

PREDICTIVE POWER OF IRRATIONAL BELIEFS ON STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS FOR FUTURE-READY EDUCATION

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Abstract

This study investigated the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education in secondary schools in Nsukka Education Zone, Enugu State. Two research questions and hypotheses guided the study and were tested at the 0.05 level of significance. A correlational research design was adopted for the study. The population comprised 3,422 Senior Secondary Two (SS II) students from 61 public secondary schools in Nsukka Education Zone. A sample of 358 students was obtained using Taro Yamene formula and selected through a multistage sampling procedure. Two instruments were used for data collection, namely: Mathematics Achievement Test (MAT) and Irrational Beliefs in Mathematics Scale (IBIMS). The instruments were validated by experts in educational psychology, mathematics education, and measurement and evaluation. The reliability of the IBIMS was established using Cronbach's Alpha method which yielded a coefficient of 0.86, while the MAT reliability was determined using Kuder-Richardson 20 (KR-20), yielding a coefficient of 0.88. Data collected were analyzed using simple linear regression while regression t-test was used to test the hypotheses. The findings revealed that irrational beliefs significantly predict students' achievement in mathematics. The findings also showed that gender moderated the relationship between irrational beliefs and students' achievement in mathematics. The study concluded that irrational beliefs and gender are important factors influencing students' achievement in mathematics and their preparedness for future-ready education. It was therefore recommended that mathematics teachers should help students overcome irrational beliefs and adopt gender-sensitive instructional strategies that promote improved achievement in mathematics.

Keywords: Irrational beliefs, predictive power, mathematics achievement, future-ready education

Introduction

Students' academic achievement in mathematics has remained a major concern among educational stakeholders because of the persistent poor achievement recorded over the years. Reports from examination bodies such as the West African Examinations Council (WAEC, 2025) have consistently shown that students' achievement in mathematics remains unsatisfactory. This situation has been attributed to several psychological and cognitive factors that influence how students learn and attain academic achievement in mathematics. Consequently, researchers have shown increasing interest in identifying psychological variables, such as irrational beliefs, that may predict students' achievement in mathematics. This concern has become even more important in the era of future-ready education, which emphasizes the development of critical thinking, problem-solving, creativity, adaptability, and digital competence required for effective functioning

in a rapidly changing technological society. Since mathematics is fundamental to scientific and technological advancement, students' achievement in the subject is essential for preparing learners for future-ready education.

Mathematics, as a core school subject, plays a fundamental role in developing learners' logical reasoning, problem-solving abilities, and analytical thinking skills required for academic advancement and real-life situations. According to Nwoye, Okoye, Ugwuanyi, Eze, and Odo (2019), mathematics is a discipline concerned with the study of numbers, quantities, patterns, structures, and spatial relationships. The subject provides learners with the intellectual foundation needed to analyze problems, make logical decisions, and develop solutions to everyday challenges. When students perceive mathematics as meaningful and logically structured, they are more likely to develop positive engagement, persistence, and improved achievement. Conversely, negative perceptions and irrational beliefs about mathematics may hinder understanding, reduce students' effort, and negatively influence their achievement in the subject.

Academic achievement in mathematics refers to the extent to which students attain the intended learning outcomes in mathematics as demonstrated through examinations, tests, classroom activities, and other assessment procedures. It reflects students' level of understanding, application of mathematical concepts, and ability to solve mathematical problems effectively. Students' achievement in mathematics is influenced by several cognitive, affective, and environmental factors. Previous studies have identified factors such as self-efficacy, motivation, attitude, anxiety, and beliefs as important predictors of mathematics achievement (Skaalvik, Federici, & Klassen, 2021). However, among these psychological factors, limited attention has been given to irrational beliefs and their possible influence on students' achievement in mathematics.

The concept of irrational beliefs is rooted in Albert Ellis' Rational Emotive Behaviour Theory (REBT), which explains that individuals' emotions and behaviours are influenced not by events themselves, but by their beliefs about those events. Irrational beliefs are unrealistic, rigid, and illogical thoughts that individuals hold about themselves, situations, or experiences. Onyewuotu, Salaudeen, and Ezugwu (2024) defined irrational beliefs as "magical, unrealistic, empirically invalidated beliefs that usually take the form of rigid, dogmatic oughts, musts, and demands." Similarly, Gkontelos, Vaiopoulou, and Stamovlasis (2021) described irrational beliefs as rigid, absolutistic, illogical, and non-reality-based demands and expectations that individuals place on themselves, which may contribute to emotional distress and poor academic outcomes. In mathematics learning, irrational beliefs may appear in forms such as self-doubt, fear of failure, and negative perceptions about students' ability to succeed in mathematics. For instance, beliefs such as "mathematics is too difficult for me," "I can never do well in mathematics," or "making mistakes in mathematics means I am unintelligent" may reduce students' confidence, persistence, and willingness to engage in mathematical tasks. Consequently, such beliefs may negatively influence students' achievement in mathematics.

Recent studies have continued to examine the relationship between students' beliefs and their achievement in mathematics. Findings from Onyewuotu, Salaudeen, and Ezugwu (2024) and Diale and Victor-Aigbodion (2022) revealed that irrational beliefs were significantly related to students' academic outcomes. Similarly, Bester and Kufakunesu (2020) and Kufakunesu (2015) reported a significant negative relationship between irrational beliefs and students' achievement in mathematics, suggesting that irrational beliefs may hinder students' confidence, engagement, and success in mathematics learning. However, Albao and Mangila (2021) found an insignificant relationship between students' irrational beliefs and academic achievement. These

variations in findings indicate the need for further investigation into the influence of irrational beliefs on students' achievement in mathematics, particularly within different educational contexts. Therefore, understanding the role of irrational beliefs is essential because persistent irrational thinking patterns may limit students' readiness to develop the competencies required for future-ready education.

Future-ready education is an educational approach that equips learners with the knowledge, skills, values, and competencies needed to function effectively in a rapidly changing, technology-driven, and globalized world. It emphasizes critical thinking, creativity, collaboration, digital literacy, adaptability, and problem-solving skills that enable learners to respond effectively to future academic, social, and occupational challenges (UNESCO, 2021). Similarly, the Organisation for Economic Co-operation and Development (OECD, 2020) describes future-ready education as learning that develops transformative competencies required for learners to navigate complex real-world situations, innovate, and participate meaningfully in society. Mathematics occupies a central position in future-ready education because it enhances learners' analytical thinking, logical reasoning, and problem-solving abilities, which are essential for innovation and lifelong learning. However, students' achievement in mathematics and their readiness for future-ready education may be influenced by psychological factors such as irrational beliefs, and this influence may vary across gender.

Gender refers to the socially constructed roles, behaviours, and expectations associated with males and females within a particular society. Ezeagwu and Nebo (2024) defined gender as the social expectations placed on individuals based on their biological characteristics. Gender may influence students' learning experiences, beliefs, motivation, and responses toward mathematics learning. Hyde (2020) explained that gender-related experiences and expectations can shape students' academic confidence and achievement in mathematics. This suggests that male and female students may differ in the way they develop and respond to irrational beliefs about mathematics. Empirical findings on gender differences in relation to irrational beliefs and mathematics achievement have remained inconsistent. For instance, Onyewuotu, Salaudeen, and Ezugwu (2024) found significant gender differences in students' irrational beliefs, while Bester and Kufakunesu (2020) reported that gender did not moderate the relationship between irrational beliefs and academic motivation among secondary school learners. These inconsistencies indicate the need to further examine whether gender moderates the relationship between irrational beliefs and students' achievement in mathematics.

Despite the growing interest in psychological factors influencing students' achievement in mathematics, limited attention has been given to the predictive influence of irrational beliefs on students' achievement, particularly within the context of future-ready education. Although previous studies have examined the relationship between students' beliefs and academic outcomes, findings regarding the contribution of irrational beliefs to mathematics achievement remain inconsistent. Furthermore, the extent to which gender moderates the relationship between irrational beliefs and students' achievement in mathematics has not been sufficiently established, especially among secondary school students in Nsukka Education Zone. This gap in literature necessitated the present study to examine the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education, while considering the moderating influence of gender.

. Given the need to understand how irrational beliefs influence students' achievement in mathematics, it is important to consider a theoretical perspective that explains the relationship between individuals' beliefs, emotions, and behaviours.

Theoretically, the study is anchored on the Rational Emotive Behaviour Theory (REBT) developed by Albert Ellis (1955), which explains that individuals' emotions and behaviours are influenced by their beliefs about events rather than the events themselves. The theory posits that irrational beliefs are rigid, unrealistic, and illogical thoughts that may result in emotional disturbances and ineffective behaviours. In mathematics, such beliefs may include ideas like "I am not good at mathematics" or "Mathematics is too difficult for me." These thoughts often lead to fear, low confidence, avoidance, and poor academic achievement. REBT is relevant to this study because it explains how irrational beliefs influence students' academic achievement in mathematics. Students who hold irrational beliefs are more likely to experience negative emotions that reduce effort and performance, while those with rational beliefs tend to show better engagement and achievement. Therefore, REBT provides an appropriate framework for understanding how irrational beliefs may predict students' achievement in mathematics and how such beliefs may influence their readiness for future-ready education.

Purpose of the Study

The general purpose of this study was to investigate the predictive power of irrational beliefs on students' academic achievement in mathematics for future-ready education in Nsukka Educational Zone. Specifically, the study aimed to investigate the:

1. predictive power of irrational beliefs on students' achievement in mathematics for future-ready education.
2. moderating influence of gender on the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education.

Research Questions

The following research questions were posed for the study

1. What is the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education?
2. What is the moderating influence of gender on the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance.

H₀₁: The predictive power of irrational beliefs on students' achievement in mathematics for future-ready education is not significant.

H₀₂: Gender does not moderate the predictive power of irrational beliefs on students' academic achievement in mathematics for future-ready education.

Methods

A correlational survey research design was adopted for this study. According to Nworgu (2015), a correlational research design is a scientific study in which the researcher examines the relationship between two or more variables and determines both the magnitude and direction of such relationships. This design was considered appropriate for the present study because it enabled the researcher to examine the relationship and predictive influence of irrational beliefs on students' academic achievement in mathematics in secondary schools within Nsukka Education Zone. Since the study only measured the variables as they naturally occur without any manipulation, the correlational survey research design was considered most suitable for achieving the objective of the study. Nsukka Education Zone was chosen for this study because of the persistent poor achievement and low resilience of the students in mathematics in the area, as observed

from the internal term results of Senior Secondary Two (SS II) students in mathematics in the area

The population for this study consisted of 3422 senior secondary two (SS II) students for 2024/2025 academic session from Nsukka Education Zone. The sample size for the study comprised 358 SS II students. The sample size was determined using TaroYamene formula. The sampling was carried out using multistage sampling procedure. Two instruments were used for data collection. The instruments were titled: Mathematics Achievement Test (MAT) which was developed by the researcher and Irrational Beliefs in Mathematics Scale (IBIMS) which was adapted for the study. The instruments were given to three experts: one from the Department of Education Foundations (Psychology Unit) and two from Department of Science Education (one from mathematics Unit and the other from Measurement and Evaluation unit) all from the Faculty of Education, University of Nigeria, Nsukka, who vetted and ensured the instruments were valid and appropriate for the study. All the instruments were trial-tested on 50 SS II students in Obollo-Afor Education Zone, which is outside the Nsukka Education Zone of Enugu State but shares similar characteristics with students from the study area.

The instruments were trial-tested on 50 students in order to determine the construct validity for IBIMS using factor analysis; which required at least 50 respondents. The items from IBIMS that survived construct validation through factor analysis were subjected to Cronbach Alpha method to ascertain the internal consistency of the instruments which yielded reliability co-efficient value of 0.86. The Mathematics Achievement Test (MAT) was subjected to Kuder-Richardson 20 (K-R)20 formula. This gave a reliability co-efficient value of 0.88. The researcher together with the research assistant administered and retrieved the instruments in all the sampled schools within the interval of two weeks. The data collected were analyzed using simple linear regression analysis (correlation) while Regression t-test was used to test the hypothesis. The coefficient of determination (r^2) obtained was used to answer the research question. Regression Analysis was considered more appropriate as the most suitable statistical tool for predicting the associations between the predictor and the criterion variables. Statistical Package for the Social Sciences (SPSS) version 27 was used as statistical package for analyzing the data obtained for the study. Interpretation of the correlation coefficient was based on Nwana (1979) guide, which stipulates that the correlation coefficient that ranges from 0.00-0.20 will be regarded as very low, 0.20-0.40 (low), 0.40-0.60 (medium), 0.60-0.80 (high) and 0.80-1.00 (very high). The null hypothesis was only rejected when the associated p-value was less than 0.05.

Results

Table 1: Simple Linear Regression Analysis of the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.132 ^a	.017	.015	1.585

a. Predictors: (Constant), IBIMS

Result in Table1 shows that the correlation coefficient obtained is 0.132 and the coefficient of determination is 0.017 indicating a very low positive association between irrational beliefs and achievement in mathematics for future-readymoderating influence of gender on the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education. The coefficient of determination of ($r^2=0.017$)

implies that 1.7% of students' achievement in mathematics is attributed to irrational beliefs.

Hypothesis 1

Table 2: Regression t-test Analysis of the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	28.672	.693		41.384	.000
	IBIMS	.696	.277	.132	2.515	.012

a. Dependent Variable: MAT - b. Predictors: (Constant), IBIMS

Table 2 reveals that the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education is significant, $t = 2.151$, $p = 0.012$. Thus, the null hypothesis is rejected ($p < 0.05$). Therefore, the predictive power of irrational beliefs on students' academic achievement in mathematics for future-ready education is significant.

Table 3: Simple linear regression analysis regression analysis of the moderating influence of gender on the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education

Model	Gender	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	Male	.482	.232	.221	.28412
2	Female	.310	.096	.085	.24530

The results in Table 3 show that the Pearson Product Moment correlation (r) of male students' achievement accountable to irrational beliefs is 0.482, indicating a moderate association. The coefficient of determination (R^2) is 0.232, indicating that 23.2% of the variation in male students' achievement is accountable to irrational beliefs. Similarly, the correlation (r) for female students is 0.310, indicating a low relationship. The coefficient of determination is 0.096, indicating that 9.6% of the variation in female students' achievement is accountable to irrational beliefs.

Hypothesis 2

Table 4: Significance of the moderating influence of gender on the predictive power of irrational beliefs on students' achievement in mathematics for future-ready education

Model	Gender	R	R Square	Standardized Beta	t	Sig.
1	Male	.482	.232			
2	Female	.310	.096	.684	9.421	0.000

Table 2 shows that the probability associated with the calculated t-value (9.421) for the influence of irrational beliefs on students' academic achievement is 0.000. The probability value of 0.000 is less than the 0.05 level of significance. Therefore, the null hypothesis was rejected. This implies that irrational beliefs significantly influence students' academic achievement in favour of male students.

Discussion of Findings

The findings of this study revealed that irrational beliefs significantly predict students' achievement in mathematics. The correlation coefficient indicated a positive but very low relationship, and the null hypothesis was rejected since the p-value was less than 0.05. The result may be so because many secondary school students hold irrational beliefs about mathematics, such as the idea that they are "naturally bad at mathematics," that mathematics is inherently too difficult, or that success in mathematics depends more on luck than effort and understanding. Such beliefs can negatively influence their confidence, persistence, and willingness to engage actively in mathematical tasks, thereby affecting their achievement. However, the relationship is very low, possibly because achievement in mathematics is not determined by irrational beliefs alone. Other factors such as teaching methods, students' interest, home support, study habits, motivation, and availability of learning resources may also play significant roles in determining students' achievement in mathematics. These factors may either strengthen or weaken the influence of irrational beliefs on students' academic performance.

The findings align with the findings of Onyewuotu, Salaudeen and Ezeugwu (2024), Diale and Victor-Aigbodion (2022) which revealed a statistically significant relationship between irrational beliefs and academic success of secondary school learners. However, the findings contradicts the findings of Albao and Mangila (2021) which revealed that an insignificant relationship between the irrational beliefs and students' academic achievement. The contradiction might be due to the mediation of other psychological or environmental factors such as motivation, classroom climate or parental support which could dilute the direct impact of irrational beliefs on the students' achievement in mathematics.

The findings of the study also revealed that gender significantly moderates the relationship between irrational beliefs and students' achievement in Mathematics in favour of male students. This implies that irrational beliefs account for a greater proportion of variation in Mathematics achievement among male students than female students. The finding of the study is in agreement with the findings of Onyewuotu, Salaudeen, and Ezeugwu (2024), who found significant gender differences in irrational beliefs among students. The finding is also consistent with studies which reported that gender plays an important role in shaping students' academic behaviour, attitudes, and achievement outcomes in Mathematics. However, the finding disagrees with the study of Bester and Kufakunesu (2020), who reported that gender does not moderate the relationship between irrational beliefs and academic motivation among secondary school learners. The disagreement in findings may be attributed to differences in the study location, sample characteristics, subject area, and research design adopted by the researchers.

Conclusion

This study investigated the predictive power of irrational beliefs on students' academic achievement in Mathematics for future-ready education among secondary school students in Nsukka Education Zone. It was concluded that irrational beliefs significantly predict students' academic achievement in mathematics, indicating that students' irrational ways of thinking can influence their level of achievement in mathematics. The study further revealed that gender significantly moderates the relationship between irrational beliefs and students' academic achievement in mathematics in favor of male students. This implies that irrational beliefs account for a greater proportion of variation in mathematics achievement among male students than female students. The study also concluded that reducing irrational beliefs and promoting rational thinking patterns among students can contribute to improved academic achievement in mathematics and enhance the

development of competencies required for future-ready education, such as critical thinking, problem-solving, and adaptability. Therefore, teachers, counselors, parents, and other educational stakeholders should adopt strategies that help students overcome irrational beliefs, develop positive attitudes toward Mathematics learning, and acquire the skills needed to function effectively in a technologically driven and future-oriented society.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Mathematics teachers should teach students using appropriate teaching methods, digital pedagogies, and instructional materials that will help reduce irrational beliefs toward Mathematics, improve students' academic achievement, and promote skills needed for future-ready education.
2. Mathematics teachers should pay attention to gender differences while teaching Mathematics by providing equal encouragement and learning opportunities to both male and female students in order to minimize the influence of irrational beliefs on achievement for future-ready education.

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