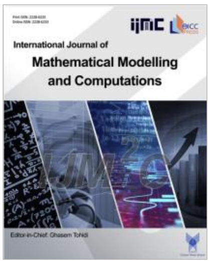

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Design and evaluation of a new teaching method based on factors to reduce math anxiety using the combined Delphi-bwm-topsis technique

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Abstract

Mathematics anxiety is one of the most significant barriers to effective learning among students, negatively impacting their academic performance and self-confidence. The present study aimed to design and evaluate an innovative teaching method based on identifying and prioritizing factors that reduce mathematics anxiety in female and male students aged 13 to 17 in Qaleh Ganj County. The research employed an exploratory-descriptive approach. Initially, using the fuzzy Delphi technique and involving 30 experts (10 teachers, 10 psychologists, and 10 mathematics education professors), 34 key factors contributing to the reduction of mathematics anxiety were identified. Subsequently, the Best-Worst Method (BWM) was used to prioritize the top five factors. Based on these selected factors, the new teaching method was developed and implemented over one academic semester in four classes of 20 students each (two control groups and two experimental groups). Data analysis, conducted using two-way analysis of variance and calculation of effect size (eta squared), indicated that this active, technology-enhanced method had a significant effect on improving mathematical performance and reducing anxiety, particularly among female students. The results suggest that a multifaceted approach can provide an effective model for reducing mathematics anxiety. One limitation of this study is its implementation in a single region with a relatively small sample. It is recommended that this model be examined in broader studies and in other schools.

Keywords: Mathematics anxiety, Innovative teaching methods, Personalized learning, Educational technology, Teacher-student interaction, Best-Worst Method (BWM), Math conceptual understanding.

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1. Introduction

Mathematics anxiety is widely recognized as a significant barrier to effective learning and academic achievement, drawing considerable attention from educational psychologists and mathematics educators alike. As Shoarani et al., [1] highlight, mathematics anxiety is not merely an emotional response but a multidimensional construct rooted in cognitive, affective, and social factors. Psychological theories, such as Spielberger's two-component theory of test anxiety [2], emphasize that mathematics anxiety comprises both worry and emotional arousal, each capable of disrupting critical thinking and problem-solving processes[3][4]. Both Iranian and international research converge on the profound influence of family environment, self-efficacy beliefs, school context, instructional methodology, and the attitudes of teachers and parents in either exacerbating or alleviating mathematics anxiety [5][6][7][8][9]. For instance, as shown by Richardson and Suinn [19] and confirmed by recent domestic studies [20], mathematics anxiety can be characterized as a pervasive feeling of tension and apprehension when dealing with numbers or mathematical tasks, negatively affecting academic confidence and performance. [10] and [11] argue that the prevalence of mathematics anxiety increases at secondary and tertiary education levels, often originating in earlier schooling experiences. Within the Iranian context, research has indicated that mathematics anxiety manifests in three primary dimensions: attitudinal (aversion), cognitive (anxiety and worry), and affective (fear of failure) [10][11]. Further, findings by domestic scholars such as [12] and [3] reveal that environmental and instructional factors play crucial roles, with traditional didactic methods frequently cited as exacerbating anxiety. In contrast, active and participatory teaching approaches—such as game-based learning, interactive instruction, and educational technology—have been shown to reduce mathematics anxiety and enhance motivation [1][21]. In light of contemporary educational psychology, frameworks such as Bandura's social learning theory [13] and the attitude-behavior model [14] have also been emphasized in Iranian research. These theories, as substantiated by numerous studies domestically and internationally, reinforce the impact of teacher attitudes, emotional family support, and negative social beliefs on mathematics anxiety [14]. What distinguishes the present study is its focus on Qaleh Ganj, a deprived region in southeastern Iran. This county faces persistent challenges, including limited educational resources, restricted access to technology, and generally low parental educational attainment [23]. Consequently, local students not only encounter common mathematical anxiety factors but also face distinct obstacles stemming from cultural and socio-economic hardship. Despite these realities, prior studies have rarely given in-depth attention to the unique social and educational context of regions like Qaleh Ganj. Accordingly, the current research utilizes a hybrid methodology combining Fuzzy Delphi and Best-Worst Method (BWM) to identify and prioritize the most effective intervention strategies. The Fuzzy Delphi method allows for systematic expert consensus and reduces individual bias, making it well-suited for contexts with significant uncertainty [15][16]. BWM, in comparison to classical multi-criteria decision-making methods such as the Analytic Hierarchy Process [22], offers greater simplicity and ranking accuracy [17][18]. This methodological combination is applied for the first time to mathematics anxiety in deprived Iranian areas, aiming to generate context-adapted, evidence-based strategies.

The objectives of the study are threefold:

1. Comprehensively identifying the critical instructional, psychological, and familial factors influencing mathematics anxiety among students in Qaleh Ganj county.

2. Examining gender differences both in the contributing factors and in the effectiveness of intervention strategies;

3.Providing context-specific, practical recommendations for educational administrators and mathematics teachers in deprived environments.

It is hoped that the findings of this research will contribute not only to improving mathematics teaching quality in Qaleh Ganj and similar regions, but also to advancing educational equity and reducing the gap in learning opportunities.

2. Research Aim

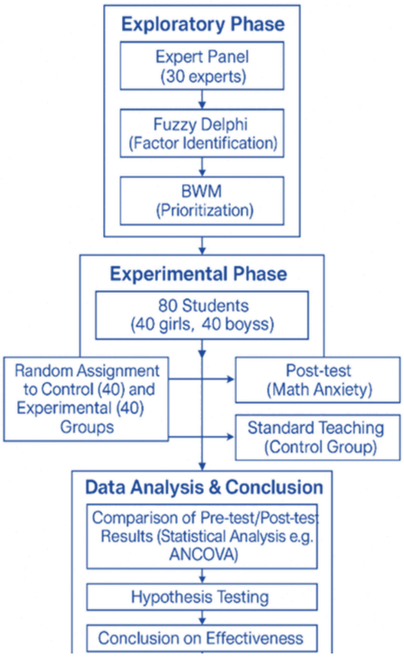
The primary aim of this research is to identify and prioritize the factors that effectively reduce mathematics anxiety and to propose and evaluate an innovative teaching method for reducing anxiety and improving mathematics achievement among students in Qaleh Ganj County. The specific objectives are as follows:

1. **Identifying effective factors for reducing mathematics anxiety in learning:** Using the Delphi technique (expert opinions and a review of previous studies), the key contributors to reducing students' anxiety in mathematics are identified.
2. **Prioritizing factors for reducing mathematics anxiety in learning:** The relative importance of each identified factor is determined using the Best-Worst Method (BWM), thereby enabling a focus on the most impactful factors.
3. **Design and implementation of a teaching method based on prioritized factors:** A teaching approach is developed drawing on the top five factors, which include active learning, personalization, technology integration, and enhancement of self-efficacy.
4. **Testing research hypotheses based on the proposed teaching method:** The impact of the innovative teaching approach on reducing mathematics anxiety and improving students' performance is analyzed via pre-test and post-test evaluations, including an examination of the interaction between gender and teaching approach.

2. Methodology

2.1. Research Design

This study is applied in terms of purpose, quasi-experimental in terms of data collection, and employs a multi-group pretest-posttest design. The research consists of two main phases: exploratory and descriptive. In the exploratory phase, there are two main research questions aimed at identifying and prioritizing factors responsible for reducing mathematics anxiety in learning. For these questions, a purposive sample of thirty experts was selected, comprising ten mathematics teachers with over twenty years of teaching experience, ten psychologists specializing in adolescents and young adults, and ten faculty members in mathematics education. To address the research questions in the identification stage, the fuzzy Delphi technique was applied, and for prioritization, the Best-Worst Method (BWM) was employed. Subsequently, a quasi-experimental research approach using a pretest-posttest design with two experimental groups and one control group was utilized to test four research hypotheses. From the total population of male and female students in Qaleh Ganj County, 40 girls and 40 boys were selected and distributed homogeneously into four classes of 20 students each. Two classes consisting of 20 girls and 20 boys were assigned to the control group, and two corresponding classes were assigned to the experimental groups. An innovative teaching strategy, based on the top five ranked factors, was designed and implemented for the experimental classes. Finally, the effect of the anxiety-reducing method on students' mathematics learning was evaluated based on the stated hypotheses.



2.2. Instruments and Data Collection Procedures

Two data collection methods were employed in this research: library research and fieldwork. In the library research phase, relevant articles, theses, and reputable websites were consulted to compile the theoretical framework, literature review, and initial formulation of the questionnaires. In the fieldwork phase, two main instruments were used: the fuzzy Delphi questionnaire and the Best-Worst Method questionnaire, along with a mathematics achievement test.

2.3. Validity and Reliability of Instruments

- **Content Validity:** Both the Delphi and Best-Worst questionnaires were validated through expert review in all stages, ensuring their content validity.
- **Reliability:** Cronbach's alpha coefficient for the Delphi questionnaire was 0.8, indicating good reliability. For the Best-Worst questionnaire, the calculated inconsistency rate was below 0.1, confirming its reliability as well.

2.4. Data Analysis Procedure

To identify anxiety-reducing factors, the fuzzy Delphi method was implemented using Excel software. For prioritizing the factors, the Best-Worst Method was conducted utilizing Excel and Lingo software. To test the research hypotheses and analyze pretest-posttest data, both descriptive and inferential statistics were applied using SPSS 24 software.

2.5. Research Findings

This study aimed to identify the factors that reduce anxiety in learning mathematics and to design an innovative teaching method to improve students' performance. The research phases were as follows:

a) Identification of factors affecting anxiety reduction

Initially, using a semi-structured questionnaire and the insights of 30 experts in mathematics education and adolescent psychology, 40 preliminary factors were identified. After three rounds of the Delphi process, 34 final factors with mean expert ratings above the threshold value (3.5) were confirmed. The following table (Table1) presents the results of the first phase of the study, showing the identified factors for reducing mathematics anxiety.

2.6. Weighting Factors Using the Best-Worst Method (BWM)

The identified factors were re-evaluated by the same panel of 30 experts. At the beginning of this process, "teaching mathematical concepts in simple language with understandable examples" was selected as the most important factor, while "positive parental attitude" was identified as the least important factor. Subsequently, the experts completed two sets of questionnaires: one comparing the best (most important) factor against all others, and another comparing all factors to the worst (least important) factor. At the final stage, a linear programming model was developed based on the results of these questionnaires, and the LINGO software was used to solve the model and obtain the final weights for each factor. The five highest-ranked factors were then selected for designing the instructional method. Out of the 34 ranked indicators, the top five were chosen as the basis for instructional design. The results are presented in the following table. The results of the designed model, as generated by the LINGO software, are as follows:
From the 34 ranked indicators, the top five presented in the table below were selected for the development of the teaching method. The details are as follows:

c) Teaching Method Design

An instructional approach entitled **"Active, Personalized, and Technology-Based Mathematics Learning"** was developed based on the top five

1. identified factors. This method was implemented across eight 60-minute sessions, incorporating features such as collaborative learning, integration of technology, and enhancement of self-confidence. The session structure was as follows:

First Session: Orientation and Motivation

This session focused on familiarizing the teacher and students with each other. The goal was to motivate the students and engage their attention toward the educational objectives. Group discussion about the challenges of learning mathematics and students' past experiences was conducted, and an interesting, simple problem was posed as the first step in reducing math anxiety.

2. **Second Session: Simplifying Mathematical Concepts**

In this session, mathematical concepts were introduced using simple language, accompanied by examples and visual tools. Students participated in group activities to solve basic problems related to the new lesson.

3. **Third Session: Personalizing Instruction**

Instruction was tailored to students' needs and interests. Students had the opportunity to choose from a variety of activities, and individualized support was provided to address specific learning challenges.

4. **Fourth Session: Integration of Technology**

Educational technologies such as instructional software, applications, and interactive websites were introduced. Students learned how to leverage these tools to gain a better understanding of mathematical concepts.

5. **Fifth Session: Improving Teaching Methods**

Educational activities were designed using various instructional strategies such as games, group discussions, and role-playing. The aim was to make the learning process more engaging and to foster student participation. Student feedback regarding the methods was also collected and reviewed.

6. **Sixth Session: Enhancing Mathematical Confidence**

Challenging activities were designed to improve students' self-confidence in mathematics. These included solving advanced problems, participating in math competitions, and presenting solutions to classmates.

7. **Seventh Session: Review and Summary**

Key concepts taught in previous sessions were reviewed. Group activities, such as comprehensive problem-solving and educational games, were conducted to help students assess their abilities and consolidate understanding.

8. **Eighth Session: Evaluation and Feedback**

An assessment was administered, consisting of a variety of challenging questions. After the test, the teacher provided comprehensive feedback on student performance and offered suggestions for further improvement in the learning process.

b) Evaluation of Research Hypotheses

- Using a quasi-experimental approach and employing pre-test and post-test in both experimental and control groups, several hypotheses were examined. The results indicated that:
  Research Hypotheses
- **Hypothesis 1:** Teaching through an active, personalized, and technology-based approach leads to improved mathematics performance among students. **Null Hypothesis (H_0):** There is no significant difference in the mean post-test scores between the two groups (active, personalized, and technology-based instruction vs. traditional instruction). **Alternative Hypothesis (H_1):** There is a significant difference in the mean post-test scores between the two groups.Results of this experiment are presented in Table 4. Due to inequality of variances, parametric test results were not used, and non-parametric testing was applied instead.

Table1. Key Factors in Reducing Mathematics Anxiety (Specialized in Mathematics Education)

Row	Factors Influencing Anxiety Reduction	Mean
1	Developing an Interest in School	3.9
2	Strong Mathematical Self-Concept	4.0
3	Teacher's Positive Attitude and Emphasis on Understanding in Mathematics	4.2
4	Positive Parental Attitudes	3.9
5	Providing Opportunities for Collaborative Learning and Moderating Classroom Competition	3.8
6	Use of Technology	3.8
7	Educational Management Model	3.7
8	Creating a Positive and Supportive Learning Environment	4.4
9	Perceived Teacher Support	4.03
10	Providing Personalized and Differentiated Instruction	3.9
11	Delivering Opportunities for Success and Mastery	4.0
12	Teaching Methods and Instructional Approaches	4.3
13	Learning Styles and Approaches	4.06
14	Attention to Individual Differences	4.3
15	Using Mathematical Games and Creative Methods	4.3
16	Cooperative Learning	4.1
17	Teaching Problem-Solving Skills	3.8
18	Self-Esteem	4.2
19	Confidence and Self-Efficacy	4.3
20	Goal Orientation	3.7
21	Teachers' Personality Traits	4.03
22	Metacognitive Strategies	3.8
23	Positive Reinforcement and Encouragement	4.3
24	Mathematical Confidence (Belief in One's Ability to Learn Mathematics)	4.2
25	Deep Study Approach in Students	3.9
26	Learning through Play and Gamification	3.8
27	Application of Mathematics in Daily Life	3.7
28	Explaining and Solving Real-World Mathematical Problems	3.9
29	Holding Simulated Exams to Reduce Test Anxiety	4.0
30	Changing Assessment Methods with Instructional Changes	4.0
31	Analyzing Overall Student Anxiety Factors (Family Situation and Conditions)	4.0
32	Teaching Mathematics Concepts in Simple Language with Clear Examples	4.2
33	Students' Thoughts and Beliefs toward Mathematics	4.1
34	Group Work	3.8

Results from Table 4 for the post-test indicate that the p-value for Levene's test for equality of variances is 0.000, which is less than α = 0.05. Therefore, the assumption of equal variances for mathematics scores on rational expressions in both groups is not supported. Consequently, the non-parametric Mann-Whitney U test was used, and as shown in Table 4, the resulting p-value is 0.000.

Table2. Factors Reducing Mathematics Anxiety

Row	Factors	Rank
1	Increased interest in school	30
2	Strong mathematics self-concept	23
3	Teacher's positive attitude and emphasis on conceptual understanding in mathematics	21
4	Providing opportunities for collaborative learning and reducing classroom competitiveness	33
5	Use of technology	2
6	Instructional management model	19
7	Creating a positive and supportive learning environment	20
8	Perceived teacher support	14
9	Offering personalized and differentiated instruction	3
10	Providing opportunities for success and mastery	28
11	Teaching methods and instructional approaches	4
12	Learning styles and coping strategies	18
13	Attention to individual differences	15
14	Use of mathematical games and creative approaches	29
15	Cooperative learning	22
16	Teaching problem-solving skills	7
17	Self-esteem	6
18	Self-confidence and self-efficacy	27
19	Goal orientation	24
20	Teachers' personality characteristics	32
21	Metacognitive strategies	8
22	Reinforcement and positive encouragement	25
23	Mathematical assurance (confidence in learning mathematics)	5
24	Students' deep study approach	9
25	Game-based and playful learning	10
26	Positive parental attitudes	34
27	Real-life application of mathematics	16
28	Stating and solving real-world mathematical problems	26
29	Simulated exam tests to reduce test anxiety	11
30	Adaptive assessment methods reflecting instructional changes	12
31	Addressing students' general anxiety factors (family and personal context)	17
32	Changing students' beliefs and attitudes towards mathematics	13
33	Group testing	31
34	Teaching mathematics concepts in simple language with clear examples	1

Table 3. Factors Influencing the Reduction of Mathematics Anxiety (Lingo Software Output)

Row	Factors	Weight	Rank
1	Teaching mathematical concepts in simple language with easy and comprehensible examples	0.1088483	1
2	Use of technology	0.0302383	2
3	Offering personalized and differentiated instruction	0.02966776	3
4	Teaching methods and instructional approaches	0.02966775	4
5	Mathematical assurance (confidence in learning ability)	0.02911836	5

Since this p-value is less than the significance level of α = 0.05, the null hypothesis (H_0) is rejected. Thus, it can be concluded that innovative instruction, compared to the traditional method, was significantly more effective in improving students' mathematics performance.

Hypothesis 2: There is a significant difference between the pre-test and post-test scores of students in the experimental group.

- **Null Hypothesis (H_0):** There is no significant difference between the pre-test and post-test scores of students in the experimental group.
- **Alternative Hypothesis (H_1):** There is a significant difference between the pre-test and post-test scores of students in the experimental group.

To test this hypothesis, a paired t-test was used to compare the mean pre-test and post-test scores of students in the experimental group for the topic of rational expressions. The results of these tests are presented in Table 5. Table 5 presents the results of the paired t-test for the pre-test and post-test scores of the experimental group. The results indicate that the calculated t-value is significant at the 0.05 level (sig = 0.000). This shows that the observed difference between the mean scores of the experimental group before and too large to be attributed to sampling or measurement error, and is, in fact, due to the effect of the independent variable (i.e., the active, personalized, and technology-based instructional method). Therefore, the null hypothesis is rejected and the research hypothesis is confirmed. This demonstrates that, as a result of the innovative teaching method, the mean scores of the experimental group increased, indicating the effectiveness of the intervention.

- **Hypothesis 3:** Examining the Interaction Between Teaching Method and Gender on Mathematics Post-Test Scores **Null Hypothesis (H_0):** There is no significant interaction between gender and teaching method on mathematics performance (post-test scores).
- **Alternative Hypothesis (H_1):** There is a significant interaction between gender and teaching method on mathematics performance.

According to the results presented in Table 6, the significance value for the teaching method is 0.000,

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indicating that the method of instruction (traditional vs. innovative) has a significant effect on post-test scores. Similarly, the significance value of 0.000 for gender demonstrates that being male or female has a significant effect on post-test scores. Additionally, the significance value of 0.028 for the interaction between gender and teaching method indicates that the effect of the instructional method depends on gender, or conversely, that the type of instruction has different effects for male and female students. Overall, the results of the two-way ANOVA show that the teaching method has a significant main effect on post-test scores. Furthermore, both gender and the interaction between teaching method and gender are significant, indicating that the impact of instructional approach on mathematics scores varies according to students' gender.

Hypothesis 4: The Effect of Gender and Teaching Method on Mathematics Post-Test Scores Controlling for Pre-Test Scores

- **Null Hypothesis (H_0):** After controlling for pre-test scores, neither teaching method nor gender has a significant effect on post-test scores.
- **Alternative Hypothesis (H_1):** After controlling for pre-test scores, at least one of the variables—teaching method, gender, or their interaction—has a significant effect on post-test scores.

The aim of this hypothesis is to assess the effectiveness of the teaching method and to examine the differences between male and female students while controlling for the pre-test score (initial ability). The findings show that students who received the new instructional method performed better. According to Table 7, Levene's test confirms that the assumptions of normality and homogeneity of variances are satisfied.

The analysis of covariance indicated that the pre-test score had a significant effect on the post-test score (sig = 0.000), thus its control was necessary. Furthermore, after controlling for the pre-test score, the type of instruction had a significant effect on the post-test score (F = 46.834, sig = 0.000), meaning that the innovative teaching method led to greater improvements in mathematics achievement compared to the traditional approach. The effect of gender alone was not significant (p = 0.717); however, the interaction between teaching method and gender was significant (sig = 0.001). This interaction suggests that the effectiveness of the teaching method varied between male and female students.

Based on the intersection observed in the lines representing boys and girls under innovative and traditional teaching methods, the presence of an interaction effect is confirmed. From the four tested hypotheses, the following conclusions can be drawn:

Table 4. Results for Hypothesis 1 (Effect of Active, Personalized, and Technology-Based Instruction on Mathematics Performance)

Source	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower	95% CI Upper
Posttest experimental (Equal variances assumed)	26.655	.000	4.544	78	.000	4.39192	.96664	2.46749	6.31634
Posttest experimental (Equal variances not assumed)	–	–	4.718	53.789	.000	4.39192	.93087	2.52546	6.25837

Table 5. Results for Hypothesis 2 (Significant difference between pre-test and post-test scores of students in the experimental group)

Source	Mean	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pre-testing – Posttest experimental	-0.85526	0.95795	0.15540	-1.17013	-0.54039	-5.504	37	.000

Table 6. Post-Test Results for Hypothesis 3 (Interaction between Teaching Method and Gender on Mathematics Post-Test Scores)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	851.641[a]	3	283.880	21.855	.000	.463
Intercept	20752.264	1	20752.264	1597.669	.000	.955
sex	384.249	1	384.249	29.582	.000	.280
group	347.060	1	347.060	26.719	.000	.260
sex * group	65.460	1	65.460	5.040	.028	.062
Error	987.171	76	12.989			
Total	22310.813	80				
Corrected Total	1838.812	79				

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a. Active, technology-based teaching approaches had a significant positive impact on improving mathematics performance.
b. The mean post-test scores of the experimental group were higher than those of the traditional group.
c. The interaction between gender and teaching method was significant; notably, the innovative method demonstrated greater effectiveness among female students.

Table 7. Post-Test Results for Hypothesis 4
(Effect of Gender and Teaching Method on Mathematics Post-Test Scores Controlling for Pre-Test Scores)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1578.732[a]	4	394.683	113.816	.000	.859
Intercept	37.173	1	37.173	10.720	.002	.125
befor	727.091	1	727.091	209.673	.000	.737
sex	2.487	1	2.487	.717	.400	.009
group	162.408	1	162.408	46.834	.000	.384
sex * group	45.707	1	45.707	13.181	.001	.149
Error	260.080	75	3.468			
Total	22310.813	80				
Corrected Total	1838.812	79				

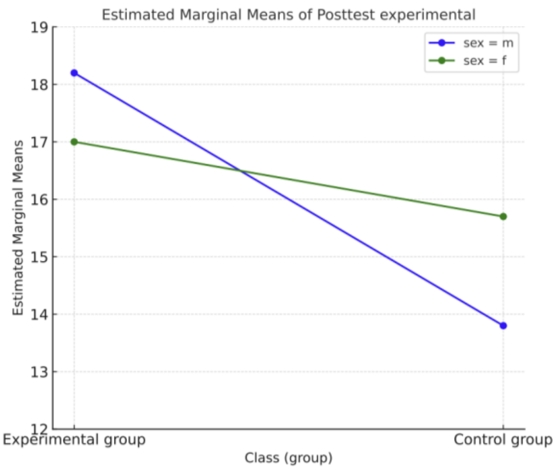

Figure 1. Class Type Status in Hypothesis 4

3. Conclusion and Recommendations

This research was designed and implemented with the aim of reducing students' anxiety in learning mathematics and enhancing their academic performance. Based on expert opinions and scientific analysis methods such as Delphi and the Best-Worst Method (BWM), five key factors were finalized: simplified instruction, use of technology, personalized learning, diverse teaching strategies, and building mathematical self-confidence. The proposed teaching approach, grounded in these factors, was implemented in various schools. The results of the study showed that the use of innovative teaching methods based on active, technological, and student-centered approaches not only reduced mathematics anxiety but also significantly improved students' performance, especially in comparison with traditional methods.
Moreover, the results highlighted a significant interaction between gender and teaching method, showing that innovative instruction was beneficial for both boys and girls, but had a more pronounced effect for girls. Overall, this research provided an applied model to enhance the quality of mathematics education and reduce students' anxiety.

The findings further demonstrated that modern instructional approaches, which activate student engagement, personalize the learning process, and integrate educational technologies, can effectively decrease mathematics anxiety and strengthen students' learning abilities. These methods not only improved classroom interaction and participation but also contributed to creating a safe space where students felt comfortable acknowledging and learning from their mistakes.

In light of these results, it is recommended that educational policymakers place greater emphasis on teacher training in the effective use of technology and modern teaching methods. Since mathematics anxiety is prevalent among many students, especially at the secondary level, such approaches can play a significant role in improving educational conditions and the overall quality of learning.

Additionally, comparative research examining the long-term effects of these methods across educational levels and age groups, and comparing them with traditional instructional methods, could provide further insights for researchers and education authorities. Future research should also seek to identify the psychological and social factors influencing the success of these approaches, in order to offer a more comprehensive understanding of how various factors interact in reducing mathematics anxiety.

In summary, this study clearly demonstrated that innovative, active, personalized, and technology-based teaching methods can serve as effective solutions for reducing mathematics anxiety and enhancing the learning process in this field. These approaches not only facilitate learning but also foster the development of problem-solving skills, critical thinking, and teamwork—competencies essential for everyday life and professional environments.

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Authors Contribution
All the authors have participated sufficiently in the intellectual content, conception and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript.

Availability of data and materials
The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests
The author states that there is no conflict of interest.

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