

## **Effect of Cognitive Behavior Therapy on Mathematics Phobia among Secondary School Students in Owerri Municipal Council of Imo State, Nigeria**

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### **Abstract**

The rate of decline in academic performance of students in Mathematics which is a core subject in Nigeria school curriculum, relevant in technological, economic and educational development of the nation prompted this study. This research aimed to examine the effectiveness of cognitive behavioral therapy which is a psychological therapy on students' Mathematics phobia bearing in mind that phobia has an influence on students' academic performance in the subject. The study utilized a quasi-experimental design with a sample size of 110 SS2 students from public secondary schools in Owerri Municipal Council of Imo state, Nigeria. Three research questions were raised and three hypotheses formulated and tested at .05 level of significance. The instrument for data collection were researcher-made titled Mathematics Phobia Scale (MPS) which was validated by specialist in Educational Psychology and Measurement and Evaluation. Its reliability was ascertained through test-retest method and calculated using Pearson product moment correlation which yielded an index of 0.81. The research questions were answered with mean and standard deviation while unpaired and paired t-test was used to test the hypotheses. The result of the study showed a significant mean difference between pretest and posttest of students' Mathematics phobia. The findings also indicated a significant gender difference in the effectiveness of CBT in the posttest. The study recommended among others that teachers should endeavor to pay close attention to the students in order to discover students with Mathematics phobia.

**Keywords: Cognitive behavior therapy, Mathematics phobia, Academic achievement, Students**

### **Introduction**

Cognitive Behaviour Therapy (CBT) is an intervention aimed at reducing symptoms of psychological problems characterized by fear, anxiety, and depression among the human population. It achieves this by revealing the false perceptions individuals may have about life events and helping them to change their beliefs toward these events. The therapy is grounded in the understanding that individuals' problems often do not stem from the obstacles they face, but from the significance they attach to those obstacles. Redirecting their thoughts and feelings about these challenges is a step toward achieving a positive mindset and eliminating the anxiety associated with them.

Knapp and Beck, as cited in Onyekwere et al. (2022), described CBT as a form of talking therapy that combines cognitive therapy and behaviour therapy. They explained that CBT focuses on how individuals think about the events in their lives—specifically, their thoughts, images, beliefs, and attitudes (cognitive processes)—and how these influence their behaviour and emotional well-being. According to Ezegbe et al. (2018), CBT theory posits that irrational thoughts can result in dysfunctional or irrational emotions and behaviours, which may hinder optimal outcomes in particular situations or events. Ugwuanyi et al. (2020) elaborated that CBT exists in various forms, including individual, group, brief, guided self-help, self-help, and online formats.

Trimmer et al. (2016) observed through their research that group-based CBT is particularly effective in treating psychological problems such as academic stress, sleep disturbances, and cognitive failures. This is because the social interactions developed among group members indirectly reduce symptoms and enhance the overall effectiveness of CBT. Wood et al., as cited in Mohammed et al. (2021), emphasized that the primary aim of CBT is to help individuals identify and process their emotions and understand how their beliefs and assumptions influence their feelings and behaviours, allowing them to consider alternative perspectives.

Cognitive therapy is based on Beck's tri-part model of emotion, as posited by Antonia and Edna (2015), which suggests that thoughts, feelings, and behaviours are interconnected. This implies that an individual's ability to manage their thoughts can lead to the effective regulation of emotions and the dissociation of fear and anxiety, thus enabling the individual to harness positive behavioural outcomes.

The effectiveness of CBT has been demonstrated across various domains, including the educational sector. This research specifically aims to examine the effect of CBT on students' Mathematics phobia and academic achievement. This focus is necessary due to the high levels of fear and anxiety that students often exhibit when confronted with mathematical problems, leading to a decline in academic performance in Mathematics.

Phobia is a longstanding psychological issue, with individuals experiencing different types of fear such as acrophobia (fear of heights), aquaphobia (fear of water), and enochlophobia (fear of crowds), among others. Hamm (2009) noted that phobic disorders are characterized by a marked and persistent fear triggered by specific objects or situations, accompanied by a compelling urge to avoid them. Shin and Liberzon (2010) further explained that these fears and avoidance behaviours can cause significant distress or impairment in occupational, academic, or social functioning. Mathematics phobia is a psychological disorder involving

the fear of mathematical formulas, equations, and problems, which negatively affects an individual's perception of the subject. Although the precise origin of this fear is unclear, some studies have attributed it to factors such as teacher competence, peer influence, and family background (Ihechukwu & Ugwuegbulam, 2016; Foley et al., 2017; Kunwar, 2020).

According to Olaniyan and Salman (2015), Mathematics phobia is seen as a form of mathematical weakness among students, rooted in the psychological aspects of learning. Tobias and Weissbrod, as cited in Ihechukwu and Ugwuegbulam (2016), described Mathematics phobia as the panic, helplessness, paralysis, and mental disorganization that arise when individuals are required to solve mathematical problems. Gier and Bisanz, also cited in Ihechukwu and Ugwuegbulam (2016), referred to it as a feeling of tension and anxiety that disrupts the manipulation of numbers and the solving of mathematical problems across both everyday life and academic contexts.

Mathematics is widely recognized as the foundation of science. It underpins scientific knowledge, methodologies, technological innovations, and advancements. Without Mathematics, many of the world's technological developments would not be possible, as calculations are vital in understanding the relationships between matter and the environment. Mathematics also plays a central role in daily human activities such as financial transactions and business operations, all of which require proficiency in basic arithmetic concepts like addition, subtraction, division, and multiplication.

In Nigeria, Mathematics holds a critical place in the national curriculum at all levels of education-primary, secondary, and tertiary. It is a core subject in major external examinations such as the Senior School Certificate Examination (SSCE) and the Joint Admissions and Matriculation Board (JAMB) examination, which are prerequisites for entry into tertiary institutions. Ndubisi et al. (2019) stated that without a pass in Mathematics at the WAEC level, it is difficult for students to gain admission into most higher education courses. Sule et al. (2016) further emphasized the modern-day applications of Mathematics, including building economic models to manage recessions and inflation, selecting investment portfolios, planning industrial and transport systems, investigating economic and population growth, and studying competition effects in business environments.

Notwithstanding the obvious importance of mathematical knowledge, students' poor performance in the subject remains a persistent problem. According to Lawal (2019), from 1991 to 2016, only 27.31% of students in Nigeria attained credit and above (A1–C6), while 72.69% had a pass or below (D7–F9) in the May/June WASSCE in General Mathematics. Similarly, Sani and Hassan (2023), in their Statistical Analysis of Students' Mathematics

Performance in the West African Senior School Certificate Examination (WASSCE) from 2018 to 2022 in Selected Secondary Schools in Birnin Kebbi, Kebbi State, Nigeria, applied the Malthusian population model to analyze students' performance. They found that students' progression in Mathematics was sluggish, consistent with the Malthusian parameter, which was reported to be extremely low.

Several studies have explored various factors that influence or correlate with students' academic performance in Mathematics. For instance, Peteros et al. (2022), in their study on the effects of school proximity on students' performance in Mathematics in the Philippines, found that most students lived far from school and had limited road access. A significant relationship was observed between the students' distance from school and their academic performance in Mathematics, although no significant relationship was found between their mode of transportation, home accessibility, and performance. Similarly, Baliyan and Khama (2020) in Botswana revealed that distance to school significantly impacted Mathematics performance, with post hoc analysis showing that long travel distances negatively affected students' Mathematics outcomes.

Iyamuremye et al. (2021), through a meta-analysis, examined the influence of teaching approaches on students' performance in Mathematics. Their findings indicated that teaching approaches have a significantly positive effect. In the same vein, Abdulai et al. (2023) examined the influence of teacher characteristics—such as mastery of content, punctuality to class, and student-teacher relationships—on students' Mathematics performance in Sagnarigu Municipality and found them to be significant predictors of performance.

However, Hursh, as cited in Awofala and Fatade (2023), argued that students' disengagement and underperformance in Mathematics are more attributable to individual, familial, and neighborhood shortcomings than to flaws within the school system itself. Aligning with this view, several researchers have examined the influence of home background on students' academic performance. Ndubisi et al. (2019), for instance, found that family type, parents' occupation, and educational level had no significant influence on students' Mathematics achievement. Conversely, Onyekwere et al. (2019) assessed the role of family socioeconomic status and emotional intelligence in predicting academic achievement in Mathematics among primary school pupils. Their results showed a positive relationship between these variables and academic achievement.

Bini and Idehen (2023) explored the relationship between students' self-efficacy and their academic achievement in Mathematics using a correlational research design with 187

students from public and private schools. They found a positive, albeit not statistically significant, relationship between academic self-efficacy and achievement.

While these studies focus on home and school-related factors, they tend to overlook psychological factors such as phobia, which is a personal characteristic that can significantly impact performance. A student's fear of a subject can lead to anxiety, diminish interest, and drastically affect academic outcomes. It is noteworthy that some studies have investigated phobia and anxiety as contributors to failure in Mathematics. For example, Sule et al. (2016) studied the manifestation of Mathematics phobia among senior secondary school students and its implications for manpower development in science education in Nigeria. Their findings showed that students without phobia performed significantly better than those with phobia, with male students performing better overall.

Similarly, Kunwar (2020) examined the causes, symptoms, and remedies for Mathematics phobia and found that major causes include tests and examinations, teachers, parents, peers, and the inherent nature of Mathematics. The study recommended that overcoming Mathematics phobia requires intensive efforts from all stakeholders.

Recognizing the link between Mathematics phobia and declining academic performance, several interventions have been employed to reduce this fear and improve student outcomes. For example, Aremu and Taiwo (2014) investigated the effects of numerical cognition and Emotional Freedom Techniques (EFT) on reducing Mathematics anxiety among students with pseudo-dyscalculia in Ibadan. The results indicated a significant reduction in anxiety. Likewise, Onwuka and Tibi (2014) found Cognitive Behavioral Therapy (CBT) to be effective in reducing Mathematics anxiety, with no significant gender difference in its effectiveness. Guimaraes et al. (2021) also reported a decrease in Mathematics anxiety among children after twelve sessions of individual cognitive-behavioral interventions

### **Statement of the Problem**

It has already been established that Mathematics is a sine qua non in all considerations of how a nation can advance. Acknowledging this, the Nigerian government has made Mathematics one of the core subjects to be studied in both primary and secondary schools, with students' performance in the subject playing a crucial role in their progression to tertiary education. Yet, a thorough investigation into students' performance in the subject reveals a consistent lag. This lag has often been attributed to students' unwillingness to learn and teachers' lack of preparedness. Regardless of the reasons behind this situation, it is indeed worrisome.

Adeniyi, as cited in Sule et al. (2016), clearly posited that the marking of Mathematics in the WASSCE is enough to leave anyone disheartened about the state of Mathematics in secondary schools. He further noted that some candidates submit their answer scripts without writing anything; others merely recopy the questions, while a significant percentage of those who attempt to respond are often involved in cheating. Okezie et al. (2021) asserted that the Chief Examiner's report for 2015–2019 on the annual Unity Examination results indicated a poor performance in Mathematics, with many candidates scoring zero or marks within the zero range.

Suffice it to say, if this decline in Mathematics performance is not addressed, it could lead the nation to spiral downwards in terms of technological, economic, and educational advancement. Through a review of studies by other researchers, as well as the researcher's personal encounters with students, it is evident that many students experience Mathematics phobia, which in turn negatively affects their performance. Therefore, it is necessary to investigate strategies to eradicate Mathematics phobia among students with the aim of improving their academic performance.

### **Purpose of the Study**

The aim of this study is to investigate the Effect of Cognitive Behavior Therapy on Mathematics Phobia among Secondary School Students in Owerri Municipal Council of Imo State, Nigeria. Specifically, examined

1. The mean difference between pretest and posttest of students' Mathematics phobia
2. Mean difference in posttest of students' Mathematics phobia based on gender

### **Research Questions**

The following research questions were raised for the study:

1. What is the mean difference between pretest and posttest of students' Mathematics phobia?
2. What is the mean difference in posttest of students' Mathematics phobia based on gender?

### **Hypotheses**

The following hypotheses were formulated and tested at .05 level of significance

1. There is no significant mean difference between pretest and posttest of students' Mathematics phobia
2. There is no significant mean difference in posttest of students' Mathematics phobia based on gender

### **Method**

The study utilized a quasi-experimental one-group pretest-posttest design. This design is appropriate as it investigates the effectiveness of a treatment. The population of the study comprised all Senior Secondary II students in Owerri Municipal Council of Imo State. A purposive sampling technique was used to select 110 public secondary school students (55 males and 55 females) based on their Mathematics performance, which was obtained from their respective teachers. A Mathematics phobia test was administered to them before inclusion in the study.

The instrument for data collection was a researcher-made questionnaire titled Mathematics Phobia Scale (MPS). The MPS consisted of 20 items used to assess students' level of Mathematics phobia, using a four-point Likert scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

The instrument was validated by specialists in the areas of Educational Psychology and Measurement and Evaluation. To establish its reliability, the test-retest method was employed. The instrument was administered to participants in five public secondary schools in Owerri North L.G.A (outside the study area), and re-administered after two weeks. Pearson Product Moment Correlation was used to determine its consistency, yielding a reliability coefficient of 0.81.

Permission was granted by the respective schools and participants involved in the study. A pretest was administered to the participants at the beginning of the programme to assess their level of Mathematics phobia and performance. The participants were then exposed to Cognitive Behavioral Therapy (CBT) over a period of six weeks. After the treatment, a posttest was administered to determine the effect of the therapy. Mean and standard deviation were used to answer the research questions, while paired and unpaired t-tests were used to test the hypotheses at a 0.05 level of significance.

## **Results**

**Table 1: Mean difference between pretest and posttest of students' Mathematics phobia**

<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Mean Difference</b>	<b>Remark</b>
<b>Pretest</b>	110	62.80	14.83	20.7	Effective
<b>Posttest</b>	110	42.10	10.12		

The result in table 1 shows the mean value of Mathematics phobia at the pretest level at 62.80 with SD at 14.83. However after the implementation of CBT the mean value of Mathematics phobia at the posttest level is 42.10 and SD 10.12. This shows a reduction in

Mathematics phobia with a mean difference of 20.7. Therefore CBT is effective in reducing Mathematics phobia among students.

**Table 2: Mean difference of posttest of students' Mathematics phobia based on gender**

Variables	N	Mean	SD	Mean Difference
Male	55	39.3	11.02	5.6
Female	55	44.9	13.09	

The result shows a mean difference of 5.60 which is in favor of male gender with a mean 39.30 and SD of 11.02 less than the female gender with a mean of 44.90 and SD of 13.09. This implies that the effectiveness of CBT is more on the male gender than the female gender.

**Table 3: Summary of paired t-test of significance of mean difference between pretest and posttest of students' Mathematics phobia**

Variables	N	Mean	SD	Df	T	P-val	Decision
Pretest	110	62.8	14.83	109	46.09	.001	Significant
Posttest	110	42.1	10.12				

Table 3 shows the result of paired t-test of significance of mean difference between pretest and posttest of students' Mathematics phobia. It shows a calculated value of 12.09 and a tableted value of 1.96. However the p-value of .000 less than .05 shows that the mean difference is significant. Therefore the null hypothesis is rejected. There is a significant mean difference between pretest and posttest of students' Mathematics phobia.

**Table 4: Summary of unpaired t-test of significance of mean difference in posttest of students' Mathematics phobia based on gender**

Variables	N	Mean	SD	t <sub>cal</sub>	t <sub>tab</sub>	P-val	Decision
Male	55	18.02	4.02	6.16	1.96	.000	Significant
Female	55	24.08	6.09				

Table 4 shows the result of z-test of significance of mean difference of posttest of students' Mathematics phobia based on gender. It shows a calculated value of 6.16 and a tableted value of 1.96. However the p-value of .000 less than .05 shows that the mean difference is



significant. Therefore the null hypothesis is rejected. There is a significant mean difference of posttest of students' Mathematics phobia based on gender.

### **Discussion**

The study examined the effectiveness of CBT in reducing students' Mathematics phobia through the mean difference in pretest and posttest. And likewise investigated the gender difference in effectiveness of CBT through the mean difference of the posttest. In response to the research question one which examined the mean difference between the pretest and posttest of students' Mathematics phobia discovered the therapy effective in reducing Mathematics phobia of students through the reduction in mean value in the posttest. However, the testing of hypothesis found out that the difference in mean value at the pretest and posttest is significant and therefore rejected the null hypothesis. This finding is in consonance with other studies such as Onwuka and Tibi (2014) whose study on CBT in reducing Mathematics anxiety, found it significantly effective in reducing Mathematics anxiety among students. Likewise, Guimaraes et al. (2021) study on cognitive-behavioral intervention for math anxiety in childhood which discovered a decrease in Mathematics anxiety after 12 individual intervention sessions. Whereas this study discovered a gender difference in effectiveness of CBT on Mathematics phobia of students in favor of the male, the study by Onwuka and Tibi (2014) discovered no gender difference in effectiveness of CBT.

The mean difference between pretest and posttest of students' Mathematics achievement was ascertained in response to research question two and it was discovered that CBT increased the mean performance on students in Mathematics after its implementation. The mean difference was also significant. Therefore, the backwardness in academic performance of students in Mathematics in Nigeria, CBT is a therapy that can help boost students' performance. The gender difference was significant in favor of the male gender. Sule et al. (2016) investigated the disposition of phobia among senior secondary school students' Mathematics by comparing performance of students with phobia and those without phobia in Mathematics. The result of the study revealed that students without phobia achieved more in Mathematics than those with phobia. This showed that phobia has an influence in students' academic performance in Mathematics and therefore reducing phobia through CBT, equally increases the performance of students in Mathematics as this study discovered. However there was a significant gender difference in the effectiveness of CBT on Mathematics with the male having higher mean performance than their female counterpart.

This is in agreement with Sule et al. (2016) study which also showed a significant gender difference in Mathematics in favor of male.

### **Conclusion**

The essence of this study was to identify strategies for reducing students' Mathematics phobia, which has been shown to significantly impact their performance in the subject. Consequently, the study investigated Cognitive Behavioral Therapy (CBT) as a psychological intervention effective in alleviating Mathematics phobia and enhancing students' academic performance in Mathematics. The difference in mean scores between the pretest and posttest indicated that the therapy was effective in both reducing Mathematics phobia and improving performance. However, the study also revealed that the therapy was more effective among male students than their female counterparts. Overall, CBT has proven to be a valuable psychological tool for enhancing Mathematics achievement, which is crucial for national development through technological advancement

### **Recommendations**

1. Teachers should endeavor to pay close attention to the students in order to discover students with Mathematics phobia.
2. Academic performance of students in Mathematics should be monitored in order to know students lagging behind in class.
3. Cognitive behavior therapy should be introduced in schools to help students with Mathematics phobia

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