

**EFFECT OF COGNITIVE RESTRUCTURING THERAPY ON SECONDARY
SCHOOL STUDENTS' NEGATIVE ATTITUDE TOWARDS LEARNING
MATHEMATICS IN OSHIMILI SOUTH L.G.A OF DELTA STATE**

PROF. ANYAMENE, A. N. (PhD)

&

OGUGUA, G.U (PhD)

**Department of Guidance and Counselling,
Faculty of Education,
Nnamdi Azikiwe University, Awka
Senior Special Assistance on Tertiary Education,
Anambra State**

Abstract

This study investigated the Effect of Cognitive Restructuring Therapy on secondary school students' negative Attitude towards learning Mathematics in Oshimili South L.G.A of Delta State. Two research questions and two hypotheses guided the study. The design of the study was a quasi-experimental, pretest posttest, involving one treatment group and control group. The sample consisted of 121 SS II students, 56 males and 65 females from four public schools with the highest number of students with negative attitudes towards learning Mathematics. These schools were randomly assigned to experimental and control groups. The instrument adapted for this study was the Test of Mathematics Related Attitudes (TOMRA) and Cognitive Restructuring treatment Package. The treatment groups were exposed to cognitive restructuring treatment package while the control group received placebo programme. The data obtained were analysed using mean for research questions and ANCOVA for the hypotheses. All the null hypotheses were tested at 0.05 probability levels. Results showed that Cognitive Restructuring significantly enhanced the Mathematics attitude of students found to have negative attitudes towards learning Mathematics. The null hypothesis of no significant difference in the post-test Mathematics attitude mean scores of male and female students treated with CRT was rejected. Based on the findings it was recommended that workshops and seminars should be organized in schools to train teachers on how to use cognitive restructuring therapy in the classroom to improve students' attitude towards learning Mathematics.

Keywords: Cognitive Restructuring Therapy, Mathematics, Attitudes, Gender, Secondary school

Introduction

The importance of Mathematics in the education system of Nigeria cannot be overemphasized. Mathematics is a central subject in the school curriculum for all levels of education and lends itself as a tool in many other science subjects. The government of Nigeria has therefore, made it compulsory for admitting candidates into the tertiary institutions irrespective of the persons' discipline. Despite the importance of Mathematics, research has shown that Mathematics education in Nigeria has persistently been experiencing some challenges, especially in relation to general poor performance of students in Mathematics (Asikhia, 2014). This has raised concern for teachers, parents, counsellors and education stakeholders, hence, the need to encourage students to develop positive attitudes towards the learning of Mathematics.

According to Cohen, O'Donoghue and Fitzsimons in Ogugua (2010), Mathematics is the language of science and the pivot around which the whole essence of living revolves. According to Yadav (2017), Mathematics is defined as the scientific study of quantities, including their relationship, operations and measurements expressed by numbers and symbols. The Mathematics dictionary of James and James (2001) defined Mathematics as the science of logical study of numbers, shape, arrangement, quantity, measure and many related concepts. Mathematics is a very fundamental subject in the education system of every country and that is why Adeniji and Salman in Julius, Abdullah and Suhairom (2018) described it as the backbone of science and technology and a tool inevitable for human survival in everyday life. Mathematics according to Betiku (2009), is the bedrock of science while physical science is the necessity for technological and industrial development. It can also be applied in our daily lives because it enhances creative and logical reasoning about problems in our inherently geometric world. In spite the emphasis given to the teaching and learning of Mathematics in schools, the level of performance in Mathematics is still not promising and has consequently affected students' attitudes and perception towards Mathematics.

Mata, Montero and Peixoto (2012), defined an attitude towards Mathematics as a disposition towards an aspect of Mathematics that has been acquired by an individual through his or her beliefs and experiences but which could be changed. Attitude according to Dalha in Julius et al., (2018), is a concept that is concerned with an individuals' way of thinking, acting, and behaving. Han and Carpenter (2014) opined that attitudes consist of cognitive, affective and behavioural reactions that individuals display towards an object or the surrounding based on their feelings or interest. Mensah, Okyere and Kuranchie (2013) state that cognitive components of attitude is what a person thinks or believes about Mathematics. On the other hand, affective components of attitude are the feeling or emotions of the person associated with learning Mathematics. According to Ingram (2015), affective aspects of attitude is influenced by the belief formed from the cognitive components of attitude, that creates a mindset that becomes constant over time and influences the feelings of the students towards learning Mathematics. The behavioural aspects of attitude are the tendency to respond in a certain way towards learning

Mathematics (Mensah et al., 2013). Attitude towards Mathematics can be seen as negative or positive. A positive attitude towards Mathematics depicts a positive emotion disposition concerning the subject while a negative attitude towards Mathematics relates to a negative emotional disposition (Mata et al., 2012).

In an attempt to unravel both the students' attitude towards Mathematics and the subject itself and their implications for learning Mathematics, many scholars have conducted different studies. For instance, studies have shown a correlation between students' attitude towards Mathematics and their mathematical results (Bilican, Demirtasli and Kilmen, 2011; Lubienski et al., 2012). Similarly, Nicolaidou and Philippou in Mata et al., (2012) reveal significant correlations between attitudes and performance. Other research evidence has shown that students' performance in Mathematics is not necessarily associated with their attitude towards learning of Mathematics (chow, 2011). Although the above evidence indicates that there are no consistent results in the relationship between students' attitudes towards Mathematics and their Mathematics achievement, encouraging positive attitudes in students towards learning Mathematics is still highly recognized as a crucial component in developing students' mathematical ability and understanding. In respect to the above, the important question that arises here is: How can an increased level of confidence and awareness of the importance of learning Mathematics be achieved so that students' attitude towards learning Mathematics become more positive?

Consequent upon this, this study is intended to investigate the effect of Cognitive Restructuring Therapy (CRT) on secondary school students' negative Attitude towards learning Mathematics. The choice of CRT is due to the current trend in literature that CRT can bring about changes in a person's thinking or Cognitive processes (Asikhia, 2014). Cognitive Restructuring Therapy refers to a structured, collaborative therapeutic approach in which distressed individuals are taught how to identify, evaluate and modify the faulty thoughts, evaluations and beliefs that are considered responsible for their psychological disturbances (Dobson and Dozois, 2010). Cognitive restructuring is a useful technique for understanding unhappy feelings and moods, and for challenging the sometimes-wrong automatic beliefs that can lie behind them. As such, you can use it to reframe the unnecessary negative thinking that we all experience from time to time. Moreover, while acknowledging the fact that several kinds of literature abound on the efficacy of Cognitive Restructuring Therapy in improving several abnormal and antisocial behaviours, there is still a dearth of research efforts on the use of CRT on negative attitudes towards learning Mathematics. It is against this background that the researcher sought to investigate the effect of Cognitive Restructuring Therapy on secondary school students' negative Attitude towards learning Mathematics in Oshimili South L.G.A of Delta State

Purpose of the Study

The purpose of this study was to determine the effect of Cognitive Restructuring Therapy on students' negative attitudes towards learning Mathematics in Oshimili South L.G.A of Delta State. Specifically, the study sought to determine:

1. The effect of Cognitive Restructuring Therapy (CRT) on secondary school students' negative attitudes towards learning Mathematics.

2. The difference in post-test scores of male and female secondary school students treated with CRT

Research Questions

The study was guided by the following research questions:

1. What is the effect of Cognitive Restructuring Therapy (CRT) on secondary school students' negative attitudes towards learning Mathematics?
2. What is the difference in post-test Mathematics attitude scores of male and female secondary school students treated with CRT?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the post-test Mathematics attitude mean scores of students treated with CRT and those in the control group.
2. There is no significant difference in the post-test Mathematics attitude mean scores of male and female students treated with CRT.

Methods

Research Design

The study adopted the quasi-experimental research design. The design is called quasi-experimental because it does not employ randomization in the placement of participants into experimental and control group.

Table I

The quasi-experimental design is graphically presented as follows:

Group	Pre-test	Research condition	Post-test
Experimental	O ₁	X ₁ (treatment)	O ₂
Control	O ₁	X ₀ (conventional counselling)	O ₂

Here,

O₁ stands for the pre-test that was given to all the pupils

X₁ stands for the treatment (Cognitive restructuring therapy) which was administered to the experimental group.

X₀ stands for the (conventional counselling) which was administered to the control group.

O₂ stands for the post-test which was administered to both the experimental and control groups.

Population of the Study

The population of the study comprised of 644 senior secondary (SS) class II students that have negative attitude towards Mathematics in the 29 secondary schools in Oshimili South L.G.A Delta State. Senior secondary (SS) class II students were chosen because they have experienced internal and external (Junior secondary school certificate examination) examination. Moreover, they are the next set to take external extermination 2019/2020 session. For the researcher to get the population of students with negative attitude towards Mathematics in the study area, he visited 14 selected secondary schools and administered

Test of Mathematics Related attitudes (TOMRA) scale. A student with 70 and above total TOMRA score were identified as a student with negative attitude towards Mathematics. A total of 1400 copies of questionnaire were administered in the 14 secondary schools with the help of a few selected teachers. Those found high in Test of Mathematics Related attitudes (TOMRA) scale constitute the population of the study.

Sample and Sampling Technique

The sample consisted of 121 SS II students, 56 males and 65 females from four public schools with the highest number of students with negative attitudes towards learning Mathematics. After the pre-test, four intact schools were purposively sampled and were randomly assigned to treatment and control groups thus:

Treatment Group	Male	Female	Total
Experimental group	27	34	61
Control group	29	31	60
Total	56	65	121

Instrument for Data Collection

The instrument adapted for this study was the Test of Mathematics Related Attitudes (TOMRA). The Test of Mathematics Related Attitudes (TOMRA) is a 20-items modified form of the Test of Science Related Abilities (TOSRA) which was developed by Fraser (1981) to measure students' attitudes toward their science class. Participants responded using a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. Positive items are scored by allotting 5 for 'strongly agree' and 1 for 'strongly disagree' responses. Negative items are scored by allotting 1 for 'strongly agree' and 5 for 'strongly disagree' responses. Several studies have investigated students' attitudes to learning Mathematics using the TOMRA. For instance, Spinner and Fraser (2005) assessed students' attitudes to Mathematics using the Enjoyment of Mathematics Lessons and Normality of Mathematicians scales from TOMRA. The TOMRA's factor structure and internal reliability were supported.

Validation of the Instrument

The instruments "Test of Mathematics Related Attitudes" (TOMRA) was subjected to face and content validation. The researcher presented copies of the questionnaires together with purpose of the study, research questions and hypotheses to three experts, – two from guidance and counselling and one from measurement and evaluation all of whom are from Nnamdi Azikiwe University, Awka. The experts made scrutiny of the items to ensure their appropriateness and adequacy as well as their relevance, clarity and language expression. The experts' constructive criticism and suggestions for modifying the instruments were affected to standardize the instrument.

Reliability of the Instrument

The reliability of the TOMRA has been established in previous studies. In the United Emirates, Aldridge, Afari and Fraser (2013) reported an alpha reliability of

0.95 while in Ontario, Canada, Fraser and Raaflaub(2013) reported an alpha reliability of over 0.90. However, the reliability of the instruments was established for Nigeria settings through internal consistency estimate. Participants involving 50 students from secondary schools in Anambra State were selected through accidental sampling technique. The researcher used Cronbach alpha statistical method in determining the reliability coefficients of the instrument. The reliability coefficient of Nigerian Samples yielded 0.91. This was considered high enough to be used for this study.

Experimental Procedure

The sampled students participated in 45 minutes sessions which were held once a week for six consecutive weeks. The treatment was a group directed talk therapy. Participants in both the experimental and control groups were pre-tested before the administration of treatment package. The researcher treated the experimental group with CRT while the control group received a placebo treatment. The experiment was done in three phases: Pre-treatment phase-treatment phase-post-treatment phase.

Pre-treatment: The researcher introduced herself to the participants and asked them to introduce themselves to one another. Influences of negative attitude towards learning Mathematics were discussed. The researcher and the subjects discussed personal problems, negative thoughts which are known to affect Mathematics achievements. Afterwards, TOMRA was administered on the students in the experimental and control group. The tests were administered by the research assistants with the researcher monitoring the exercise, to make sure that the test was taken under the same conditions and then collected the entire completed questionnaire.

Treatment phase: The researcher administered the experimental treatment while the research assistants handled the control group. The phase focused on developing and testing cognitive restructuring therapy to counter negative thoughts of participants as regards to learning Mathematics. A total of six sessions were used for the experiment. The control group was exposed to conventional counselling with the school counsellors providing the services to the control group. This also continued for 6 weeks, and then the pupils were post-tested.

Post-treatment: After the treatment, the Test of Mathematics Related Attitudes (TOMRA) was re-administered to the experimental and control groups. The instrument was disguised by reshuffling before they were re-administered. This was done by the 6th week. The researcher monitored the exercise to ensure that the students are under the same conditions and then, collects all completed questionnaire. The student responses were scored and data generated were collected for statistical analysis.

Control of Extraneous Variables

The following measures were adopted to control some of the extraneous variables that may constitute threats to this study

1. One of such strategies is the use of separate schools in this experiment for the therapeutic treatment. That is, experimental and control groups were located at different schools to avoid subject interaction and contamination.

2. The researcher was aware of the Hawthorne effect. The Hawthorne effect according to Macefield (2007), is an experimenter effect whereby participants, in the study may exhibit atypically high levels of performance simply because they are aware that they are being studied, and thus changes in participants' behaviour during a study. The measures put in place to avoid this are: The researcher will use the first week trying to familiarize himself with the pupils to avoid the student faking their behaviour and also the items in the post-test instrument were reshuffled.
3. Use of analysis of covariance (ANCOVA): some extraneous variable may remain uncontrolled, in spite of the measure the researcher must have put in place. Such possible gaps were taken care of through careful application of the analysis of covariance (ANCOVA) in data analysis, thereby isolating the distorting variable as covariates.

Method of Data Analysis

The data collected for this study were organized in tables and analyzed. Mean was used in answering the research questions and analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 levels of significance.

Presentation of Results

Research Question one

What is the effect of Cognitive restructuring therapy (CRT) on secondary school students' negative attitudes towards learning Mathematics?

Table 2: Pre-test and Post-test Mathematics attitude mean scores of students treated with CRT and those in the control group.

Treatment groups	N	Pretest Mean	Posttest Mean	Pretest/posttest mean gain score	Remarks
Experimental group	61	53.51	75.49	21.98	Effective
Control	60	53.23	53.52	0.29	

Research question one shows that the students treated with CRT had pre-test mean score of 53.51 and post-test mean score of 75.49 with mean gain of 21.98 in their Mathematics attitude scores, while the students in the control group who received conventional counselling had pre-test mean score of 53.23 and post-test mean score of 53.52 with mean loss 0.29. This indicates that students with negative attitudes towards learning Mathematics who were exposed to cognitive restructuring therapy improved in their Mathematics attitude scores than those who did not. To ascertain whether the observed difference was significant the corresponding hypothesis was tested.

Hypothesis one

There is no significant difference in the post-test Mathematics attitude mean scores of students treated with CRT and those in the control group.

Table 3: ANCOVA on the pre-test and post-test Mathematics attitude mean scores of students treated with REBT and those in control group

Dependent Variable: POSTTEST						
Source	Type III Sum of Squares	df	Mean Square	Cal.F	Crit.F	P ≥ 0.05
Corrected Model	15858.161 ^a	3	5286.054			
Intercept	2430.695	1	2430.695			
PRETEST	3449.862	1	3449.862			
Treatment Models	488.788	1	488.788	18.437	3.89	S
Error	3101.839	117	26.511			
Total	510361.000	121				
Corrected Total	18960.000	120				

a. R Squared = .836 (Adjusted R Squared = .832)

The results in Table 3 show that the CRT had significant effect on students' negative attitude towards learning Mathematics. This is because the calculated F-value of 18.437 in respect of the treatment is shown to be significant at $p > 0.05$. This indicates that exposing students with negative attitudes towards learning Mathematics to Cognitive Restructuring Therapy improves their attitudes towards learning Mathematics. The null hypothesis of no significant difference in the Mathematics attitude mean scores of the treatment and control groups is rejected.

Research Question Two

What is the difference in post-test Mathematics attitude scores of male and female secondary school students treated with CRT?

Table 4: Pre-test and Post-test Mathematics attitude mean scores of male and female students treated with CRT.

Gender	N	Pretest Mean	Posttest Mean	Pretest/posttest mean gain score	Remarks
Male	27	55.00	78.29	23.29	More Effective
Female	34	50.00	70.18	20.18	

Research question two revealed that male students treated with CRT had pre-test mean score of 55.00 and a post-test mean score of 78.29 with a mean gain of 23.29, while the female students in the group had pre-test mean scores of 50.00 and post-test mean score of 70.18 with a mean gain of 20.18. Therefore, CRT was more effective on male students than their female counterparts. To ascertain whether the observed difference was significant the corresponding hypothesis was tested.

Hypothesis Two

There is no significant difference in the post-test Mathematics attitude mean scores of male and female students treated with CRT.

Table 5: ANCOVA on the pre-test and post-test Mathematics attitude mean scores of male and female students treated with CRT

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	df	Mean Square	Cal.F	Crit.F	P ≥ 0.05
Corrected Model	2014.348 ^a	2	1007.174			
Intercept	3218.995	1	3218.995			
PRETEST	1022.132	1	1022.132			
GENDER	429.954	1	429.954	14.478	3.96	S
Error	1722.438	58	29.697			
Total	335704.000	61				
Corrected Total	3736.787	60				

a. R Squared = .539 (Adjusted R Squared = .523)

From Table 5, the calculated F-value of 14.478 in respect of the post-test Mathematics attitude mean scores of male and female students treated with CRT is significant at 0.05. The null hypothesis of no significant difference in the post-test Mathematics attitude mean scores of male and female students treated with CRT is rejected.

Discussion of Findings

The result in research question one indicated that the students' showed significant difference on their posttest mean score as a result of the treatment given to them and this difference favoured the experimental group. It was also revealed that the experimental group Mathematics attitude scores were significantly higher than the control group. The findings of this study are consistent with the postulations of the behaviourist learning theory that effective cognitive restructuring theory would lead one to refute irrational beliefs and mindsets and evaluate the basis of such beliefs and mindsets. The direct confrontation of such negative thoughts with alternative explanations can to a large extent dislodge the basis of such irrational beliefs and could subsequently lead to a change in disposition. The finding is in line with Ogugua (2019) that CRT was effective in changing students' irrational thoughts as regards to learning Mathematics.

The findings in research question two indicated that the difference in the posttest Mathematics attitude means scores of male and female students treated with CRT was significant. In particular, the increase in Mathematics attitude mean scores of male students was higher than that of the female students after they had participated in CRT treatment. The result is line with Leaper, Farkas and Brown (2012) that girls exhibit less positive attitudes towards Mathematics at secondary school. The result was also not in agreement with Mata et al., (2012) that claimed that boys and girls present very similar attitudes towards Mathematics.

Conclusion

The study investigated the effect of Cognitive Restructuring Therapy (CRT) on secondary school students' negative attitude towards learning Mathematics in Oshimili South L.G.A

of Delta State. Following the findings of this study, the following conclusions have been drawn:

- That CRT is an effective treatment in improving students' attitudes towards learning Mathematics among secondary school students. As such, its usage should be encouraged.
- The increase in Mathematics attitude mean scores of male students was more than female students after the treatment. The study also found significant difference in the mean post-test score of male and female students. Indeed, math is viewed as a male-dominated domain which is evident in career choices and jobs (Leaper et al., 2012)

Recommendations

Based on the findings, the following recommendations are hereby made:

1. Counsellors should apply Cognitive Restructuring Therapy on students' negative attitudes towards learning Mathematics as it has been proved to be effective on it.
2. Counselling should be an integral part of any educational institution, especially at the secondary school level, to boost the self-confidence of the students.
3. Workshops and seminars should be organized to train teachers on how to use the techniques in the classroom since students exposed to Cognitive Restructuring Therapy had a higher mean score than those who did not receive the treatment

References

- Aldridge, J. M., Afari, E., & Fraser, B. J. (2013). Influence of teacher support and personal relevance on academic self-efficacy and enjoyment of mathematics lessons: A structural equation modelling approach. *Alberta Journal of Educational Research*, 58, 614–633.
- Asikhia, O. A. (2014). Effect of Cognitive restructuring on the reduction of Mathematics anxiety among senior secondary school students in Ogun State, Nigeria. *International Journal of Education and Research*, 2(2), 1-20
- Betiku, O. F. (2009). *Resources for the effective implementation of the 2- and 3-Dimensional Mathematics topics at the junior and senior secondary school levels in the Federal Capital Territory, Abuja. Nigerian Journal of Curriculum Studies*, 6(2),49–52.
- Bilican, S., Demirtasli, R. N., & Kilmen, S. (2011). The attitudes and opinions of the students towards Mathematics course: The comparison of TIMSS 1999 and TIMSS 2007. *Educational Sciences: Theory & Practice*, 11(3), 1277–1284.
- Chow F.T, (2011). Students’ Difficulties, Conceptions and Attitudes Towards Learning Algebra: An Intervention Study to Improve Teaching and Learning. *Unpublished Doctoral Thesis*, Curtin University
- Dobson, K. S., & Dozois, D. J. A. (2010). Historical and philosophical bases of the cognitivebehavioraltherapies. In K. S. Dobson (Ed.). *Handbook of cognitive-behavioral therapies*(3rd ed., pp. 3–38). New York, NY: Guilford Press.
- Fraser, B. J. (1981). *Test of Science-Related Attitudes (TOSRA)*. Melbourne, Australia: Australian Council for Educational Research.
- Fraser, B. J., & Raaflaub C. (2013). Subject and sex differences in the learning environment – Perceptions and attitudes of Canadian mathematics and science students using laptop computers. *Curriculum and Teaching*28 (1), 57-78.
- Han, S. Y., & Carpenter, D. (2014). Construct validation of student attitude toward science, technology, engineering and Mathematics project-based learning: The case of Korean middle grade students. *Middle Grades Research Journal*, 9(3), 27–41.
- Ingram, N. (2015). Students’ relationships with Mathematics: Affect and identity. In M. Marshman, V. Geiger, & A. Bennison (Ed.), *Mathematics education in the margins* (Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia) (pp. 301–308). Sunshine Coast, Australia: MERGA.
- James and James (2001). *Mathematics Dictionary*. India: CBS Publishers & Distributors
- Julius E., Abdullah A.H & Suhairom N. (2018). Attitude of Students towards Solving Problems in Algebra: A Review of Nigeria Secondary Schools. *Journal of Research & Method in Education*, 8(1), 26-31
- Leaper C., Farkas T., & Brown C.S (2012). Adolescent girls’ experiences and gender-related beliefs in relation to their motivation in math/science and English. *Journal of Youth andAdolescence*, 41(3),268–282
- Lubienski, S. T., Lubienski, C., & Crane, C. C. (2012). Achievement differences and school type: The role of school climate, teacher certification, and instruction. *American Journal of Education*, 115(1), 97–138.

- Macefield, R. (2007). Usability studies and the Hawthorne Effect. *Journal of usability studies*, 2(3), 145-154.
- Mata M.L, Montero V., & Peixoto F., (2012). Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors. *Child Development Research*, 20(12), 1-10
- Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards Mathematics and performance: Does the teacher attitude matter? *Journal of Education and Practice*, 4(3), 132–139.
- Ogugua G.U (2019). Effect of Cognitive Restructuring on junior secondary school Mathematics test anxiety in Oshimili south L.G.A of Delta State. *Hofa: African Journal of Multidisciplinary Research*, 4(1)
- Ogugua, G.U (2010). Effects of Cognitive restructuring, on Mathematics achievement of secondary school adolescents. *Unpublished Masters thesis*, Nnamdi Azikiwe University, Awka, Nigeria.
- Spinner, H., & Fraser, B. J. (2005). Evaluation of an innovative mathematics program in terms of classroom environment, student attitudes, and conceptual development. *International Journal of Science and Mathematics Education*, 3, 267-293.
- Yadav, D.K (2017). Exact definition of Mathematics. *International Research Journal of Mathematics, Engineering and IT*, 4(1), 34-42