%. This indicated that country accounted for 10.7 % of the variance in maths anxiety.

The second hypothesis: Maths anxiety does not differ depending on gender in college students in the USA and Egypt.

The results were analysed using a two-way analysis of variance (ANOVA) with one between two factors, which were gender and country and maths anxiety. The means and standard deviations for the effect of gender on maths anxiety in Egypt and the USA are presented in table 4.

Table 4

Descriptive Statistic for Gender in Egypt and the USA

Variables	n	M	SD
Male on the anxiety at Egypt	84	49.38	17.77
Females on the anxiety at Egypt	85	45.77	15.07
Male on the anxiety at USA	78	41.27	15.90
Females on the anxiety at USA	83	36.98	13.52

This analysis revealed a significant main effect for country, F (1,329) = 11.41, p < .001, partial _ η^2=.06, a significant effect for gender, F (1,329) = 3.09, p =.08, partial _ η^2

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=.02, and a non-significant interaction effect between country and gender, *F* (1,329) =, 001, *p* = .45, partial _ η^2=.00.
In the analysis, *R-Square* was computed as 10.1%. This indicated that gender accounted for 10.1 % of the variance in maths anxiety.

Discussion

The questions of this study, which were derived from the research literature and then stated as null hypotheses, are not fully supported by the data. The study results indicate that maths anxiety differs between undergraduate college students in Egypt and those in the USA. Moreover, the study results are not consistent with the predictions, as maths anxiety did not vary by major as was predicted by the first hypothesis. Additionally, the study results indicate that gender does not have a significant effect on maths anxiety.

Maths Anxiety across Cultures

Country has a significant effect on maths anxiety. The Egyptian students sampled reported higher scores on maths anxiety (Figure 3).

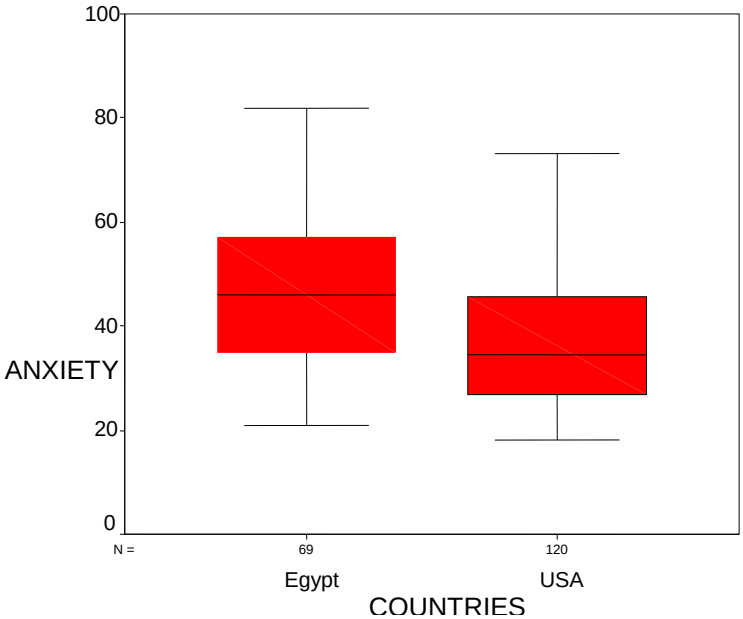

Figure 3. Frequency of maths anxiety in Egypt and the USA.
This may be due to the Egyptian educational system being different to the American educational system. As been stated above, there is a big difference between the Egyptian and American educational systems in terms of the selection of maths courses, when students have to study maths and the number of maths courses.

Maths Anxiety across Majors

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As indicated previously, the study shows that students' scores on maths anxiety are not significantly different across majors when comparing Egypt and the USA. The neutral mean for all of the majors indicates that major (hard science, social science, health science and fine arts) has no significant effect in Egypt or the USA. This may be explained by the number of students with each major in the American sample. As table 3 indicates, the number of students majoring in hard sciences contributed 40 % of the total sample of the study, and those students demonstrate maths acuity (μ = 11.97). Therefore, these students are most likely to not experience maths anxiety. The large numbers of these students in this sample may have impacted on the results.

The researchers suggest that if the numbers of social science and arts students were increased, the outcomes may differ a great deal. As table 2 indicates, the numbers of students in the four majors were fairly evenly distributed and the mean maths anxiety scores varied very little. Again, differences in the educational systems of Egypt and the USA may have influenced the results of this study because, in Egypt, students in social and arts majors do not take any maths or statistics courses so may not experience maths anxiety. These students are not likely to be concerned about maths problems in general, whereas hard science students are likely to be proficient in maths so may also experience less maths anxiety.

Maths Anxiety and Gender

Gender was not found to have an impact on maths anxiety in either the Egyptian or the American sample. Males and females had similar maths anxiety scores in this study. This finding is consistent with the conclusions of Tapia (2004), Haynes et al. (2004). However, it is not consistent with the conclusions of Fusion (2007), Khatoon and Mahmood (2010), Malinsky, et al. (2006), Preis and Biggs (2001) and Zaslavsky (1994), all of whose research found that women, especially adult women, are more hindered by maths anxiety. Zaslavsky (1994) reported results from a long-term research project which concluded that around the seventh grade, girls begin to doubt to their capability to do maths, and this perception is contributed to by family belief systems.
table 4 shows that males scored higher on maths anxiety in both the Egyptian sample (3.61) and the American sample (4.29). This indicates that males and females feel similar levels of maths anxiety.

Implications

There are direct and indirect implications of this study. The direct implications pertain to the answers to the posed research questions and they are addressed in the previous discussion. The existence of indirect implications is a consequence of the decades of research and abundance of findings, which indicate a lack of consensus on the nature and factors underlying maths anxiety. Because of this lack it was necessary to try to probe even further into this complex phenomenon. The construct of maths anxiety, initially seen and labelled as number anxiety, has been studied by many researchers.

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The label “maths anxiety” has been used as an umbrella term describing certain behaviours exhibited by individuals identified as suffering from this condition.
However, definitions of maths anxiety, although overlapping, are not identical in nature. If anxiety can be described as feelings of tension, fear, and panic when faced with the object of the anxiety, does that indicate that maths anxiety corresponds to feelings of tension, fear, and panic when faced with mathematics? And if it does, what does being faced with mathematics truly mean? Does it mean being faced with numbers, or number manipulation? Does it mean being faced with a mathematical task, performing one, or being evaluated on one? The lack of answers to these questions implies that the definition of maths anxiety needs to be revisited, and the behaviours encompassed by this condition need to be specifically stated.
This study has suggested that maths anxiety cannot be predicted by major or gender. Although the results did not find a positive relationship between maths anxiety and gender or major, educators may be able to use this knowledge to increase students’ motivation.

General anxiety may cause difficulties within any educational program regardless of the subject. Therefore, educators should continually be cognisant of the issues related to anxiety disorders. Moreover, the researchers recommend that educators and student advisors use psychological tools to assess students’ anxiety in general, and maths anxiety specifically, to modify teaching methods to help decrease anxiety and increase student motivation.

Conclusion

This study, like previous research, has demonstrated that maths anxiety is a subtle and complex problem with no simple solution. Cultural and educational systems play an important role in creating maths anxiety. Although the results of the current study were not consistent with the literature review and some of the other available research regarding the relationship between maths anxiety and major, the results indicated that maths anxiety can be created and possibly overcome through the educational system. Moreover, the study revealed that males and females did not differ in their levels of maths anxiety in either country, and this is consistent with the literature review and some research studies, although inconsistent with other studies.

Limitations of the Study

One limitation of this study is the convenient sample, which may hinder the generalization of the results. Another limitation is the self-reporting nature of the assessment, which depends entirely on how students responded to items. In such cases, one assumes that students are honest and respond to the items based on their true feelings. However, researchers need to be aware that some students might hide their real emotions or respond randomly.

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