Understanding Challenges of Mathematics Education in Iraq: A Focus on Kurdistan Region

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Abstract
Mathematics is stereotyped as a 'difficult' subject in many parts of the world, and many other stereotypes about the subject abound. This study, therefore, determined and examined some of the psychological barriers to mathematics education that could be responsible for driving such stereotypes in Kurdistan region, Iraq. A questionnaire was used to collect data from students in five departments of the faculty of education at an International University in Kurdistan, Iraq and analysed through SPSS and Minitab. Results confirmation lack of self-confidence, anxiety, and attitude toward mathematics as some of the psychological barriers to mathematics for students in the region. The study further corroborated the assertion that teachers play a key role in influencing students' attitudes toward mathematics but have a negligible or no role in enhancing students' self-confidence in mathematics in the region. Additionally, attitude is shown to have a strong negative relationship with anxiety and self-confidence. Suggestions and recommendations to improve the situation are outlined in the paper.
Keywords: Mathematics stereotypes, Mathematics anxiety, Attitude, Self-Confidence, One Sample t-Test.

Introduction
It is a universal phenomenon observed in higher institutes of learning that programs with a heavy bias in mathematics receive the least number of students during enrolment. Kurdistan region - Iraq is not an exception. Be it in private or public universities, mathematics departments register very few students in comparison to other departments. In one of the private universities in the region, for instance, the total number of mathematics students from first grade to fourth grade is less than the number of students in one class of biology. This gives the idea of how severe the situation currently is. The consequences of this are a smaller number of mathematicians in the region, and most importantly very few mathematics teachers.

Research indicates that students, and to a larger extent the society, view mathematics as a difficult subject (Rose & Gallup, 2005). Given the general acceptance that mathematics is an important subject for almost all areas of human life (Aksu, 1991), nearly every person who has stepped in a formal classroom has encountered mathematics in one way or another. These two, seemingly conflicting issues have created concern, fear, and even developed phobias especially in people who take mathematics courses simply because they must. Such phobias most often over time generate stereotypes about the subject and may develop anxiety in people about it.

Anxiety, as suggested by Tobias, (1993), brings about forgetfulness and erosion of self-confidence in people. He defined it as a state of arousal that a person experiences when confronted with a stimulus, manifested by bodily, emotional, and mental changes.

Anxiety and phobia make studying mathematics seem difficult for most students. For such students, mathematics is not something that comes intuitively or automatically, it takes a lot of effort. Fleming, (2020) supports this notion that mathematics is a subject that sometimes requires students to devote a lot of time and effort. Students may have reasons for pointing an accusing finger at teachers for ineffective teaching, insufficient examples, and generally demotivating students in mathematics lessons. However, Yayla & Bangir-Alpan, (2019) enumerated some of the things that place responsibility of viewing mathematics as a difficult subject right on the students' shoulders, they include not studying, not practicing at home, not listening to the course instructors, getting bored with rule-concept-formulas, not understanding the subject's content matter, prejudice-fear, frequent absences from the course, poor mathematics foundation, and general dislike of mathematics teachers.

Anxiety

According to Brewster & Miller, (2020), anxiety attacks the affective mechanism of a person in the form of sweating, faster heart beating, nausea, and even visible shaking. A lot of students experience such symptoms most especially at the start of mathematics examination. In recent years, there has been an increase in research on the role of anxiety in mathematics learning. Anxiety has been identified as a psychological barrier to mathematics learning, with research showing that it can have a negative impact on students' academic performance and learning outcomes (Vuolo, 2021; Gürel & Köse, 2018; Liew & Low, 2016).

Previous studies have found that anxiety can lead to avoidance of mathematics tasks, decreased motivation and engagement, and negative self-evaluations (Liew & Low, 2016; Gürel & Köse, 2018). Additionally, research has shown that mathematics anxiety can lead to feelings of dread, fear, and worry (Vuolo, 2021). This can lead to a decrease in students' confidence in their own abilities and a decrease in their academic performance (Liew & Low, 2016). As a natural consequence of this anxiety, failure in the lesson manifests itself.

Majority of students become insecure about advanced mathematics courses if they failed the previous one, because mathematics develops in the level of abstraction from one course to the next. The abstract structure in mathematics is very attractive for some, but it has an extremely repulsive nature for others (Karimi & Venkatesan, 2009). The psychological burden they carry from failing the previous course may lead them to develop negative attitudes toward mathematics that can only grow consistently in later years.

Attitude toward Mathematics

A meta-analytic review by Meehan and Umland (2020) explored the role of attitude toward mathematics as a psychological barrier to mathematics. They examined the relationship between attitude toward mathematics and mathematics achievement and found that attitude toward mathematics was a moderately strong predictor of mathematics achievement. Furthermore, the results suggested that the effect of attitude toward mathematics was largest

among students in the early years of schooling and that the effect size decreased across grade levels.

Other studies have found that students' attitudes toward mathematics are related to their mathematics performance and mathematics anxiety (Hemmings, 2004; Ma, 1999). Students who have positive attitudes toward mathematics have higher levels of mathematics achievement than those who have negative attitudes (Ma, 1999). In another study, Ghasemi, Sajjadi, and Bakhshi (2011), found that attitude toward mathematics was the strongest predictor of mathematics anxiety and mathematics performance. They concluded that positive attitudes toward mathematics are essential for mathematics performance, and that cultivating a positive attitude toward mathematics is essential for students to succeed in mathematics.

Conversely, Cai, Boaler, and Williams (2013) found that negative attitudes towards mathematics can lead to the avoidance of mathematics, which in turn can lead to poorer performance in the subject. These findings suggest that negative attitudes towards mathematics can lead to the development of psychological barriers to mathematics, which can limit students' engagement and ability to learn mathematics.

Self-Confidence

Research indicates that self-confidence is a contributing factor to students' success in mathematics. Studies show that students with a higher level of self-confidence in mathematics were more likely to succeed in the subject than those with lower levels of self-confidence (Ferrari & Paull, 2018; Beilock & Willingham, 2009; Ciarrochi, Chan & Caputi, 2000). The studies concluded that higher self-confidence level is likely to result in persistence in mathematics tasks (To & Chen, 2019; Long, & Wang, 2018; Huang & Li, 2017), asking questions, and seeking help when needed. The study further found that students with higher levels of self-confidence in mathematics reported feeling more capable and were less likely to give up on tasks.

Research also found that students with higher levels of self-confidence in math had better performance on tests than those with lower levels of self-confidence, and these students were more likely to engage in activities related to mathematics such as reading math-related materials and participating in math-related activities (Smith, 2021; Lee & Smith, 2020; Schreiber & Schulenberg, 2019). Overall, the research suggests that self-confidence is an important factor in understanding mathematics, and that students with higher levels of self-confidence are more likely to succeed in mathematics courses.

Teacher's Behaviour

Teachers determine the educational environment and therefore play important roles such as endearing the course to their students, ensuring that students learn, and making students feel important. Indeed, most mathematics teachers agree that teaching strategies and techniques have an impact on students' mathematics success (Yayla & Bangir-Alpan, 2019).

Additionally, Khan & Ullah, (2020) found that the quality of the teacher-student relationship and the teacher's expectations had a significant effect on student's mathematics performance. They also found that a teacher's teaching style, feedback, and attitude had a positive effect on student's mathematics performance. These findings suggest that teachers' behaviour can be a

psychological barrier to mathematics and that changes in teachers' behaviour could help improve mathematics performance.

Furthermore, Liang & Lee, (2019) that teachers' beliefs, attitudes, and behaviours can significantly impact students' perceptions of mathematics and motivation to learn mathematics. Specifically, teachers' negative attitudes and beliefs toward mathematics, lack of knowledge of mathematics and mathematics instruction, overly strict and disapproving behaviour, and lack of positive reinforcement can create a psychologically hostile environment for students. Indeed, teacher behaviour acts as a psychological barrier to mathematics learning as presented by (Walker, 2009) who found an important factor in this area to be teacher expectations. The author suggests that teachers' expectations for their students' learning and achievement in mathematics can have a strong influence on students' own beliefs and attitudes toward the subject. Further studies concur that when teachers have low expectations for their students' learning, it can become a psychological barrier to mathematics achievement (Gates, 2007). For example, teachers may be less likely to give students challenging tasks and may not provide them with the same level of support and guidance as other students (Gates, 2007). This can lead to students feeling a lack of confidence in their ability to succeed in mathematics and can cause them to become disinterested in the subject (Gates, 2007).

This study seeks answers to pertinent questions about the dwindling numbers in Mathematics classrooms in the semi-autonomous Kurdistan region of Iraq. The research endeavoured to establish the psychological barriers that may have driven students away from mathematics lecture halls, determine the causes of such psychological barriers, and suggest possible ways of minimizing the effects on mathematics performance by affected students. The aim of this paper, therefore, was to explore such underlying psychological embodiments that may lead to students avoiding mathematics departments, with the following specific research questions.

Research Design and Methodology

Data for the study was collected through questionnaires from all the 5 departments of the faculty of education at an international university. Descriptive statistics for the data found 85% to be homogeneous with an overall mean for all questions at 75. One-Sample t-test was done do verify the consistency of data and it was found that an average 95% of the respondents were consistent. The test was based on the null hypothesis that: H_0: $\mu=72$ against the alternative hypothesis that: H_1: $\mu \neq 72$. And the results obtained $P(71 \leq \mu \leq 79) = 0.95$.

Results

Several statistical tests were carried out on the data and findings are presented as follows. First, the biodata results are presented followed by t-tests and analyses of variance (ANOVA), then descriptive data analysis concludes

Gender

Table 1: Two-Sample t-Test on gender done using the hypothesis $H_0: \mu_1 = \mu_2$ against $H_1: \mu_1 \neq \mu_2$

Gender	Mean	Std Deviation	t-value	P-value
Female	75.69	7.25	0.36	0.719
Male	74.0	21.6		

Authors' compilation

The test indicates no significance difference in the way both genders answered the questionnaire, and therefore the null hypothesis, $H_0: \mu_1=\mu_2$, was not rejected. Out of the total number of respondents, 78% were female and the male students lagged with 22% as can be seen from fig. 1. It should be noted that male students are generally less than female students in most departments.

The bar chart for gender distribution of the students

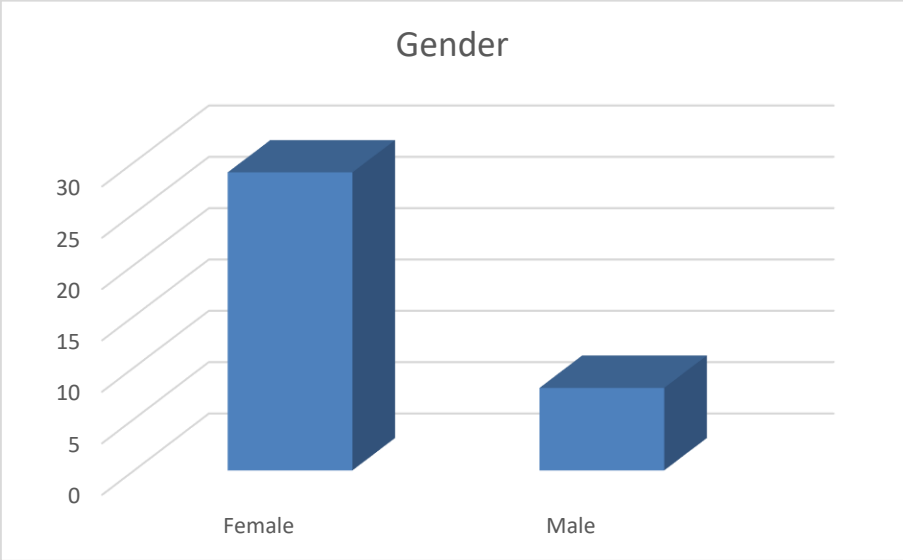

Figure 1: The bar chart indicates the gender of the students.

Grade Levels

The One-way ANOVA was used to examine the relationships among the grade levels of the respondents among all the 5 departments of the faculty of education using the hypothesis that all means are equal, that is, the mean for 1st grade students is equal to that of 2nd grade, 3rd grade and 4th grade students. i.e., *H_0: All means are equal* against *H_1: At least one mean is not equal*

Table 2: A One-Way AOVA Showing the relationship among the grade levels

Source	DF	SS	MS	F-Value	P-Value
Factor	3	460.2	153.4	1.17	0.336
Error	33	4323.9	131.0		
Total	36	4784.1			

Authors' compilation

Results in table 2 above demonstrates that there was no significant difference in the way students in the different grade levels answered the questionnaires, and therefore the null hypothesis was not rejected. However, majority of the respondents came from 4th grade and 3rd grade. Fourth grade had the highest percentage of about 35% as shown in fig. 2, followed by third grade with 29%, then other classes follow each other with an average rating for 2nd grade 20% and 1st grade 16%. First grade students were the least in answering the questionnaire perhaps because they had just started their university education at the time of the survey and may not have been familiar with surveys.

The bar chart illustrating students' grade level

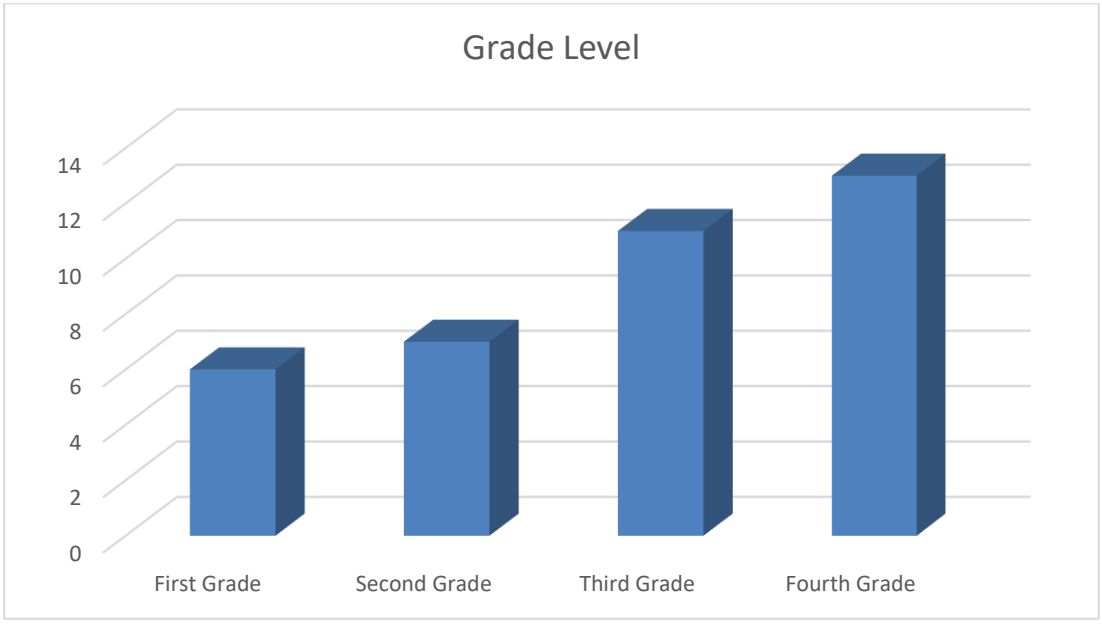

Figure 2: The bar chart illustrates the grade level of the respondents for the study.

Departments

To explore if there were any relationships in the way students from different departments answered the questionnaire, again a One-Way ANOVA was used as shown below.

The bar chart for departments in the faculty

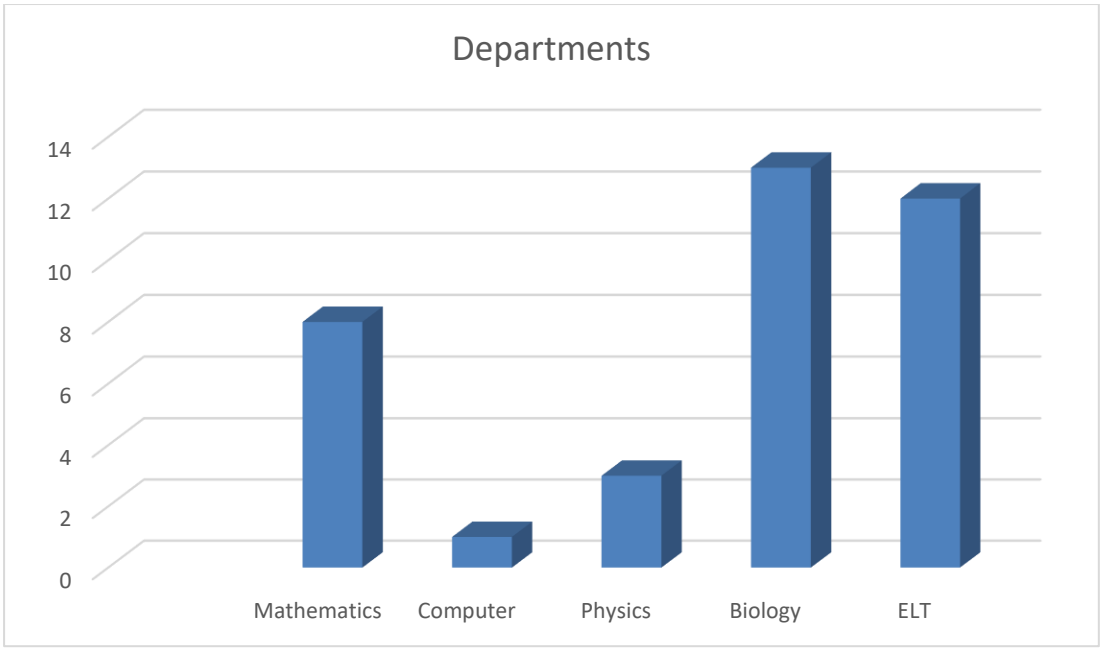

Figure 3: The bar chart shows which department the students in this study are from.

Why not Mathematics Department?

The mean, a descriptive statistic, was used to analyse why students from ELT, Biology, Physics, and Computer departments did not choose mathematics department, and results from figure 4 shows the highest percentage 37% of students responded that "I don't like mathematics", whereas the least percentage of students 19% answered that "Mathematics is difficult". The 2 other options, "Most Mathematics cannot be used in real life" and "Mathematics is for smart people" had 22% each.

The bar chart for reasons students advance for not choosing Mathematics Departments

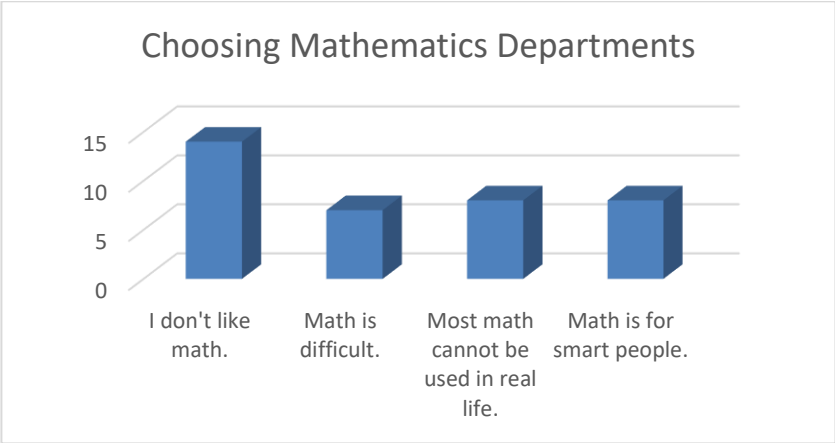

Figure 4: Reasons students advance for not choosing Mathematics Departments.

Mathematics Psychological Barriers

The results of mathematics psychological barriers can be analysed through 4 categories namely, self-confidence, Anxiety, attitude, and the role of the teacher in all these. They are presented below.

Self-Confidence

Table 3: Students' self-confidence analysis

Item	Strongly disagree	Disagree	Not Sure	Agree	Strongly Agree
I get tense when I prepare for a mathematics test.	11	16	38	32	3
I get nervous when I have to use mathematics outside of school.	16	22	27	16	19
I worry that I will not be able to use mathematics in my future career when needed.	22	27	22	24	5
I worry that I will not be able to get a good grade in my mathematics course.	14	27	24	24	11
I worry that I will not be able to do well on mathematics tests.	14	24	38	19	5
I worry that I do not know enough math to do well in future math courses.	14	24	27	35	0
I worry that I will not be able to complete every assignment in a math course.	19	13	22	43	3
I worry that I will not be able to get an "A" in my mathematics course.	19	19	32	24	6

Note: Author's compilation.

It is evident from the table that more than one-third of the respondents agree that they get tense when preparing for mathematics tests, and approximately the same number become nervous when they must use mathematics outside of school. Mathematics is used in almost all spheres of human life and many a times people are called up to apply it knowingly or otherwise. The results also clearly show that approximately a third of the respondents worry about a number of things, including being unable to get good grades in the course 35%, or not being able to do well in the tests 24%, or not being able to get an overall grade A in the course 30% mostly because they are not sure whether they'll be able to complete all the course assignments 46%, or simply if they have enough mathematics to take on the course 35%. All these worries and uncertainties contribute to eroding self-confidence in the ability to do mathematics.

Anxiety

Table 4: Students' anxiety levels

Item	Strongly disagree	Disagree	Not Sure	Agree	Strongly Agree
I feel stressed when listening to mathematics instructors in class.	19	22	22	32	5
I get nervous when asking questions in class.	19	22	32	27	0
Working on math homework is stressful for me.	16	24	16	33	11

Note: Author's compilation.

Stress is one of the major causes of anxiety in people, and the results in the table clearly shows that students get stressed when dealing with mathematics activities. More than half of the respondents were either not sure or get stressed when working on mathematics homework and assignments, and 27% of them get nervous when asking questions in class, but most importantly, almost 40% of the respondents confess that listening to mathematics teachers stresses them. This could be because they know the subject is important but they are not able to grasp the concepts teachers are presenting.

Attitude Toward Mathematics

Table 5: Students' Attitudes Toward Mathematics

Item	Strongly disagree	Disagree	Not Sure	Agree	Strongly Agree
I believe I can do well on a mathematics test.	14	5	22	46	13
I believe I can complete all of the assignments in a mathematics course.	8	14	32	32	14
I believe I am the kind of person who is good at mathematics.	14	8	24	32	22
I believe I will be able to use mathematics in my future career when needed.	8	8	16	41	27
I believe I am the type of person who can do math	11	13	27	30	19

Note: Author's compilation.

Attitude is one of the most important factors in determining the success of an individual in a given task. The table clearly indicates that majority of the respondents have the right attitude towards mathematics subject. For instance, close to 60% believe they can do well on mathematics tests, and almost half of them believe they can complete all assignments given in mathematics. Whereas slightly more than one-half believe they are good in mathematics and about 50% believe they can do mathematics, almost 70% believe they will be able to apply

mathematics in their future careers. This should be a motivating factor enough to push students to understand mathematical concepts.

The Teachers' Role

Table 6: Teachers' Role in breaking mathematics psychological barriers

Item	Strongly disagree	Disagree	Not Sure	Agree	Strongly Agree
I feel confident enough to ask questions in my Mathematics class	11	13	22	40	14
I believe I can understand the content in a mathematics course.	5	16	20	43	16
I believe I can get an "A" when I am in a math course.	13	16	27	22	22
I believe I can learn well in a math course.	5	11	16	49	19
I feel confident when taking a math test.	5	22	27	27	19
I believe I can do the math in a math course.	5	14	19	40	22

Note: Author's compilation.

Teachers are crucial in students' lives not only in academics but also in other aspects that aspects that affect the students' performance at school. Clearly, majority of the respondents 54% agree that they feel confident enough to ask questions in a mathematics class. This could mean that the teacher has created a safe and accommodating classroom environment for all students to express themselves. As can be seen from that table, close to 60% believe they can actually understand mathematics content. Again, understanding content has a great deal to do with the teacher. If the teacher provides clear and concise guidance to the class, then students' effort in understanding concepts would be a lot less and therefore will be more encouraged to study more. This can also easily explain the close to 70% who believe they can study mathematics well, the 46% who feel confident when taking mathematics tests, the 44% who believe they can score a straight "A" at the end of the course, and the more than 60% who believe they can simply do the mathematics in the mathematics course. Therefore, with the right facilitation from the teacher, students can feel confident in all aspects of mathematics learning.

Summary

All the four factors; self-confidence, anxiety, attitude towards mathematics, and the teacher's role were analysed together to determine whether there was a relationship among or between them. One-Way ANOVA at $\alpha=0.05$ was applied using the hypothesis: H_0: *All means are equal* against H_1: *At least one mean is not equal*, and the results are displayed in table 8 below.

Table 7: One-Way ANOVA for self-confidence, anxiety, attitude, and the teacher's role

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	3	2835	944.95	41.93**	0.000
Error	144	3245	22.54		
Total	147	6080			

Note: Author's compilation.

The results in the table indicate a highly significant relationship among the variables leading the rejection of the null hypothesis. Further analysis, as depicted in the figures below, revealed specific variables that are related and how they are related.

Table 8: Descriptive analysis of self-confidence, anxiety, attitude, and the teachers' role

Factor	Code	Mean	Std Dev.	95% CI
Self-Confidence	C71	17.000	4.577	(15.457, 18.543)
Anxiety	C72	20.162	5.737	(18.620, 21.705)
Attitude	C73	8.486	3.185	(6.944, 10.029)
Teachers' Role	C74	17.432	5.113	(15.890, 18.975)

Pooled StDev = 4.74733

Note: Author's compilation.

The table shows a clear comparison of the means thus ordering the variables based of their influence of teaching and learning of mathematics.

Chart for comparison of means

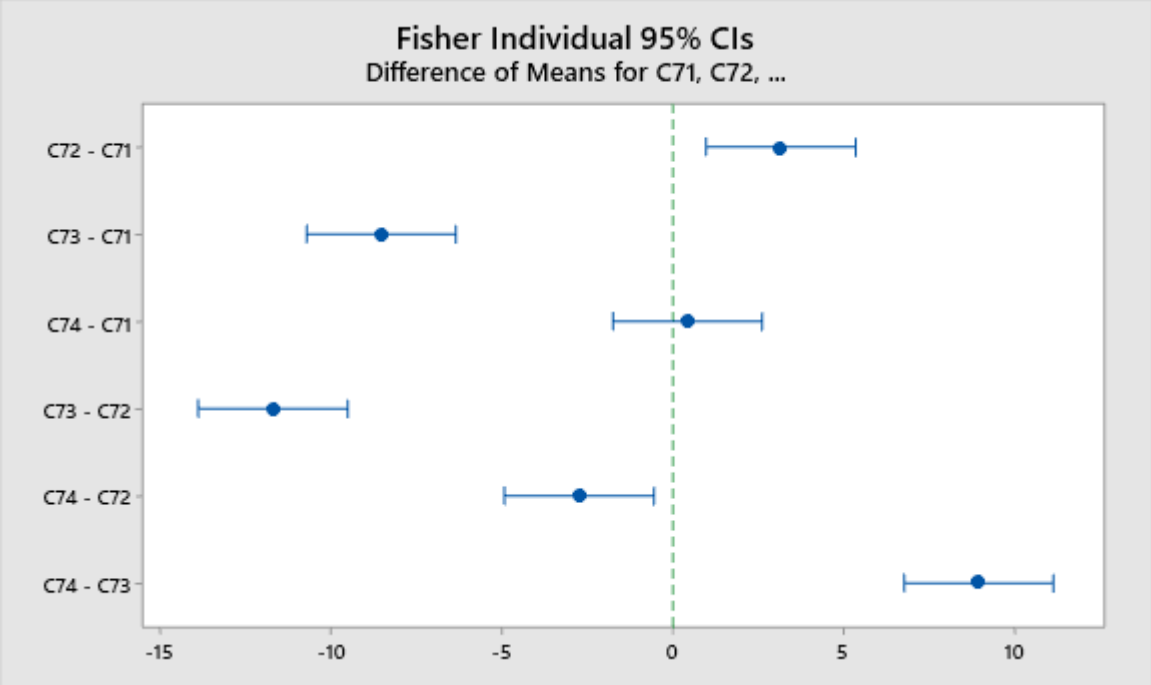

Figure 5: Difference of means among self-confidence, anxiety, attitude, and the teachers' role.

It can be seen clearly from the figure above that the teachers' role has a strong positive significant influence on the students' attitude towards mathematics. Indeed, the chart shows clearly that the relationships between anxiety and self-confidence, teachers' role and self-confidence, and teachers' role and anxiety are not significant and therefore negligible, most

especially teachers' role and self-confidence that has mean difference of a paltry 0.4. On the other hand, attitude is shown to have a very strong negative relationship with anxiety, and also the same relationship with self-confidence but not as strong.

To sum up, it is obvious from the data that anxiety has the highest effect as a mathematics psychological barrier with the highest mean of 20.163 followed by the teachers' role and self-confidence with means of 17.432 and 17.000 consecutively. Students' attitude towards mathematics seems to have the least effect as a psychological barrier with a small mean of 8.486.

Discussion

Why not Mathematics Department?

This study indicates clearly that many people are prejudiced against mathematics. The high percentage of students who chose 'I don't like mathematics' indicate bias against the subject because they had an option of simply saying that 'mathematics was difficult'. The prejudices may be as a result of societal acceptance and normalizing stereotypes such as mathematics is only for the gifted few, especially boys. Gender bias is still actively playing out in mathematics and/or STEM fields (Fleming, Foody & Murphy, 2020). In Kurdistan region particularly, prejudices against mathematics may stem from the luck of job opportunities for graduates. The only jobs available for mathematics graduates are teaching jobs, this is the most despised profession in the region, which creates a strong negative attitude towards mathematics.

Self-Confidence

Evidently, many students tense when doing mathematics tests and/or exams, and they worry about getting good grades. This points to a lack of self-confidence in the students about their ability to perform well in the subject. This may make it difficult for them to apply the mathematical concepts they have learned, as they may be too afraid to take risks or make mistakes, making them less likely to attempt difficult problems or engage in challenging tasks (Koo & Sibley, 2020; Zhang, Fang & Gu, 2019). Low self-confidence or complete lack of it may lead students to avoid math-related activities and participate less in classroom discussions (Hall & Williams, 2018).

Attitude toward Mathematics

However, based on the findings, majority of students believe they can do well and excel in mathematics. This alludes to the idea that students have positive attitude towards the subject but because of the society's general negativity, they avoid it or simply do not take it seriously. This may partially explain the dwindling numbers in Mathematics lecture halls. Kubinger & Frieß, (2016) found a direct correlation between attitude toward mathematics and the strand

chosen by students. Strand refers to the group of subjects the students chose to take, like STEM, Arts and Design, and Languages.

Anxiety

In this research, it has been found that most students feel stressed and become anxious when doing mathematics activities. This may be due to the pressure from family and the society on students to get higher scores in the subject. Families in this region place a high value on grades, therefore students work under pressure to achieve what the society and family demands from them. Given prejudices against the subject, most students find themselves in mathematics lecture rooms simply because they received a scholarship. These kinds of students may lack motivation to study the subject and therefore get anxious around exam times or even just simple class tasks because they must perform well to maintain the scholarship and to please their families too. Anxiety can lead to avoidance of challenging tasks and can also result in decreased performance on mathematics tests (Chandra & Gopinath, 2018). Research has shown that students who are anxious about mathematics are more likely to experience math-related stress, which can affect their ability to focus and understand the material (Gulliford & Macaskill, 2019). It is also likely that students with higher math anxiety levels are more likely to procrastinate and put off completing tasks (Eum & Lee, 2020).

Teachers' Role

Teachers play a significant role in the overall life of students; this study brings out the teachers' role in combating students' negative attitudes towards mathematics. Attitude is one of the most important determiners of better performance, and therefore if teachers can help steer students' attitudes in the right direction, then students can develop confidence which may lead to better performance. Teachers can create a positive learning environment that encourages student engagement and curiosity, while providing support and guidance to help students succeed (Sanders & Price, 2018). Teachers can promote positive attitudes towards mathematics by emphasizing its relevance and importance in everyday life. They can use real-world examples to illustrate mathematical concepts and encourage students to draw connections between mathematics and other subjects (Lamberg & Sweeny, 2015). Teachers can also utilize hands-on activities and projects to make mathematics more engaging and enjoyable for students. This can help students understand mathematics and develop a more positive attitude towards the subject (Ding & Yang, 2019).

Conclusion

In conclusion, mathematics psychological barriers are an issue that can be addressed with the right strategies and interventions. A key factor in addressing these barriers is to ensure that students have access to the right resources and support, especially from teachers, as well as modern teaching strategies that are tailored to the individual. It is also important to recognize the importance of creating an environment in which students can feel comfortable and

encouraged to explore their mathematics skills, this reduces anxiety and develops self-confidence in students. Finally, it is essential to understand that the psychological aspects of mathematics can have a profound impact on students' ability to succeed and that interventions should be tailored to meet their individual needs.

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