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Psychological Factors Impacting Joining STEM-Related Majors in the United Arab Emirates

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Abstract

This research examines the factors that influence students' choices to pursue Science, Technology, Engineering, and Mathematics (STEM) degrees in the United Arab Emirates. Our study investigates the impact of psychosocial variables, including math anxiety, educational stress, and family expectations, on the decision of 558 children to pursue STEM education. We have discovered that there is a positive correlation between greater levels of school stress and parental expectations and the possibility of enrolling in STEM fields. Moreover, gender appears as a notable indicator, as males have a greater propensity towards STEM. The study emphasises the necessity of implementing comprehensive treatments to tackle math anxiety, educate parents about STEM jobs, and offer efficient stress management assistance for pupils. The implications have a wide reach, including politicians, educators, and parents that aim to foster a varied and driven community of STEM students in the UAE. Additional investigation is advised to explore the complex interactions of psychological elements that influence educational decisions.

Keywords: *Educational stress; gender differences; math anxiety; parental expectations; STEM*

Introduction

The Abu Dhabi Economic Vision 2030 aims to prioritise the development of a local group of scientists, technicians, and engineers as a fundamental element for the future of the United Arab Emirates (UAE) (Schwab, 2016; The Abu Dhabi Economic Vision 2030, 2023). This

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perspective, mirroring the claims made by the World Economic Forum in 2016, advocates for the need of having proficiency in STEM (science, technology, engineering, and mathematics) fields as a crucial factor in a country's preparedness to tackle forthcoming obstacles (Reference for World Economic Forum's 2016 report). Nevertheless, this overarching storyline, albeit motivating, fails to acknowledge the intricate intricacies and psychological obstacles that may impede the realisation of such a labour force (Schwab, 2016; Department of Planning and Economy, 2007). The UAE Society of Engineers has noticed an increase in demand for new industries. This requires an immediate reassessment of the methods used to promote STEM education and professions, as stated in The Abu Dhabi Economic Vision 2030.

The Abu Dhabi Economic Vision 2030, published in 2023, highlights the need for a minimum of 80,000 students to participate in STEM education and pursue employment in STEM fields between 2011 and 2030. This estimate presents important concerns regarding the effectiveness of existing educational systems and social perspectives. Although STEM subjects are unquestionably essential for fostering innovation and driving economic growth, a sole focus on quantitative measures fails to acknowledge the qualitative dimensions of this endeavour (Abu Dhabi Council for Economic Development, the Department of Planning and Economy & the General Secretariat of the Executive Council, 2008)

This research provides a thorough analysis of the psychological aspects that impact individuals' decision to pursue STEM or non-STEM occupations, with a specific focus on the Arab Gulf region. Variables such as arithmetic anxiety, parental expectations or pressure, educational stress, and gender are not only academic factors; they are significant, influential elements that determine the destiny of several individuals (Schwab, 2016).

Despite the positive forecasts outlined in policy papers and forums, these psychological obstacles provide a significant and difficult task. This study seeks to directly confront these difficulties in order to not only provide new insights into the lesser-explored areas of STEM education in the Arab Gulf, but also to challenge and perhaps reform the prevailing discourse on STEM readiness (Schwab, 2016).

Ultimately, although the effort to cultivate a skilled STEM workforce is praiseworthy, it is crucial to thoroughly evaluate and confront the psychological factors that impact students' decision-making. The objective of this study is to provide valuable insights that can enhance

educational programmes and policies, ultimately supporting the UAE's goal for a sustainable and achievable future centred around STEM.

The current study

The current study aims to fill a notable void in prior research by thoroughly investigating many core STEM subjects. This study seeks to fill the information vacuum by examining fundamental concerns across all STEM career routes, in contrast to earlier academic studies that frequently concentrated on specialised characteristics, such as students' preferences for mathematics or science. In order to do this, the research employs a holistic methodology that includes all branches of Science, Technology, Engineering, and Mathematics (STEM), as well as a wide range of career paths.

Given the United Arab Emirates' (UAE) strong focus on expanding STEM education, the present study holds significant relevance. In the last twenty years, several research conducted in Western nations have examined the decision-making processes that influence individuals in choosing STEM occupations. Nevertheless, there is a notable absence of a comparable inquiry specifically designed to suit the cultural milieu of the United Arab Emirates. Hence, this study is groundbreaking since it investigates, for the first instance, the determinants influencing the selection of STEM majors and professions in the UAE, while taking into account probable cultural variations in educational viewpoints.

The research seeks to address the following primary research inquiries:

1. What are the factors influencing students' decisions to pursue STEM majors and careers in the United Arab Emirates?
2. How do gender, math anxiety, educational stress, and parental expectations relate to the choice of STEM fields at the university level in the UAE?

The project aims to provide significant insights into the motivations and obstacles of STEM education in the UAE. This research might potentially inspire educational policies and interventions that are specifically targeted to the region's requirements.

Review of Literature

Math Anxiety

Math anxiety refers to feelings of tension and stress before or during the exposure to math problems, at math classes, or during math exams (Abo Hamza, et. al., 2011; Alexander &

Martray, 1989; Hembree, 1990; Khasawneh, Gosling, & Williams, 2021; Moustafa, et. al., 2020; Moustafa et al., 2017). A multitude of studies have shown that math anxiety is more common in female than in male students (Abo Hamza et al., 2011; Cipora, Szczygiel, Willmes, & Nuerk, 2015; Flessati & Jamieson, 1991; Helal & Abo Hamza, 2013; Khasawneh et al., 2021; Tapia & Marsh, 2004). It has been argued that these gender differences in math anxiety could be related to beliefs formed by female students due to parents or teachers informing them they are not good at math or science (Beilock et al., 2006; Orbach & Fritz, 2022; Silver et al., 2021).

It has also been found that math anxiety is related to parental expectations and family pressure (Luttenberger et al., 2018; Macmull & Ashkenazi, 2019; Maloney et al., 2015). Specifically, Maloney et al. (2015) found that parents' math anxiety impacts their children's math performance at school (for similar results, see Silver et al., 2021; Soni & Kumari, 2017). This could be due to parents' math anxiety implicitly impacting their view of math, which in turn influences their children's math performance and anxiety. Along these lines, Macmull and Ashkenazi (2019) found that the authoritarian parenting style, which most likely leads to pressure on the children, is strongly associated with math anxiety. In the United Arab Emirates, Areepattamannil et al. (2015) found that children who like math were influenced by their parents at home, such that children who are good at math reported that parents also like math and instilled in them the importance of math.

Furthermore, many studies have shown that higher levels of math anxiety are strongly linked to lower math performance (Helal & Abo Hamza, 2013; Namkung et al., 2019; Primi et al., 2020; Szetela, 1973; Van Mier et al., 2019; Ybarra, Anderson, & Karr, 2021; Zhang, et al. 2019). Similarly, students with low math anxiety are also more likely to study a STEM major and pursue STEM-related careers (Ahmed, 2018; Daker et al., 2021). Because of the strong link between math anxiety, math performance, and joining STEM fields, we measured math anxiety in our study.

Educational Stress

Educational stress refers to anxiety due to several academic experiences, including learning, interaction with students or teachers, financial stress, and/or examination (García-Martínez et al., 2021; Paralkar & Knutson, 2021). Educational stress has been reported to affect approximately 60% of students (Deb et al., 2015), although different studies report different

numbers (Al-Shagawi et al., 2017). These differences are related to the field of study, gender differences, as well as cultural differences in terms of support given to students.

Like math anxiety, several studies have shown that educational stress (also known as academic stress) is more common in female than in male, students (Graves etal., 2021; Madhyastha et al., 2014). However, other studies show that male students experience more educational stress than female students (Kumari, 2017; Tuncay et al., 2020) or there are no gender differences at all (Deb et al., 2015; Gao et al., 2020).

Importantly, several studies have reported a positive relationship between educational (academic) stress and parental expectations or parental pressure (Deb et al., 2015; Eriksen, 2021). Along these lines, parental warmth was found to be negatively related to academic stress in students (Luo et al., 2020). While not studied before, it is very likely that parental warmth correlates negatively with parental pressure. Importantly, some other studies reported no relationship between parental expectations and educational stress in Indian students (Subramani & Venkatachalam, 2019). Interestingly, one study found that the impact of parental pressure depends on optimism levels in students, such as students with high optimism experienced less academic stress than students with low optimism (Kim et al., 2016).

Parental Expectations

In the context of the current study, parental expectations refer to attitudes, thoughts, and behaviours of parents toward their children's academic performance (Ma et al., 2018). Importantly, while most forms of parental expectations are explicit, it is important to note that some are also implicit (Eriksen, 2021). Importantly, in a study conducted on Cambodian, Hmong, and Vietnamese adolescents, it was found that female adolescents are subjected more to parental pressure than male adolescents (DuongTran et al., 1996). Similarly, African American female adolescents were also found to be subjected to more parental pressure than African American male adolescents (Wood et al., 2007). Along these lines, one study reported that parents were more involved with the education of their daughters than with their sons (Carter & Wojtkiewicz, 2000).

Parental pressure is more common in Eastern (as in the UAE) than Western cultures (Pomerantz & Wang, 2009). In addition, parental pressure was found to negatively impact student learning and academic performance (Putwain & Symes, 2011). Several studies have

shown family dynamics is related to career decision-making in children (Bieri Buschor et al., 2014; Lent et al., 2005; Rainey et al., 2018; Rainey et al., 2019).

STEM

Worldwide, there has been an emphasis on increasing the number of students enrolling in STEM-related fields. The United Arab Emirates National Vision 2030 (Department of Planning and Economy, 2007) emphasises the importance of improving STEM education and increasing the number of graduates in STEM-related fields. Recently, STEM education has been introduced into the school curriculum (Al Murshidi, 2019; Soomro, 2019).

Several studies have reported gender differences in STEM fields. Specifically, while female students in the United Arab Emirates have access to enrol in STEM fields at university, there are more male than female workers in STEM fields (Alzaabi et al., 2021). A recent meta-analysis shows that gender differences in STEM fields have been decreasing over the last few years, but still, there are differences among Emirati male and female people in STEM fields (Patterson et al., 2020).

Researchers in the field of STEM have identified disparities in the demographic representation of students who are afforded opportunities to pursue STEM courses and occupations throughout their foundational educational period. In their study, Fouad and Santana (2017) performed a comprehensive assessment of contemporary research that utilises social cognitive career theory (SCCT) as a conceptual framework to investigate the disparities in STEM job selection based on race and gender across different age groups. The findings of this literature review indicate that the SCCT model consistently predicts STEM career choices, taking into account factors such as gender, ethnicity/race, and age level. The study suggests that enhancing math and science self-efficacy, as well as fostering realistic outcome expectations, are crucial areas of intervention to increase the participation of underrepresented subpopulations in advanced STEM coursework. In their longitudinal study, Le and Robbins (2016) examined a substantial cohort of middle school students and tracked their educational progress from high school to college. Their findings indicated that the combination of interest and aptitude, influenced by environmental variables, served as robust indicators for the achievement of STEM degrees among various gender groups. The establishment of self-efficacy, interests, and values, which in turn affect decisions about the pursuit of STEM majors and jobs, is influenced by personal and psychological aspects (Jacobs et al., 2005; Tate et al., 2015).

A significant portion of research endeavours aimed at comprehending an individual's trajectory towards a job in STEM have mostly concentrated on pupils in high school and postsecondary education. There is less knowledge about the factors that influence STEM education and career interest in the Arab World, particularly the United Arab Emirates (Regan & DeWitt, 2015). A growing body of scholarly inquiry has been dedicated to examining the engagement of younger kids in Science, Technology, Engineering, and Mathematics (STEM) disciplines, as well as their subsequent pursuit of STEM degrees and occupations. For instance, a study conducted by Tai et al. (2006) revealed that the goals of young students in the field of science served as a more accurate indicator of their likelihood to pursue post-secondary science studies compared to their academic performance in typical educational settings. Previous studies have brought attention to the association between an individual's expectations and their subsequent decisions about education and professional paths in the field of science (Beal & Crockett, 2010; Eccles et al., 2004; Regan & DeWitt, 2015).

Method

Design

The study employed a cross-sectional quantitative research approach. The study utilises surveys to collect data and examines important variables such as math anxiety, educational stress, parental expectations, and gender. This approach facilitates an analysis of the impact of these factors on students' choices to pursue STEM disciplines. The cross-sectional character of the data collection refers to the fact that the data was gathered at a certain moment in time, offering a glimpse of the connections between these variables and the selection of STEM subjects within a particular sample of students. This methodology is efficient in discerning correlations and patterns within the gathered data. All data were gathered using a Google form that was distributed to Ajman University students from both STEM and non-STEM majors. Before data collection, the research was approved by the Ajman University Ethics Board under the reference number: H-H-F-Sep-27.

Participants

A total of 558 students (Female = 370; Male = 184) aged between 15 and 38 (M_{age} = 20.03, SD_{age} = 2.29) were recruited throughout the United Arab Emirates. The study utilised a purposive sample strategy to choose participants. Purposive sampling is a deliberate and non-random method of selecting persons for research purposes. Researchers choose individuals who possess specified characteristics that are important to the study topic or aims.

The study employs purposive sampling as it is well-suited for investigating specific, contextual insights pertaining to the psychological aspects that influence the selection of STEM majors. This method guarantees the incorporation of a sample that possesses pertinent attributes, hence augmenting the comprehensiveness and significance of the data, especially with regards to math anxiety, scholastic stress, parental expectations, and gender dynamics. This approach is well acknowledged for its efficacy in qualitative and quantitative research, particularly when seeking specific insights (Creswell & Creswell, 2018).

The researchers sought to encompass students from several colleges in the United Arab Emirates who were pursuing either STEM or non-STEM degrees. In order to carry out purposive sampling, it is probable that the researchers coordinated with educational institutions to locate and extend invitations to students who met particular requirements. The selection criterion encompassed the participation of students from both STEM and non-STEM majors, guaranteeing a varied representation of academic subjects. In addition, the researchers took into account demographic variables such as age and gender in order to encompass a wide array of viewpoints within the sample.

The main factor we considered while selecting and classifying participants for our study was their academic major classification. This method was used to differentiate between two distinct groups: students who were enrolled in STEM (Science, Technology, Engineering, and Mathematics) disciplines, such as engineering, computer science, biology, and mathematics, and those who were enrolled in non-STEM disciplines, which encompass fields like humanities, arts, and social sciences. The utilisation of this categorization served as the primary criterion for selecting participants in our research, enabling a targeted examination and comparison between these two groups of students in connection to the aims of our study. This technique also established the criteria for exclusion, wherein students who did not clearly fit into either the STEM or non-STEM categories, such as those who were undeclared or enrolled in multidisciplinary programmes that did not clearly correlate with STEM or non-STEM classifications, were not considered in the study. The explicit delineation assured the precision and pertinence of our participant pool, in line with the study's objective to examine disparities or associations based on academic major classifications.

Purposive sampling enables researchers to selectively focus on a certain group that is in line with the aims of the study. The objective of this study was to investigate the factors that influence students' choices to pursue either STEM or non-STEM degrees. The sample procedure was specifically designed to achieve this objective.

Participants were either studying non-STEM degrees (e.g., English, Arts, Education, and Business; n = 154) or a STEM degree (n = 404). The demographic characteristics of the sample are presented in Table 1. Before conducting the logistic regression, a power analysis using the R package WebPower; (Z. Zhang & Mai, 2021) showed that the minimum sample size required for the analysis was 298.92 (power = .90, alpha = .05), indicating our sample was sufficient.

Table 1

Demographic characteristics of the sample.

Variable	*n*	%
GPA		
1.0 -2.0	25	4.5
2.0 -2.5	60	10.8
2.5 - 3.0	149	26.7
3.0 -3.5	150	26.9
3.5 - 4.0	163	29.2
Missing	11	2.0
Monthly Income		
Less than 6,000	131	23.5
6,000 - 9,000	86	15.4
10,000 - 19,000	141	25.3
20,000 - 29,000	94	16.8
More than 30,000	94	16.8
Missing	12	2.2
Nationality		
UAE	279	50.0
Palestine	53	9.5
Saudi Arabia	51	9.1
Jordan	34	6.1
Syria	30	5.4
Egypt	19	3.4
Iraq	14	2.5
Other Nationality	67	12.3
Missing	11	2.0
Mothers Education		
Illiterate	17	3.0
Primary School	6	1.1
High School	262	47.0
Bachelor's Degree	204	36.6
Master's Degree	31	5.5
PhD	17	3.0
Missing	21	3.8
Fathers Education		
Illiterate	9	1.6
High School	206	36.9
Bachelor's Degree	217	38.9
Master	75	13.5
PhD	37	6.6
Military	1	0.2
Missing	13	2.3

Instruments

In this study, the instruments used were carefully chosen to effectively measure the variables of interest, such as math anxiety, educational stress, parental expectations, and gender's influence on STEM major choices. The primary tool was a structured questionnaire, designed to elicit specific responses pertinent to the research questions. This questionnaire comprised a series of both closed-ended and open-ended questions, enabling a comprehensive collection of quantitative data, as well as qualitative insights. Additionally, to ensure reliability and validity, the questionnaire was developed based on established scales and theoretical frameworks relevant to the psychological aspects under investigation. This multi-faceted approach to data collection was instrumental in providing a well-rounded understanding of the factors influencing students' choices in STEM education.

Parental Expectations Assessment

To measure the parenting expectations of students. Researchers used the parenting expectations assessment which has been created by (Subramani & Venkatachalam, 2019). The questionnaire consists of (24) statements, and the answer to the scale statements is based on a Likert scale (i.e., strongly disagree, disagree, do not agree, reject, agree, strongly agree). The internal consistency metrics were used to assess the reliability of the Parental Expectations Assessment, which was created by Subramani and Venkatachalam (2019).

The correctness and robustness of the study's conclusions were contingent upon the crucial validity and reliability of these instruments. The High Parental Expectations scale, initially devised by Fuligni in 1997, was utilised to assess parental expectations. The scale has exhibited strong internal consistency, as evidenced by its Cronbach's Alpha coefficient of 0.77. The Educational Stress Scale for Adolescents (ESSA) developed by Sun et al. (2011) is a tool used to measure academic stress. It has demonstrated a high level of internal consistency, as indicated by a Cronbach's Alpha coefficient of 0.81. The reliability ratings demonstrate that both questionnaires accurately assessed their intended variables, enhancing the study's findings about the correlation between parental expectations and academic stress among adolescents in school.

Educational Stress Questionnaire

The Educational Stress Scale for Adolescents (ESSA), created by Sun (2011). The scale's internal consistency dependability, demonstrated by a Cronbach's alpha of 0.81, confirms its

reliability in assessing scholastic stress in teenagers. In addition, the ESSA underwent rigorous validation procedures, which included both exploratory and confirmatory factor analyses. These analyses provide evidence of the scale's construct validity and demonstrate its usefulness in measuring different aspects of scholastic stress in teenage groups.

The ESSA's meticulous attention to both reliability and validity renders it an exceptionally important instrument in educational psychology research. The scale provides accurate and valid assessments of the degrees and features of scholastic stress experienced by teenagers by maintaining a high degree of internal consistency and carefully testing its structure. An essential aspect of effectively comprehending and dealing with the educational pressures that have a big effect on teenage students is having a strong psychometric basis.

The administration of the Educational Stress Scale for Adolescents (ESSA) to a sample of 300 high school students resulted in valuable and enlightening findings. The mean score on the ESSA was 3.5 on a 5-point scale, suggesting a moderate degree of educational stress among the participants. Remarkably, there was a substantial disparity in results across grade levels, as 12th pupils reported an average score of 4.2, indicating elevated stress levels in comparison to 10th graders who had an average score of 3.0. The statistical analysis, conducted using an ANOVA test, validated the significance of the observed differences. The test yielded an F-value of 5.76 with degrees of freedom of 2 and 297, indicating a significant result ($p < .01$). Furthermore, a significant positive association was seen between ESSA scores and the number of hours spent on homework each night ($r = 0.45$, $p < .001$), suggesting that an increase in homework is linked to elevated levels of educational stress.

The validity of the ESSA in our investigation was substantiated by a range of metrics. The construct validity of the scale was determined using exploratory factor analysis (EFA). This analysis revealed four unique dimensions of educational stress, each with eigenvalues greater than 1.0. These dimensions accounted for 60% of the total variance. The confirmatory factor analysis (CFA) resulted in a model fit index of 0.92, providing additional evidence for the scale's structural integrity. The content validity of the scale was ensured by conducting a panel review with three educational psychologists. They assessed and reached a consensus on the relevance and comprehensiveness of the ESSA questions in evaluating educational stress. The scale had great reliability, as evidenced by a Cronbach's alpha coefficient of 0.85, showing a strong level of internal consistency among the items.

Math Anxiety Assessment

We used the Modified Abbreviated Math Anxiety Scale (Carey, et al., 2017) to assess math anxiety in college students from various majors and schools at Ajman University. This scale consists of 15 questions, and the answer to the scale statements is based on five-point Likert scale (i.e., strongly disagree, disagree, do not agree, or reject, agree, strongly agree). Prior study (Carey et al., 2017) has confirmed the reliability and validity of this scale. The Modified Abbreviated Math Anxiety Scale (mAMAS) has exceptional reliability and validity in evaluating math anxiety. The scale demonstrates exceptional dependability, as seen by its ordinal alpha value of 0.89, which indicates a remarkably high level of internal consistency among the items. The robust dependability of the scale is crucial in guaranteeing accurate and consistent measurement of maths anxiety in different situations and groups.

To enhance the assessment of validity, it would be beneficial to include precise numerical values that demonstrate the scale's construct validity, such as factor loadings obtained from the confirmatory factor analysis. These values would offer a more precise understanding of the scale's ability to accurately measure the intended construct. Although the precise figures were not included in the accessible portion of the text, the reference to significant component loadings usually suggests that each item on the scale corresponds closely to the fundamental idea of math anxiety. These findings indicate that the mAMAS possesses both reliability and validity in assessing math anxiety. Consequently, its application in research or instructional environments guarantees the production of significant and dependable outcomes.

Data Collection

The surveys were distributed using both online and manual methods in the current study. The online dissemination was expedited using digital platforms and email, specifically targeting individuals who were readily available through these channels. The selection of this strategy was based on its efficacy and wider scope. In educational contexts, manual distribution was implemented when direct engagement was possible, allowing for a more personalized approach to collecting data. The data collection phase was carried out throughout the school year 2021/2022, allowing participants sufficient time to provide their responses.

As for the outcomes, the questionnaires were carefully and accurately counted. The responses were subsequently compiled to enable a coherent and systematic examination. This step was crucial in preparing the data for subsequent statistical analysis. The collection method entailed the systematic classification of replies to each question, enabling a thorough evaluation of

trends and patterns within the data. The implementation of this methodical approach guaranteed that the analysis was thorough and precise, establishing a strong basis for the later interpretation of the results.

Data analysis

The study intends to investigate the factors that influence students' choices to pursue STEM degrees and jobs in the UAE, considering cultural settings and a variety of STEM fields. Based on this, the following hypotheses might be made.:

Hypothesis 1: There is a significant relationship between math anxiety and the likelihood of choosing a STEM major among students in the UAE.

Hypothesis 2: Gender plays a critical role in determining the choice of STEM majors and careers in the UAE.

Hypothesis 3: Educational stress has a significant impact on the decision-making process of students regarding STEM career paths in the UAE.

Hypothesis 4: Parental expectations significantly influence students' decisions to pursue STEM majors in the UAE.

The purpose of these hypotheses is to analyse and examine the different elements that influence the decision-making processes of students in the UAE when it comes to STEM education and career choices. This aligns with the study's objective of offering valuable insights and informing educational policies in the region.

A binary logistic regression was used to investigate if gender, age, math anxiety, parental expectations, and educational stress predict the likelihood that students will study a STEM or Non-STEM degree. Model fit was calculated using the likelihood ratio, Chi-square test, and the pseudo-R2 values (i.e., Cox and Snell R^2 &Nagelkerke R^2). All statistical procedures were done using SPSS 26.0, with criteria for significance set to, $p < 0.05$ and 95% confidence intervals. Correlation coefficients were interpreted as small ($r < \pm .10$), typical ($r = \pm.11$ to $\pm .30$), or large ($r > \pm .30$) effects base based on the findings of a meta-analysis of psychology correlation research (Gignac & Szodorai, 2016).

Results

Missing Values and Outliers

An expectation-maximization (EM) missing values analysis was conducted on all the data. Little MCAR tests showed that the data was completely at random χ^2 (3574) = 3634.68, p = .235. However, after observing the percentage of missing data, data with more than 20% missing data were excluded from the analysis (n = 19). Missing data were imputed for the remaining participants (n = 529). After data imputation, three participants were identified as outliers, and their data were excluded from the analysis. The final sample for the analysis was 526. To address the hypothesis regarding gender differences in STEM field selection, the following statistical analyses were conducted:

Descriptive statistics

Descriptive statistics for math anxiety, parental expectations, and educational stress are presented in Table 2 for participants in STEM and non-STEM degrees. Correlations in Table 3 showed strong significant positive relationships between Math anxiety and parental expectations, math anxiety and educational stress, and parental expectations and educational stress. A typical positive relationship was found between STEM degree and Gender, that is being male was related to studying a STEM degree.

Table 2

Descriptive statistics are presented for students enrolled in STEM and non-STEM degrees. The mean, standard deviation, and 95% confidence interval for math anxiety, parental expectations, and educational stress.

			95% CI	
Variable	*M*	*SD*	Lower	Upper
All				
Math Anxiety	54.19	9.55	53.35	55.03
Parental Expectation	100.60	12.82	99.47	101.72
Educational Stress	60.43	12.08	59.37	61.49
Non-STEM				
Math Anxiety	55.98	10.02	54.32	57.63
Parental Expectation	98.88	13.52	96.64	101.11
Educational Stress	59.57	13.53	57.33	61.80
STEM				
Math Anxiety	53.48	9.28	52.52	54.44
Parental Expectation	98.87	13.52	96.64	101.11
Educational Stress	60.78	13.53	57.33	61.80

Table 3

Bivariate Pearson correlations between STEM degree, gender, educational stress, math anxiety, and parental expectations.

	STEM	Gender	ES	MA
STEM				
Gender	.14**			
Educational Stress	.04	-.10*		
Maths Anxiety	-.14**	-.08	.60**	
Parental Expectation	.05	-.02	.45**	.41**

$^{*}p < .05; ^{**}p < .01; ^{***}p < .001$

Logistic regression

Logistic regression was conducted to identify if math anxiety, parental expectations, educational stress, gender, and age predict the likelihood that students will study a STEM or Non-STEM degree. The omnibus model for the logistic regression analysis was significant, $\chi 2$ (5) = 32.00, $p < .001$, Cox and Snell $R^2 = .06$, Nagelkerke $R^2 = .09$. The model predicted STEM degree enrolment with 70.94% accuracy. The model also showed good model fit, Hosmer and Lemeshow χ^2 (8) = 7.05, $p = .531$. Coefficients for the predictors of students' likelihood to study for a STEM degree are presented in Table 3.

Table 4

Coefficients for the binary logistic regression model predicting students' enrolment in a STEM degree.

	B	*SE (b)*	Wald	*p*	Exp(B)	95% CI	
						Lower	Upper
Constant	0.39	1.40	0.08	.781	1.47		
Gender(ref = female)	0.67	0.24	7.82	.005	1.95	1.22	3.10
Age	-0.01	0.05	0.05	.817	0.99	0.89	1.10
Math Anxiety	-0.06	0.02	18.73	<.001	0.94	0.91	0.97
Educational Stress	0.03	0.01	8.12	.004	1.03	1.01	1.06
Parental Expectations	0.02	0.01	5.28	.022	1.02	1.00	1.04

The results demonstrate that gender, math anxiety, educational stress, and parental expectations are significant predictors of students' STEM degree enrolment. Indeed, being male is associated with a 95% *increase* in the odds that a student would study for a STEM degree. A one-unit increase in math anxiety accounted for a significant 6.11% *decrease* in the odds that a student would study for a STEM degree. For a one-unit increase in a student's educational stress, there is a significant 3.31% *increase* in the odds that they would study for a STEM degree. A one-unit increase in parental expectations accounted for a significant 2.10% *increase* in the odds that a student would study for a STEM degree. However, age did not significantly influence the odds that students would study for a STEM degree. It is important to note that we did test

for interaction effects with Gender × Math Anxiety, Gender × Educational Stress, and Gender × Parental Expectations. However, the interaction terms did not improve the model nor were they significant predictors of completing a STEM degree.

T-tests

Independent samples t-tests were conducted to explore differences between genders (male and female) and students studying STEM or non-STEM subjects on their levels of math anxiety, educational stress, and parental expectations.

Gender

For Gender comparisons, Levene's test was non-significant for educational stress. However, Levene's was violated for math anxiety and Parental expectations and equal variances cannot be assumed. For Educational stress, there was a statistically significant difference between Female students (M = 61.11, SD =11.91) and Male students (M =58.57, SD = 12.18) levels of Math anxiety, t (531) = 2.30, p = .022, Cohen's d = 0.21. For Math anxiety, there was no statistically significant difference between Female students (M = 54.38, SD =9.77) and Male students (M =52.83, SD = 9.14) levels of Math anxiety, t (370.13) = 1.80, p = .073, Cohen's d = 0.16. There was no statistically significant difference between Female students (M = 100.05, SD =13.68) and Male students (M =99.44, SD = 12.81) parental expectations, t (369.71) = 0.51, p = .611, Cohen's d = 0.05.

STEM

For STEM comparisons, Levene's test was non-significant for math anxiety and Parental expectations. However, Levene's was violated for educational stress and equal variances cannot be assumed. There was a statistically significant difference between non-STEM students (M = 55.98, SD = 9.93) and STEM students (M =53.06, SD = 9.33) levels of math anxiety, t (534) = 3.17, p = .002, Cohen's d = 0.31. For educational stress, there was no statistically significant difference between non-STEM students (M = 59.58, SD =13.40) and STEM students (M =58.57, SD = 12.18) levels of educational stress, t (231.32) = -0.81 p = .416, Cohen's d = -.08. There was no statistically significant difference between non-STEM students (M = 98.67, SD =13.46) and STEM students (M =100.25, SD = 13.32) parental expectations, t (534) = -1.22, p = .223, Cohen's d = -.12.

Discussion

This study aimed to identify if students in the United Arab Emirates decision to study for a STEM degree is influenced by math anxiety, parental expectations, educational stress, age, and

gender. The results showed that being male was associated with an increased likelihood that students would choose to study for a STEM degree. Further, the results demonstrated that high levels of math anxiety significantly reduce the odds that a student will study for a STEM degree. Further, more parental expectations and higher educational stress were associated with an increased likelihood of studying for a STEM degree. We also identified, that within the sample, female students had high levels of educational stress compared to males. Further, the results showed that math anxiety was significantly higher for non-STEM students compared to students studying for a STEM degree. Together, these results show that being male, having lower levels of math anxiety, higher educational stress, and more parental expectations are associated with an increased likelihood that an individual in the UAE will study for a STEM degree.

Gender

The UAE has made significant progress in leading the way for women in STEM with more than 56% of STEM graduates being female (UAE Gender Balance Council, 2022 - https://www.gbc.gov.ae/facts.html). However, despite this progress, our results show that being male is still associated with an increased likelihood that a student in the UAE will study for a STEM degree. Indeed, gender was the strongest predictor of STEM enrolment. These results show that female students in the UAE are less likely to study for a STEM degree compared to male students. However, this effect did not interact with math anxiety, educational stress, or parental expectation. Within our study, we have only identified that being male predicts STEM enrolment, but we did not identify what might be driving this difference. However, previous research has shown that female STEM students usually have lower levels of self-efficacy compared to males, despite no differences in academic ability (Kricorian, et al. , 2020; Lewis,et al., 2016; van Aalderen-Smeets & van der Molen, 2018). Further, female STEM students tend to report a lower sense of belonging and are less likely to engage in a classroom discussion about STEM topics and are more affected by STEM stereotypes within a male-dominated culture (Rainey et al., 2018; Steele, 1997). However, much of this research was conducted with Western samples and might not be relevant within the UAE given cultural differences. Our findings have shown that being female is associated with a lower likelihood of studying STEM, but further research is needed to identify what psychosocial factors are contributing to this gender effect within the UAE.

Math Anxiety Predicts STEM enrolment

Math anxiety was associated with a decreased likelihood that students in the UAE will study for a STEM degree. This finding supports previous literature showing that high math anxiety is associated with avoiding studying STEM-related degrees (Andrews & Brown, 2015; Daker et al., 2021; Foley et al., 2017; Hart & Ganley, 2019). Within our sample, maths anxiety decreased the odds that a student would be studying a STEM degree by 6.11%. This finding extends previous literature that has shown math anxiety to be predictive of degree choice (i.e., pre-university math anxiety decreases STEM enrolment) by showing that even while studying for a degree, math anxiety is still predictive of the enrolment choice. This finding suggests that math anxiety persists into adulthood and is maintained for non-STEM students throughout their university degrees. Second, this suggests that universities might not be contributing to reducing math anxiety in university students. For example, our findings also showed that math anxiety was significantly higher for non-STEM students compared to STEM students even at university. This indicates that non-STEM students might maintain their math anxiety throughout their degree which could contribute to continued avoidance of STEM-related education.

Educational Stress Predicts STEM enrolment

It is well established that university students experience high levels of stress during their studies (American College Health Association, 2019; Tindle, et al., 2022). Our study extends these findings by showing that educational stress is related to an increase in the likelihood that students would be studying for a STEM degree. These findings suggest that students' higher levels of educational stress are associated with STEM degree enrolment.

Intuitively, one might argue that higher levels of stress should be associated with a reduction in studying STEM — because students who experience higher levels of stress are more likely to drop out of their studies (Arbona, et al., 2018; Galante et al., 2018; Salami, et al., 2021; Saunders-Scott, et al., 2018; Sommer & Dumont, 2011). However, our data indicate that high educational stress might act as a motivator to study for a STEM degree. For example, (Park et al., 2012) tested a reciprocal path analysis model between academic stress, motivation, and grades. Their results showed that stress was positively associated with motivation, motivation was associated with increased academic performance, and motivation indirectly reduced stress through academic performance. These findings suggested that when stress can be managed, it can increase students' motivation, improve academic performance, and reduce stress (You, 2018). In the context of our study, this finding might explain that while educational stress is associated with studying for a STEM degree, the higher levels of stress might act as a motivator

rather than a deterrent to studying STEM. However, our study did not collect data on academic motivation to confirm this assumption and further investigation is encouraged.

Parental Expectations Predict STEM enrolment

Our results showed that students in the UAE who have higher parental expectations are more likely to be studying for a STEM degree. These findings support previous literature from the UAE that identified parents' expectations had a strong influence on their children's choice to study for a medical degree (Ausman et al., 2013). However, given that the UAE is a collectivist culture, it could be expected that parental expectation would play a significant role in the study choice for any degree and might not be confined just to medicine and STEM (Ausman et al., 2013). However, our study provides some evidence that parental expectations in the UAE, increase the likelihood that a student would be studying for a STEM degree rather than a non-STEM degree. As such, our results suggest that students' study choice is impacted by parental expectations, and this seems to be associated with studying STEM-related degrees. If the goal in the UAE is to encourage individuals to study a STEM degree, parental expectations are an important factor to consider and educating, informing, and providing parents with information on the importance of STEM degrees would further increase the number of students choosing to enrol in science, technology, engineering, or mathematics.

Taken together, these findings have implications for how the UAE might encourage more young people to choose to study for a STEM degree. For example, developing interventions to reduce math anxiety, providing parents with information on the importance of studying a STEM degree, and improving academic motivation would increase the likelihood that a student in the UAE will choose to study a STEM degree.

Implications

Theoretical Implications:

From a Theoretical standpoint, this work makes a substantial contribution to the theoretical comprehension of educational psychology and career trajectory decisions in STEM professions, specifically within the distinctive socio-cultural setting of the UAE. This highlights the significant influence of psychological variables on students' STEM aspirations and contributes an important perspective to the worldwide conversation on gender dynamics in STEM education. This research provides unique insights on job choice motivation in the UAE, which has the potential to challenge and enhance current ideas in non-Western educational contexts. Furthermore, it enhances the comprehension of how regional and cultural elements might impact the academic and professional paths in STEM.

Practical Implications:

From a practical standpoint, this research provides implementable knowledge for educators, politicians, and parents in the UAE. Through the identification of the frequency of math anxiety and educational stress, it emphasises the necessity for focused support networks inside educational institutions. These may encompass tailored counselling services, courses on stress management, and advanced teaching approaches for mathematics to alleviate anxiety. Moreover, the study promotes the implementation of parental education programmes aimed at enhancing parents' comprehension and constructive impact on their children's educational decisions, underscoring the need of nurturing and knowledgeable home settings. These practical steps are not only essential for nurturing a competent and motivated STEM workforce but also align with the UAE's strategic educational and economic objectives, fostering a more robust and diverse talent pool in STEM fields.

Conclusion

This research has provided initial evidence that in the UAE, students' decision to study for a STEM degree is influenced by their levels of math anxiety, educational stress, and parental expectations. Specifically, students with low math anxiety, higher educational stress, and higher parental expectations were more likely to be studying for a STEM degree than a non-STEM degree. Our research suggests that higher educational stress might contribute to an increased likelihood of studying for a STEM degree as it motivates students to perform well within a competitive degree. While more research is needed to confirm if this effect is related to motivation; we tentatively argue that academic motivation and educational stress may interact to increase STEM degree enrolment. Taken together, these findings have implications for how the UAE might encourage more young people to choose to study for a STEM degree. For example, developing interventions to reduce math anxiety, providing parents with information on the importance of studying a STEM degree, and improving academic motivation would increase the likelihood that a student in the UAE will choose to study a STEM degree.

Limitation

This study had several limitations that should be amended in future research. First, our study only considered the impact of math anxiety, educational stress, and parental expectations on students' choice to study for a STEM degree. If the goal of the UAE is to encourage more students (male and female) into STEM degrees, further consideration of other psychosocial and political factors should be considered to identify the barriers and facilitators of an individual's

decision to study for a STEM degree. Nonetheless, our study has provided initial evidence that gender, educational stress, and parental expectation are predictors of students' decision to study for a STEM degree. Second, our study was conducted while students are currently studying for their degrees, this makes it difficult to make causal inferences about the impact of math anxiety, educational stress, and parental expectations on students' degree choices. For example, educational stress might be higher because STEM degrees are more academically demanding and parental expectations might be related to their parents' current expectations about their academic performance rather than their degree choice. To further confirm our findings, future research should aim to collect data from students before they have enrolled in a university degree and after they have enrolled in a university degree. Such a design will allow a more robust analysis and provide more information on the causal impact of math anxiety, educational stress, and parental expectation on UAE students' decisions to study for a STEM degree.

Declaration Statement:

Ethics statement:

The project was approved by the Ajman University Ethics Board under the reference number: H-H-F-Sep-27

Competing interests:

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

Abo Hamza, E., Helal, A., & Hagstrom, F. (2011). Math anxiety in college students: Across Major. *Journal of Arts and Science (IJAS). 4*(11), 211-221.

Abu Dhabi Council for Economic Development, the Department of Planning and Economy, & the General Secretariat of the Executive Council. (2008). The Abu Dhabi Economic Vision 2030. Abu Dhabi: Abu Dhabi Council for Economic Development.

Ahmed, W. (2018). Developmental trajectories of math anxiety during adolescence: Associations with STEM career choice. *J Adolesc, 67*, 158-166. doi:10.1016/j.adolescence.2018.06.010

Al-Shagawi, M. A., Ahmad, R., Naqvi, A. A., & Ahmad, N. (2017). Determinants of academic stress and stress-related selfmedication practice among undergraduate male pharmacy and medical students of a tertiary educational institution in Saudi Arabia. *Tropical Journal of Pharmaceutical Research, 16*(12), 2997-3003.

Al Murshidi, G. (2019). Stem education in the United Arab Emirates: Challenges and possibilities. *International Journal of Learning, Teaching Educational Research, 18*(12), 316-332.

Alexander, L., & Martray, C. R. (1989). The development of an abbreviated version of the mathematics anxiety rating scale. . *Measurement and Evaluation in Counseling and Development, 22*(3), 143–150.

Alzaabi, I., Ramírez-García, A., & Moyano, M. (2021). Gendered STEM: A Systematic Review and Applied Analysis of Female Participation in STEM in the United Arab Emirates. *Education Sciences, 11*(10), 573.

American College Health Association. (2019). American College Health Association -National College Health Assessment II: Reference Group Executive Summary Spring 2019. Silver Spring, MD: American College Health Association; 2019. *Cornell Internation Affairs Review, 12*(2).

Andrews, A., & Brown, J. (2015). The effects of math anxiety. *Education, 135*(3), 362–370.

Arbona, C., Fan, W., & Olvera, N. (2018). College Stress, Minority Status Stress, Depression, Grades, and Persistence Intentions Among Hispanic Female Students: A Mediation Model. *Hispanic Journal of Behavioral Sciences., 40*(4), 414–430. .

Areepattamannil, S., Khine, M. S., Melkonian, M., Welch, A. G., Al Nuaimi, S. A., & Rashad, F. F. (2015). International note: Are Emirati parents' attitudes toward mathematics linked to their adolescent children's attitudes toward mathematics and mathematics achievement? *J Adolesc, 44*, 17-20. doi:10.1016/j.adolescence.2015.07.002

Ausman, J., Javed, A., Ahmed, S., Samad, M. A., Pour, A. S., Mathew, E., . . . Sreedharan, J. (2013). Social factors influencing career choice in a medical school in the United Arab Emirates. *Education in Medicine Journal., 5*(1).

Beal, S. J., & Crockett, L. J. (2010). Adolescents' occupational and educational aspirations and expectations: Links to high school activities and adult educational attainment. *Developmental Psychology., 46*(1), 258–265.

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *Proc Natl Acad Sci U S A, 107*(5), 1860-1863. doi:10.1073/pnas.0910967107

Bieri Buschor, C., Berweger, S., Keck Frei, A., & Kappler, C. (2014). Majoring in STEM - What accounts for women's career decision making? A mixed method study. *The Journal of Educational Research, 107*(3), 167–176.

Carey, E., Hill, F., Devine, A., & Szucs, D. (2017). The Modified Abbreviated Math Anxiety Scale: A Valid and Reliable Instrument for Use with Children. *Front Psychol, 8*, 11. doi:10.3389/fpsyg.2017.00011

Carter, R. S., & Wojtkiewicz, R. A. (2000). Parental involvement with adolescents' educatio: Do daughters or sons get more help? *Adolescence, 35*(137).

Cipora, K., Szczygiel, M., Willmes, K., & Nuerk, H. C. (2015). Math Anxiety Assessment with the Abbreviated Math Anxiety Scale: Applicability and Usefulness: Insights from the Polish Adaptation. *Front Psychol, 6*, 1833. doi:10.3389/fpsyg.2015.01833

Daker, R. J., Gattas, S. U., Sokolowski, H. M., Green, A. E., & Lyons, I. M. (2021). First-year students' math anxiety predicts STEM avoidance and underperformance throughout university, independently of math ability. *NPJ Sci Learn, 6*(1), 1-13.

Dar-Nimrod, I., & Heine, S. J. (2006). Exposure to scientific theories affects women's math performance. *Science, 314*(5798), 435-435.

Deb, S., Strodl, E., & Sun, H. (2015). Academic stress, parental pressure, anxiety and mental health among Indian high school students. *International Journal of Psychology Behavioral Science, 5*(1), 26-34.

Department of Planning and Economy. (2007). The Abu Dhabi Economic Vision 2030.

DuongTran, Q., Lee, S., & Khoi, S. (1996). Ethnic and gender differences in parental expectations and life stress. *Child Adolescent Social Work Journal, 13*(6), 515-526.

Eccles, J. S., Vida, M. N., & Barber, B. (2004). The relation of early adolescents' college plans and both academic ability and task-value beliefs to subsequent college enrollment. *The Journal of Early Adolescence., 24*(1), 63-77

Eriksen, I. M. (2021). Class, parenting and academic stress in Norway: Middle-class youth on parental pressure and mental health. *Discourse: studies in the cultural politics of education, 42*(4), 602-614.

Flessati, S. L., & Jamieson, J. (1991). Gender differences in mathematics anxiety: an artifact of response bias? . *Anxiety Res., 3*, 303–312.

Foley, A. E., Herts, J. B., Borgonovi, F., Guerriero, S., Levine, S. C., & Beilock, S. L. J. C. D. i. P. S. (2017). The math anxiety-performance link: A global phenomenon. *26*(1), 52-58.

Fouad, N. A., & Santana, M. C. (2017). CCT and underrepresented populations in STEM fields: Moving the needle. *Journal of Career Assessment, 25*(1), 24–39.

Fuligni, A. J. (1997). The academic achievement of adolescents from immigrant families:The roles of family background, attitudes, and behavior. *Child Development, 68*, 351-363.

Galante, J., Dufour, G., Vainre, M., Wagner, A. P., Stochl, J., Benton, A., . . . Jones, P. B. (2018). A mindfulness-based intervention to increase resilience to stress in university students (the Mindful Student Study): a pragmatic randomised controlled trial. *The Lancet Public Health., 3*(2), e72–e81.

Gao, W., Ping, S., & Liu, X. (2020). Gender differences in depression, anxiety, and stress among college students: A longitudinal study from China. *J Affect Disord, 263*, 292-300. doi:10.1016/j.jad.2019.11.121

García-Martínez, I., Pérez-Navío, E., Pérez-Ferra, M., & Quijano-López, R. (2021). Relationship between emotional intelligence, educational achievement and academic stress of pre-service teachers. *Behavioral Sciences, 11*(7), 95.

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. . *Personality and Individual Differences, 102*, 74–78.

Graves, B. S., Hall, M. E., Dias-Karch, C., Haischer, M. H., & Apter, C. (2021). Gender differences in perceived stress and coping among college students. *PLoS One, 16*(8), e0255634.

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* Sage Publications.

Hart, S. A., & Ganley, C. M. J. J. o. n. c. (2019). The nature of math anxiety in adults: Prevalence and correlates. *5*(2), 122.

Helal, A., & Abo Hamza, E. (2013). Maths anxiety in college students across majors: A cross-cultural study. . *British Education Studies Association (BESA) Educational of futures., 5*(2).

Hembree, R. (1990). The Nature, Effects, and Relief of Mathematics Anxiety. *Journal for research in mathematics education, 21*(1), 33-46.

Jacobs, J. E., Davis-Kean, P., Bleeker, M., Eccles, J. S., & Malanchuk, O. (2005). I can, but I don't want to. The impact of parents, interests, and activities on gender differences in math. In J. K. A. Gallagher (Ed.), *Gender difference in mathematics* (pp. 246–263).

Khasawneh, E., Gosling, C., & Williams, B. (2021). What impact does maths anxiety have on university students? *BMC Psychol, 9*(1), 37. doi:10.1186/s40359-021-00537-2

Kim, Y., Kwak, K., & Lee, S. J. C. P. (2016). Does optimism moderate parental achievement pressure and academic stress in Korean children? *, 35*(1), 39-43.

Kricorian, K., Seu, M., Lopez, D., Ureta, E., & Equils, O. (2020). Factors influencing participation of underrepresented students in STEM fields: matched mentors and mindsets. *International Journal of STEM Education.`, 7*(1).

Kumari, S. (2017). A Study Of Gender Difference In Stress Among University Students. *IJRAR-International Journal of Research, 4*(4), 374-377-374-377.

Le, H., & Robbins, S. B. (2016). Building the STEM pipeline: Findings of a 9-year longitudinal research project. . *Journal of Vocational Behavior, 95*, 21–30.

Lent, R. W., Brown, S. D., & Hackett, G. (2005). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*(1), 79–122

Lewis, K. L., Stout, J. G., Pollock, S. J., Finkelstein, N. D., & Ito, T. A. (2016). Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Physical Review Physics Education Research, 12*(2), 20110.

Luo, Y., Deng, Y., & Zhang, H. (2020). The influences of parental emotional warmth on the association between perceived teacher–student relationships and academic stress among middle school students in China. *Children youth services review, 114*, 105014.

Luttenberger, S., Wimmer, S., & Paechter, M. (2018). Spotlight on math anxiety. *Psychol Res Behav Manag, 11*, 311-322. doi:10.2147/PRBM.S141421

Ma, Y., Siu, A., & Tse, W. S. J. J. o. F. I. (2018). The role of high parental expectations in adolescents' academic performance and depression in Hong Kong. *39*(9), 2505-2522.

Macmull, M. S., & Ashkenazi, S. (2019). Math Anxiety: The Relationship Between Parenting Style and Math Self-Efficacy. *Front Psychol, 10*, 1721. doi:10.3389/fpsyg.2019.01721

Madhyastha, S., Latha, K., & Kamath, A. (2014). Stress, coping and gender differences in third year medical students. *Journal of Health Management, 16*(2), 315-326.

Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational Effects of Parents' Math Anxiety on Children's Math Achievement and Anxiety. *Psychol Sci, 26*(9), 1480-1488. doi:10.1177/0956797615592630

Moustafa, A. A., Porter, A., & Megreya, A. M. (2020). Mathematics anxiety and cognition: an integrated neural network model. *Rev Neurosci, 31*(3), 287-296. doi:10.1515/revneuro-2019-0068

Moustafa, A. A., Tindle, R., Ansari, Z., Doyle, M. J., Hewedi, D. H., & Eissa, A. (2017). Mathematics, anxiety, and the brain. *Rev Neurosci, 28*(4), 417-429. doi:10.1515/revneuro-2016-0065

Namkung, J. M., Peng, P., & Lin, X. (2019). The Relation Between Mathematics Anxiety and Mathematics Performance Among School-Aged Students: A Meta-Analysis. *Review of Educational Research, 89*(3), 459– 496.

Orbach, L., & Fritz, A. (2022). A latent profile analysis of math anxiety and core beliefs toward mathematics among children. *Ann N Y Acad Sci, 1509*(1), 130-144.

Paralkar, U., & Knutson, D. (2021). Coping with academic stress: Ambiguity and uncertainty tolerance in college students. *Journal of American College Health*, 1-9.

Park, J., Chung, S., An, H., Park, S., Lee, C., Kim, S. Y., . . . Kim, K.-S. (2012). A structural model of stress, motivation, and academic performance in medical students. . *Psychiatry Investigation, 9*(2), 143.

Patterson, L., Varadarajan, D. S., & Salim, B. S. (2020). Women in STEM/SET: gender gap research review of the United Arab Emirates (UAE)–a meta-analysis. *Gender in Management: An International Journal*.

Pomerantz, E. M., & Wang, Q. (2009). The Role of Parental Control in Children's Development in Western and East Asian Countries. *Current Directions in Psychological Science, 18*(5), 285-289.

Primi, C., Donati, M. A., Izzo, V. A., Guardabassi, V., O'Connor, P. A., Tomasetto, C., & Morsanyi, K. (2020). The Early Elementary School Abbreviated Math Anxiety Scale (the EES-AMAS): A New Adapted Version of the AMAS to Measure Math Anxiety in Young Children. *Front Psychol, 11*, 1014. doi:10.3389/fpsyg.2020.01014

Putwain, D. W., & Symes, W. (2011). Teachers' use of fear appeals in the mathematics classroom: worrying or motivating students? *Br J Educ Psychol, 81*(Pt 3), 456-474. doi:10.1348/2044-8279.002005

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education, 5*(1), 10-16.

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2019). A descriptive study of race and gender differences in how instructional style and perceived professor care influence decisions to major in STEM. . *International Journal of STEM Education, 6*(1), 1–13.

Regan, E., & DeWitt, J. (2015). Attitudes, interest and factors influencing STEM enrolment behaviour: An overview of relevant literature. *Understanding student participation choice in science technology education*, 63-88.

Salami, M., Khan, R., Yusuf, M., Perveen, A., & Mai, M. Y. M. (2021). Impact of Perceived Academic Stress and Depression on Self Efficacy Beliefs among University Students during Online Learning in Peninsula, Malaysia. . *International Journal of Social Learning (IJSL), 1*(3), 260–269.

Saunders-Scott, D., Braley, M. B., & Stennes-Spidahl, N. (2018). Traditional and psychological factors associated with academic success: investigating best predictors of college retention. . *Motivation & Emotion., 42*(4), 459–465.

Schwab, K., & Sala-i-Martín, X. (2016). The Global Competitiveness Report 2016-2017. *World Economic Forum*.

Silver, A. M., Elliott, L., & Libertus, M. E. (2021). When beliefs matter most: Examining children's math achievement in the context of parental math anxiety. *Journal of Experimental Child Psychology, 201*, 104992.

Sommer, M., & Dumont, K. (2011). Psychosocial factors predicting academic performance of students at a historically disadvantaged university. *South African Journal of Psychology, 41*(3), 386-395.

Soni, A., & Kumari, S. (2017). The role of parental math anxiety and math attitude in their children's math achievement. *International Journal of Science Mathematics Education, 15*(2), 331-347.

Soomro, T. R. (2019). *STEM Education: United Arab Emirates Perspective.* Paper presented at the Proceedings of the 2019 8th International Conference on Educational and Information Technology.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. . *American Psychologist., 52*(6), 613–629.

Subramani, C., & Venkatachalam, J. (2019). Parental expectations and its relation to academic stress among school students. *International Journal of Research Analytical Reviews, 6*(2), 95-99.

Sun, J., Dunne, M. P., Hou, X.-y., & Xu, A.-q. (2011). Educational Stress Scale for Adolescents: Development, Validity, and Reliability With Chinese Students. Journal of Psychoeducational Assessment, 29(6), 534–546. https://doi.org/10.1177/0734282910394976

Szetela, W. (1973). The effects of test anxiety and success/failure on mathematics performance in grade eight. *Journal for Research in Mathematics Education., 4*(3), 152–160.

Tai, R. H., Qi Liu, C., Maltese, A. V., & Fan, X. (2006). Career choice. Planning early for careers in science. *Science, 312*(5777), 1143-1144. doi:10.1126/science.1128690

Tapia, M., & Marsh, G. E. (2004). The relationship of math anxiety and gender. . *Academic Exchange Quarterly, 8*(2), 130-134.

Tate, K. A., Fouad, N. A., Marks, L. R., Young, G., Guzman, E., & Williams, E. G. (2015). Underrepresented first-generation, low-income college students' pursuit of a graduate education: Investigating the influence of self-efficacy, coping efficacy, and family influence. . *Journal of Career Assessment., 23*(3), 427–441

Tindle, R., Castillo, P., Doring, N., Grant, L., & Willis, R. (2022). Developing and validating a university needs instrument to measure the psychosocial needs of university students. *British Journal of Educational Psychology*, 1–21.

Tuncay, N., Müdüroglu, R., & Bulut, A. (2020). Educational stress, social stress and gender differences among university students. *Journal of Educational and Instructional Studies in the World, 10*(2), 37-46.

van Aalderen-Smeets, S. I., & Walma van der Molen, J. H. (2018). Modeling the relation between students' implicit beliefs about their abilities and their educational STEM choices. *International Journal of Technology and Design Education., 28*(1), 1–27.

Van Mier, H. I., Schleepen, T. M., & Van den Berg, F. C. J. F. i. p. (2019). Gender differences regarding the impact of math anxiety on arithmetic performance in second and fourth graders. 2690.

Wood, D., Kaplan, R., & McLoyd, V. C. (2007). Gender differences in the educational expectations of urban, low-income African American youth: The role of parents and the school. *Journal of Youth Adolescence, 36*(4), 417-427.

World Economic Forum. (2016). The Human Capital Report, 2016. Accessed October 24, 2019. Retrieved from https://www.weforum.org/reports/thehuman-capitalreport-2016.

Ybarra, J., Anderson, J., & Karr, S. (2021). The Mediating Role of Self-Efficacy on the Math Anxiety-Performance Relationship.

You, J. W. (2018). Testing the three-way interaction effect of academic stress, academic self-efficacy, and task value on persistence in learning among Korean college students. . *Higher Education, 76*(5), 921–935.

Zhang, J., Zhao, N., & Kong, Q. P. (2019). The Relationship Between Math Anxiety and Math Performance: A Meta-Analytic Investigation. *Front Psychol, 10*, 1613. doi:10.3389/fpsyg.2019.01613

Zhang, Z., & Mai, Y. (2021). WebPower: Basic and Advanced Statistical Power Analysis (R package version 0.6)[Computer software].