THE EFFECTS OF BEHAVIOUR MODIFICATION STRATEGIES ON STUDENTS' ATTITUDE AND MATHEMATICS ACHIEVEMENT IN FEDERAL UNITY COLLEGES IN KADUNA STATE

By

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CERTIFICATION

I certify that this research work was conducted, written and compiled by me. I also certify that to the best of my knowledge this work has never been presented wholly or partially for the award of any Degree or for publication elsewhere.

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DEDICATION

This study is dedicated to all ambassadors of the 'ETENYIMA' family and all the advocates of attitudinal rebirth the world over. Certainly, positive attitudinal disposition is a precursor to success in all human endeavours.

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ABSTRACT

This study examined the effects of two behaviour modification strategies, Token Economy and Token Economy with Continuous Testing in Mathematics on students' attitude and Mathematics achievement. The quasi-experimental pre-test post-test control group design was adopted. A sample of 195 Junior Secondary School II students was drawn from the three Federal Unity Colleges in Kaduna state, Nigeria. The two validated instruments used for this study were Students' Mathematics Attitude Questionnaire (SMAQ) with Cronbach's Alpha of .71; a modified version of the Fennema Sherman Mathematics Attitude Scale and, Students Mathematics Achievement Test (SMAT) with Kuder Richardson's reliability coefficient KR-20= .7I25. Six research questions and fourteen hypotheses were formulated and tested at the .05% level of significance. Data collected were analysed using descriptive statistics for the research questions and the Analysis of Covariance (ANCOVA) to determine the effects of treatment on the dependent variables. Scheffe's Post-hoc analysis was also done to gain further insight on the magnitude and direction of multiple pair wise comparisons of the variables. The results of the analyses showed that there exist significant effects of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) on students' attitude towards Mathematics and achievement in Mathematics. But the study did not reveal any significant effect of students' socioeconomic background and gender on their attitude towards Mathematics and achievement in Mathematics. The study also found a significant interaction effect between the behaviour modification strategies and gender in favour of boys on students' achievement in Mathematics. But students' socioeconomic background and gender were not found to exert any significant interaction effect on their Mathematics attitude and achievement. Since this study has provided empirical evidence that students' performance in and attitude towards Mathematics was positively influenced by the behaviour modification strategies, it was recommended that government, teachers and school administrators should exploit and take advantage of the token economy strategies frequently, so as to remove the students' apathy for and their poor attitude towards Mathematics that has become a chestnut. It is believed that if the benefits of the findings in this study are harnessed, students' Mathematics achievement and affective dispositions will be heightened.

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LIST OF ABBREVIATIONS

AAT: Algebra Achievement Test

ANCOVA: Analysis of Covariance

ANOVA: Analysis of Variance

ATM: Achievement Test in Mathematics

GCRCT: Georgia Criterion Reference Competency Test

JAMB: Joint Admissions and Matriculation Board

MAT: Mathematics Ability Test

MOPS: Motivation for Occupational Preference Scale

NECO: National Examinations Council

PBL: Problem-Based Learning

SEB: Socio Economic Background

SMAQ: Students' Mathematics Attitude Questionnaire

SMAT: Students' Mathematics Achievement Test

SSCE: Senior School Certificate Examination

UTME: Unified Tertiary Matriculation Examination

WAEC: West African Examinations Council

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The main variable that anchoredthis study is Behaviour Modification.It derives its principles from Skinner's operant conditioning experiment based on Thorndike's Law of Effectwherein, the frequency of learners' behaviour is altered by the use of positive and negative reinforcement. In practice, reinforcement is the major artery that drives the behaviour modification programme. Concerns for and the need tostem the tide of underachievement in Mathematics across schools in Nigeria has become heightened in view of the central role it plays in the academic life of students, science, technology and society. This study is,therefore, premised on the postulation that students' attitude towards a subject predetermines success in it. In essence, it is held that desirable attitude towards a subject results in positive achievement in it.

Quite a number of researchers among which includeSmith & Mackie (2007);Mangal (2010) andHockenbury&Hockenbury (2007) has actually implicated attitude as a prominent variable that determine achievement and academic success among students. Ercikan, McCreith&Lapointe (2005) hinted thatattitudinal disposition such as students' confidence, interest, perseverance and curiosity in learning mathematics, is particularly important for the attainment of positive learning outcomes. This then implies that, for the desired learning outcome to come to fruition, it is expedient on the teacher and the learner to exhibit some positive attitudinal dispositions necessary to enhancethe attainment of the set instructional objectives.

Attitudeis,therefore, one of the key variablesunderpinning this study. Itis connected to Bandura's (1977) social cognitive learning theory as one of the personal factors that affect learning (Newbill, 2005). In the greater realm of social psychology, attitudeis typically classified among the affective domain and is part of the larger concept of motivation (Greenwald, 1989d). Three main components make up attitude.Attitude in the classroom setting is composed of Emotional**,** CognitiveandBehavioral components. In the views of Smith &Mackie (2007); Hockenbury&Hockenbury, (2007) andNewbill (2005), theemotionalcomponentclarifieshow the object, person, issue or event make one feel thecognitivecomponentexplains a person's thoughts and beliefs about the subject and thebehavioralcomponentillustrates how the attitude influences the behaviour.

In view of the foregoing, therefore, this study seeks to examine the progress of students' performance in Mathematics following exposure to two forms of behaviour modification strategies, token economy and token economy with continuous testing in Mathematics.

1.2 Statement of the Problem

The main challenge which prompted the conduct of this studyis poor performanceand mainlystudents' apathy for Mathematics, which is palpable. Next is the fact that teaching mathematics to students with poor or little Mathematics background is quite challenging.Yet, not many teachers are willing to carry the extra burden of meeting the students' complex learning needs.These scenarios aptly typify the pedagogy of Mathematics instruction throughout Nigerian schools (Shehu, 2006).

Certainly, the major goal of the school is to work towards the attainment of academic excellence of students. Excellence in the scholastic functioning of children is often the expectation of government, education policy makers, the school and parents. For some time now, policy makers and education experts have been concerned over the spate of the pervasive underachievement in Mathematics at the Senior School Certificate Examinations in West African Senior School Certificate Examination (WASSCE), National Examinations Council Examinations (NECO) and the Unified Tertiary Matriculation Examination (UTME) across Nigeria. While studies are replete on the degree of failure, see (WAEC Chief Examiner's reports 2005-2015 in press), there is a paucity of experimental studies targeted at improving performance in the subject.

The gap in Mathematics achievement gets more unacceptable when viewed on account of the fundamental importance it plays in the entire educational system. For instance, without a credit in mathematics, students cannot pursue most science and technology-related courses at institutions of higher learning in Nigeria. Adepoju&Oluchukwu (2011) explained this point as they portrayed Mathematics as a pre-requisite subject required to gain admission into higher institutions of learning in Nigeria and some West African Countries like Ghana, Gambia, Sierra Leone and Liberia (These countries have similar colonial origin and jointly established the WAEC). A minimum of a credit pass in Mathematics is a precondition for admission in a number of courses ranging from science to technology, commerce and even art courses accounting for almost 80% of them. The Joint Admissions and Matriculations Board (JAMB's) general entry requirements for admission into first degree courses in

Nigerian universities rightly states that a credit pass in Mathematics is required for all science based and social science courses except where it is stated otherwise (JAMB, 2014/2015: page 4). Gaining admission into Nigerian universities is a matter of survival of the fittest on account of limited vacancies occasioned by the increasing population of candidates seeking admission and the carrying capacity of the universities.

A further insight was given byAmatobi&Amatobi (2013) who noted that Nigeria's quest for technological advancement and economic emancipation is being undermined by persistent poor Mathematics achievement of secondary school students in external examinations. Theyconcluded that it is common knowledge that the economies of the industrialized nations are driven by science and technology. Hence, Nigeria's vision to be among the top 20 world largest economies by the year 2020 (Vision 2020) substantiates the emphasis it places on "science, technical and vocational education" (FRN 2004: page 8). But the realisation of this policy becomes illusive in view of the challenge posed by performance in Mathematics.

The Table below shows a vivid illustration of students'trends of performance in the Senior Secondary Certificate Examination (SSCE) organised by the West African Examinations Council (WAEC) in Mathematics, in the last ten years.

Table 1.1: Students' Performance in May/June SSCE (WAEC) 2005-2015

Year	Total no of candidates	No with credit (A1-C6)	%(A1-C6)
2005	1,054,853	402,982	38.20
2006	1,181,515	482,123	41.12
2007	1,275,330	598,129	46.90
2008	1,369,142	779,863	56.96
2009	1,373009	622,384	45.33
2010	1,351,557	560,974	41.51
2011	1,540,250	587,630	38.15
2012	1,672,224	649,156	38.81
2013	1, 689, 188	617,736	36.57
2014	1,692,248	529,425	31.28
2015	1,605,248	616,370	38.39

Source: WAEC Chief Examiner's reports (2005-2015)

The spate of poor performance in mathematics across Nigerian schools is more of a chestnut. Clearly and from the foregoing, teachers' inability to articulate and design all appropriate psychologically conducive teaching and learning classroom environment has seriously encumbered and helped to affect students' achievement. The school counsellors have also been handicapped in providing solutions to this worrisome challenge. Rather, guidance counsellors have often been preoccupied by issues like delinquencies, substance abuse, anxiety, career choice and preferences and the like (Shehu, 2006). This study, therefore, strives to consciously examine the effectiveness of behaviour shaping of

students and teachers in the selected schools with a view to improveon their achievement and attitude toward Mathematics.

Objectives of the Study

The objectives set out for this study are to:

1. Determine the effects of behaviour modification strategies (token economy and token economy with continuous testing) on students' achievement in Mathematics.
2. Verify the effect of behaviour modification strategies (token economy and token economy with continuous testing) on students' attitude towards Mathematics.
3. Study the effect of students' socioeconomic background on their achievement in Mathematics.
4. Investigate the effect of students' socioeconomic background on their attitude toward Mathematics.
5. Scrutinise the effect of gender on students' achievement in Mathematics.
6. Examine the effect of gender on students' attitude towards Mathematics.

1.4 Research Questions

The following research questions guided this study:

1. To what extent do the behaviour modification strategies (token economy and token economy with continuous testing) influence students' achievement in Mathematics?

2. To what extent do the behaviour modification strategies (token economy and token economy with continuous testing) influence students' attitude toward Mathematics?
3. How does students' socioeconomic background influence their achievement in Mathematics?
4. How does students' socioeconomic background influence their attitude toward Mathematics?
5. To what extent does gender influence students' achievement in Mathematics?
6. To what extent does gender influence students' attitude towards Mathematics?

1.5 Research Hypotheses

In view of the peculiar nature of this study, a quasi-experimental test-retest design and two forms of hypotheses were formulated for investigation. The hypotheses were designed on the one hand, to examine Main Effectsand, in another vein,the Interactive Effects of the independent (treatment) variables on the dependent variables (students' Mathematics achievement and attitude towards Mathematics).

The research hypotheses aimed at examining Main Effects are:

1. There is no significant Main Effect of treatment (token economy and token economy with continuous testing) on students' achievement in Mathematics.
2. There is no significant Main Effect of treatment (token economy and token economy with continuous testing) on students' attitude towards Mathematics.
3. There is no significant Main Effect of students' socioeconomic background on their achievement in Mathematics.

4. There is no significant Main Effect of students' socioeconomic background on students' attitude towards Mathematics.
5. There is no significant Main Effect of gender on students' achievement in Mathematics.
6. There is no significant Main Effect of gender on students' attitude towards Mathematics.

Accordingly,eight hypotheses were also drawn to examine two and three factor Interactive effects of treatment on the dependent variables, respectively. The hypotheses are:

7. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing) and socio economic background on students' achievement in Mathematics.
8. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing) and socio economic background on students' attitude towards Mathematics.
9. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing) and gender on students' achievement in Mathematics.
10. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing) and gender on students' attitude towards Mathematics.
11. There is no significant Interactive Effect of socioeconomic background and gender on students' achievement in Mathematics.

12. There is no significant Interactive Effect of socioeconomic background and gender on students' attitude towards Mathematics.
13. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing), socio economic background and gender on students' achievement in mathematics**.**
14. There is no significant Interactive Effect of treatment (token economy and token economy with continuous testing), socio economic background and gender on students' attitude towards mathematics**.**

1.6 Significance of the Study

This study on the effects of behaviour modificationis aimed at improving the poor learning outcomes in mathematics that has become perennial. It is also, an immense contribution to the realisation of Nigeria's education policy dreams. It is therefore, significant in the following ways:

1. This research is in the purview of the assumption that the role of today's teacher has become complex and highly demanding. It will, as a result, assist in enhancing teachers' proficiency. It will come handy in bridging the gap in the current traditional teaching approaches and the students' maladaptive behaviours and learning outcome in Mathematics. Shehu (2006) has stressed the need for teachers to be conversant and acquainted with various types of students' problems and also be versatile. The researcher viewed that this will assist teachers in discharging their duties effectively. As such, this study shallbridgethe age long gap in teachers' proficiency in the teaching and learning of Mathematics.

2. This study will enhance the services of school counsellors. Evidently, they need an empirical study of this nature in order to have sufficient knowledge and be able to facilitate teacher proficiency skills in behaviour management, which are lacking and yet requisite for effective teaching and for positive learning outcomes. The role of school counsellors transcends merely assisting students in overcoming psychological problems in the course of their study to career choice guidance. Of all the three domains, the affective is subtlyimportant that only educational psychologists and, by extension, school counsellors have the professional capability to handle. The teacher is, most of the times, pre-occupied with the cognitive and often times psycho-motor domains, depending on course content. Against this backdrop, therefore, this study will fill a big gap within the school setting.
3. When students fail, the teacher and school administrators take the blame, but when they pass, the candidates and their parents take the glory. The issue of mass failure in mathematics and general apathy of the subject have attracted more research works on the causes and sits magnitude. There is a paucity of research on empirical ways of stemming the tide. School administrators should, by this study, be sensitised about workable solutions to the nagging problem. It will equally equip them with adequate information and strategies for stemming the tide of mass failure in Mathematics across schools. In particular, this study will provide for school administrators a frame work of programme that would enhance teacher proficiency and awareness and also improve competences and skills towards handling classroom inappropriate and maladaptive behaviours among students.

4. Parents are at the receiving end of all that happen in the school, just as the school is a social institution which, in a way, relates with the public. Parents as members of the society feel the pulse of the school as the immediate beneficiaries of school activities.When students fail, the parents feel it the most, as the resultant effect has multiplier effects on the parents. This study will bring about the much needed relief to parents. The upper Basic II class is a foundation class at the upper basic school level in Nigeria. Studies have shown that candidates fail in mathematics at the senior school terminal examinations due substantially to poor foundation at the upper basic school level. This study, therefore, will fill the desired gap.
5. In addition, international donor agencies have made substantial contributions to improving standards, especially in Mathematics. The result has left very little or nothing to desire. Their impact has not made any significant effect on students' achievement; statistics on candidates' poor performance are readily available.

1.7 Scope and Delimitations of the Study

It is imperative to acknowledge that this study has some limitations. First, although the sample size was relatively large, the fact still remains that it did not present the totality of students of Federal Unity Colleges in Kaduna state.

Obviously, the study has limitation with controlling such intervening variables like the individual differences of the subjects, differences in students' background, subjects' diversity in emotional intelligence, students' learning or cognitive styles and other latent abilities.

This study is one of the few that seeks to evolve an empirical approach to stimulate students' attitude towards Mathematics and increase performance, while attempting to reward desirable attitudes and negatively reinforce undesirable classroom behaviours. It is further acknowledged that selection bias could play a role, as in any voluntary study where non-participating students could either be less motivated, discouraged or even get excited in the experimental classes to the extent that they may in some ways influence the study.

Moreover, the study is focused on the upper basic section because it forms a significant foundation level class. Most importantly, this class was chosen for the study because it is considered the most stable of the classes in the basic education cluster. It is viewed that the upper Basic I students have not fully resumed, as many are still processing their admissions, while the upper Basic III students are preoccupied with preparation for their junior school terminal examinations.

Attitude, as earlier discussed, is a unique factor of the affective element upon which students' behaviour towards Mathematics orbits for successful learning. This study, therefore, attempts to stimulate desirable classroom behaviours through behaviour modification mechanisms, so as to bring about positive learning outcomes. As such, the study sets out to investigate six sub scales of Attitude including: Self-confidence in Mathematics, Parent and teacher expectations towards Mathematics, Mathematics value, Mathematic enjoyment dispositions, Mathematics motivation traits and Mathematics anxiety. The token economy package has been designed to capture as much as possible the behavioural traits to be explained fully in the research design. The study does not

intend to investigate other intervening or extraneous variables locked in-between the backgrounds of teachers, students and the school. This same reason accounts for the researcher's decision to make the research design, quasi-experimental. The study is, therefore, aimed at examining the efficacy of behaviour modification as modeled in the token economy plan and the continuous testing in Mathematics, as it might affect the students' attitude and achievement in mathematics.

1.8 Operational Definition of Terms

In this study, the following terminologies wereused as defined

1. **Behaviour Modification Strategies:**These are strategies anchored by operant conditioning procedures, where in positive reinforcement is used to elicit desirable behaviour and negative reinforcement is invoked to inhibit undesirable behaviour.
2. **Token Economy:** Use of secondary reinforcers like stickers, gold starsand worded wrist and shoulder bands in addition to primary reinforcers,such as assorted biscuits, fruit drinks and other pastries to strengthen learner appropriate classroom behaviour and correct inappropriate behaviour.
3. **Continuous Testing in Mathematics**: Is the systematic engagement of subjects in periodic mathematics testing on topics taught prior to the time of assessment.
4. **Achievement in Mathematics:**This is the learners' measure of performance in the Mathematics achievement (Pre and Post-tests) tagged Student Mathematics Achievement Test (SMAT).

5. **Attitude towards Mathematics:** Behavioural dispositions and traits that either enhance or inhibit Mathematics learning like timely completion of class and homework, class participation, off sit movement without permission and other factors that either enhance or hinder learningor readiness to learn.
6. **Main effects of treatment:** This is the effect of one of the independent variables (Treatment) on one dependent variable, ignoring the effects of all other independent variables.
7. **Interactive effects of treatment:** Thisis the effect of one independent variable on thedependent variable, which changes depending on the level of another independent variable.
8. **Socioeconomic status:** Is the measure of how parents' income, occupation, level of education, status of luxury and political power affect students.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

A review of related literature on an academic research of this nature is requisite. This is to the extent that a clear theoretical and/or conceptual framework is required to be charted out. Since Behaviour Modification is the principal variable anchoring this study and it derives its root from Skinner's Operant Conditioning experiment, the theoretical framework is centred on Burrhus Frederic Skinner's Operant Conditioning Theory. The major concepts reviewed, includeBehaviour Modification andthe concepts of Token Economy and Reinforcement. The review also touched on the importance of Mathematics to man, science and society.In addition, the review also looked at the factors that affect learning Mathematics with and a review of empirical studies on the mainvariables, including token economy, socioeconomic background and gender.

2.2 The Conceptual Framework

Behaviour Modification

Behaviour modification is the principal variable on which this study is anchored. The behaviour modification process is an offshoot of the operant conditioning experiment, wherein, positive reinforcement is used to elicit desirable behaviour and negative reinforcement is utilised to inhibit undesirable behaviour.

2.2.1 What is Behaviour Modification?

Behaviour modification strategies as applied to school settings vary greatly. While Martin & Pear(2007) reported that in it, a combination of positive and negative reinforcement is typically used, Cancio& Johnson(2007)listedpositive reinforcement mechanisms often used to include points, rewards and signs of status, while punishment procedures may include time-outs, point deductions, reversal of status, prolonged stays at a facility, physical restraint or even corporal punishment. Behaviour Modification uses a variety of methods, such as assertiveness training, conditioned response, stimulus response and hypnosis, aimed to change unsatisfactory or deviant patterns of behaviour. For the purpose of this study, we seek some definitions of the concept relating to the classroom setting.

2.2.2 Definitions of Behaviour Modification

Stedman's Medical Dictionary (2002) defined behaviour modification as the use of basic learning techniques, such as conditioning, biofeedback, reinforcement or aversion therapy to teach simple skills or alter undesirable behavior. Martin (1988) defined Behavior Modification as a treatment approach based on the principles of operant conditioning that replaces undesirable behaviours with more desirable ones through positive or negative reinforcement. In a related standpoint, the Dictionary of Cultural Literacy(2005) considered behaviour modification as a variant of Behaviour therapy, which it defined as a process of changing a person's reactions to certain situations or stimuli. In essence, Behavior Therapy is the American derivative of the term Behaviour Modification. Amy (2013) viewed behaviour modification from the standpoint of discipline, stating that it is

one of the five main types of child discipline and stated that it is a fairly straightforward process that uses a behaviourist approach to explain the science behind behavior change, noting that, although it was based on research with lab rats, it is definitely applicable to humans as well.

When we do a précis of these definitions, we will find that behaviour modification seeks to elicit the desired behaviour by extinguishing the abnormal and enabling the desired behavior through the use of a variety of reinforcement techniques. This is the nucleus upon which this study is anchored.

2.2.3 The Concept of Token Economy

A token economy is an operant conditioning procedure and a system of behavior modification based on the systematic reinforcement of target behavior.In an educational setting, token economy is a system for providing positive reinforcement to children by giving them tokens for completing tasks or behaving in desired ways. Token economy, according to Ellen & Susann (2009), is a system of operant conditioning in which participants are reinforced with tokens that can later be cashed in for primary reinforcers. Token economies, according to them, are often used to control the behaviour of groups of people, such as school children. In addition, Salend(2011) in Ellen & Susann (2009) noted that token economy is also adopted in the treatment of mental hospital patients or prisoners. They outlined two main advantages of token economy. First, they submitted it is effective when trying to simultaneously modify a number of behaviours in a group as in classroom. They viewed that it is easier than developing an individual operant conditioning programme, noting that it can be used for a group and even multitude of students at a time. Secondly, the token economy programme allows for immediate

reinforcement with a token; even when not practically possible to immediately present the primary reinforcers. This is typical of a classroom environment, the focus of this study. The potential problem with token economy, they observed, is that it often places the behaviour on a continuous schedule of reinforcement, which can make learners' being conditioned or under treatment become vulnerable to extinction. In Ellen's& Susann's (2009) views, this limitation is outweighed by the usefulness of the token economy in controlling the immediate behaviour of the subjects in the programme. This drawback can be jettisoned when we appreciate the imminent gain that is inherent in its use. The good thing about it is that, learning must have taken place. What this portends is that, learning must have taken place in the course if the conditioning. The major strength of a typical token economy system is that it takes in remedies that help to partial out the major drawbacks of the respective reinforcement schedules.

In addition,Ellen & Susann (2009) outlined some steps to be considered in setting up a token economy system. They pinpointed that the modifier should

1. Draw up a list of desired and undesired behaviour intended to control or modify.
2. Decide how many token to give or (take away) for each of the behaviours.
3. Develop some sort of record keeping systems to keep track of each participant's tokens.
4. Hang such drawn record keeping charts on the wall within the classroom.

These lime lights signify great benefit for this study, as it has revealed that maladaptive behaviour, especially those relating to the classroom situation is the bane of academic achievement. From the foregoing, appropriate behaviour is evidently a strong correlate of

academic achievement.As such, the appropriate use of reinforcement in class, given its antecedents as illustrated, is a potent tool for stimulating the desired learning outcome, especially in Mathematics.

2.2.4 The Token Economy Model

In this study, two token economy strategies are deployed as treatment. One of the treatments (Token Economy) is aimed at stimulating learners' desirable emotional learning engagement in Mathematics. The second (Token economy with continuous Testing in Mathematics) treatment combines two components of attitude. It embeds the emotional component in the first treatment with cognitive elements of attitude. The detail of treatment will be explained in Chapter Three.

As discussed somewhere in this chapter, it was said that, when an undesirable behaviour is negatively reinforced, it leads to a reduction of the manifest attitude, but a positive and appropriate reinforcement of the desired classroom behaviour brings about a heightening of the desirable behaviour. To this end, behaviours presumed to be detrimental and are capable of inhibiting the learning of Mathematics were identified and appropriate reinforcement targeted at modifying the behaviour were set aside. Similarly, the contingent stimulus reinforcement strategies (token economy) were equally designed for rewarding appropriate behaviour, leading to desirable learning outcomes. All these were identified and adopted for positive reinforcement.

2.2.5 The Concept of Reinforcement

Reinforcement is a major component of the Operant Conditioning experimentation and a core stimulus instrument for this study. Kendra (2013) affirmed thatreinforcement is anything that strengthens or increases behaviour, including stimuli, events and situations. There are also two major categories of reinforcement: the primary and secondary.Primary reinforcement is sometimes referred to as unconditional reinforcement; it occurs naturally and does not require learning in order to work. Primary reinforcers often have an evolutionary basis in that they aid in the survival of the species. Examples of primary reinforcers include food, air, sleep, water and sex. Genetics and experience may also play a role in how reinforcing such things are. For example, while one person might find a certain type of food very rewarding, another person may not like that food at allMangal(2010)&Kendra(2013).Secondary reinforcement, also known as conditioned reinforcement,involves stimuli that have become rewarding by being paired with another reinforcing stimulus. For example, when training a dog, the sound of a clicker can be associated with the praise and treats until its sound of the clicker itself begins to work as a secondary reinforcerMangal(2010)&Kendra(2013). Reinforcement when used to shape behaviour in the parlance of operant conditioning can either be Positive orNegative.

Positive reinforcement is said to involve the addition of something to increase a response. In the educational context, token rewards, praise, getting out of unwanted work, grades, medals and other prizes as well as candy awarded to students, extra playtime and fun activities are examples of positive reinforcersMangal(2010),Skinner(1974) andKendra(2013). Conversely, Negative Reinforcement is that which involves the

removal of something (a dance show, for example) in order to increase a response, such as canceling a quiz if students turn in all of their homework for the week. By removing the aversive stimulus (the dance), the teacher hopes to increase the occurrence of the desired behavior (completing all homework).

2.2.6 The Schedules of Reinforcement

Ellen & Susann (in press) noted that the schedules of reinforcement are the frequency and timing of the reinforcement that an organism receives in the cause of behaviour modification. In that parlance, therefore, it is imperative to note that care needs to be taken in selecting the appropriate reinforcement for the subject, so as to ensure success in the entire process. They noted that the first consideration in developing a programme of reinforcement is to choose a reinforcer that is actually reinforcing for the person or group you are trying to condition.

This is quite instructive. Clearly, if reinforcement is wrongly timed or inadequate, contingent upon the display of the desired behaviour, this might invalidate the entire behaviour modification exercise. This could render the treatment a failure and the result, spurious and a nullity. But the continuous schedule of reinforcement has been criticised as it was seen as not very helpful when using operant conditioning to modify behaviour. On this, Ellen & Susann (2009) noted that it might not be feasible, for instance, that in teaching a child to be polite.The child is reinforced with praise every time He demonstrates a polite attitude. This implies that the modifier will have to be around the child every time the subject demonstrates an act of politeness. Secondly, they observed that continuously reinforced behaviours are vulnerable to extinction. The problem with

using continuous schedules of reinforcement is that they lead to behaviours that extinguish very quickly once the reinforcement ceases, as viewed by Nevin& Grace(2005).

2.2.7 The Ratio Schedules of Reinforcement

In the ratio reinforcement schedules, the organism or learner in this context is rewarded following a predetermined frequency of the display of a number of correct responses of the desired behaviour. An example can also be obtained from the Skinner box experiment, where, for instance, the rat may be required to press the bar three times before it is rewarded.The ratio schedule has advantage over the continuous schedule due to some obvious reasons. For instance, because the continuous schedule is characterized by high rates of responding, respondents are especially likely to take many responses to get a reward. There are two subcategories of the ratio reinforcement schedule, the fixed and variable.

In the fixed ratio, a specified number of responses must be emitted before a reward (reinforcement) is handed down. But in the Variable Ratio Schedule, the number of responses required to receive a reward varies around some average. The variable ratio schedule is superior to both continuous and fixed ratio schedules, as it yields even slower rate of extinction than the fixed ratio. A good example of this is the slot machine, which pays off on a variable ratio schedule of reinforcement.

2.2.8 The Interval Schedules of Reinforcement

The interval schedules of reinforcement provide that the organism is rewarded only once per some interval of time. There is also the fixed and variable interval schedule of reinforcement. In which case, the organism is only rewarded upon the expiration of the set time. The learner may be rewarded after every 10, 20, or 30 minutes irrespective of the number of correct responses exhibited within the interval of times. It could be a Fixed Interval Schedule where the organism is rewarded for the first time of emitting the desired response after which a preset interval of time must pass before any other instances of response will be rewarded or a Variable Interval Schedule where the length of the interval of time varies.

In summary, the reinforcement schedules when used in operant conditioning according to Mangal(2010), have the following antecedents:

1. Continuous reinforcement leads to high rates of responding but the quickest extinction.
2. Ratio schedules of reinforcement lead to higher rates of responding than do interval schedules.
3. Variable schedules lead to behaviours that are the most resistant to extinction.

2.2.9 The Importance of Mathematics to Man and Society

Mathematics is a key variable that underpins this study. The choice of this subject is informed by its significance to society, science and technology and,by extension, national development. As viewed by Amine(2010), Mathematics is more than just the science of numbers taught by teachers. It is vital in a variety of ways; Mathematics is the science of

precision and is critical for the development of modern science and the society. Growth in it affects fields in the science world, including medicine, physics, biology, technology and more. In the medical field, for instance, according to TheOurant Institute, New York University, as cited inAmine(2010), “equations that describe cardiac mechanics including blood, muscle, and valve mechanics and electrophysiology are different, in both cases, a realistic treatment demands the use of methods that account for anisotropy, in homogeneity, and complex geometries”. Interestingly, these are fields in abstract mathematics. In the academic world, José(2000) stated that mathematics provides learners with the ability to compute it heightenstheir geometrical understanding of space-time andequip them with uniquely powerful ways to describe, analyse and change the world.

The United Kingdom Qualifications and Curriculum Authority (2007) noted thatMathematics equips pupils with uniquely powerful ways to describe, analyse and change the world. It can stimulate moments of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more elegant solution or notice hidden connections. It further stated that pupils who are functional in mathematics and financially capable are able to think independently in applied and abstract ways and can reason, solve problems and assess risk.

The importance of mathematics to science requires that mathematics be regarded as basic to the teaching and learning of science Eraikhuemen&Oteza(2008). Science and technology are two aspects of knowledge that combine to form the heart of national development. The view that the importance of Mathematics to science requires that it should be regarded as basic to the teaching and learning of science, vis-à-vis Biology,

Chemistry and Physics is increasingly becoming popular to educators. Chemistry is one of the science subjects that require a substantial mathematical base for its understanding. Problem solving is a part and parcel of Chemistry at the secondary school level. In Physics, quantum physics, thermal dynamics and statics, electric field, wave motion and sound are examples of areas where mathematics knowledge proves an invaluable tool.

Manapure (2011) posits that a student needs a basic knowledge of mathematics like change of subject of formula to understand density, which appears under major topics like ecology in biology, diffusion in chemistry and floatation in physics. Vector quantity, which is taught in physics, requires a great deal of mathematics. Consequently relationships between variables, such as volumes, pressure and temperature are revealed through the use of mathematical concepts. Different mathematical topics, such as vectors, calculus, logarithms and arithmetics are applied to solve scientific problems. Onwuka, Onwuka&Iweka(2010) affirmed that many topics in the science subjects (biology, chemistry and physics) are inter-related and further noted that there are overlaps or areas of intersection in some content areas like atomic structure just as fermentation is taught both in biology and chemistry.

As remarkable as all these findings may sound, under-achievement in Mathematics across Nigerian secondary schools has been a major challenge facing the Nigerian education system. But in order to be well informed as to evolving a sustainable solution to the problem, it will be worthwhile to assess the factors capable of influencing, enhancing or militating against performance in Mathematics.

2.2.10Factors that Affect Learning Mathematics

Studies aimed to investigate poor performance in Mathematics have implicated a number offactors as accounting for underachievement. Mainly, whileOnoshakpokaiye (2011)blamed poor achievement on learners' attitude towards the subject, teachers' teaching style and school structure,Adebola&Ademola (2011)implicatedconveniences and instructional materials.Similarly**,** Zachariah, Komen, George, Muthaa&Reche (2012)unfolded the factors contributing to poor performance in Mathematics to include understaffing, inadequate teaching and learning materials, lack of motivation and poor attitudes by both teachers and students and retrogressive practices. Conversely, Andile&Moses (2006) identified two factors that directly influence Mathematics learning to include teaching strategies, content knowledge, motivation, laboratory use and non-completion of the syllabus in a year. They also found indirect influences,the role played by parents in their children's education and general language usage together with its understanding as vital to positive learning outcomes in mathematics.

These findings are quite helpful, as they have assisted in revealing that the problem of underachievement in mathematics cuts across most regions of the world. It also indicated that the socio-economic factor and parents' education do play significant effects on overall achievement. This has a great impact on the study as gender, socio-economic factor and parents' education level are factors and attitudes are variables not evenly distributed among school children's population. Yet, they play subtle role in determining students' learning outcomes.

The lesson learned from this study is enormous and quite instructive. These findings have revealed some important facts. It has stressed the need for both the teacher and student to exhibit positive attitudes towards the learning exchange before meaningful and successful learning can take place.

2.2.11 Theoretical Framework

The Burrhus Frederic Skinner's Operant Conditioning Theory

This study is anchored on the concept of behaviour modification, which derives its roots from Skinner's Operant Conditioning experiment. The fundamental assumptions of the operant conditioning theory were postulated by Skinner in 1948. He is known as the father of Operant Conditioning.His work on the operant conditioning experiment was based on Thorndike's law of effect. It asserts that any behavior that has good consequences will tend to be repeated and any behavior that has bad consequences will tend to be avoided.

2.2.12 The Operant Conditioning Experiment

Skinner (1948) studied operant conditioning by conducting experiments using animals, which he placed in what he called the "Skinner Box", which was similar to Thorndike's puzzle box, as shown in the next page.

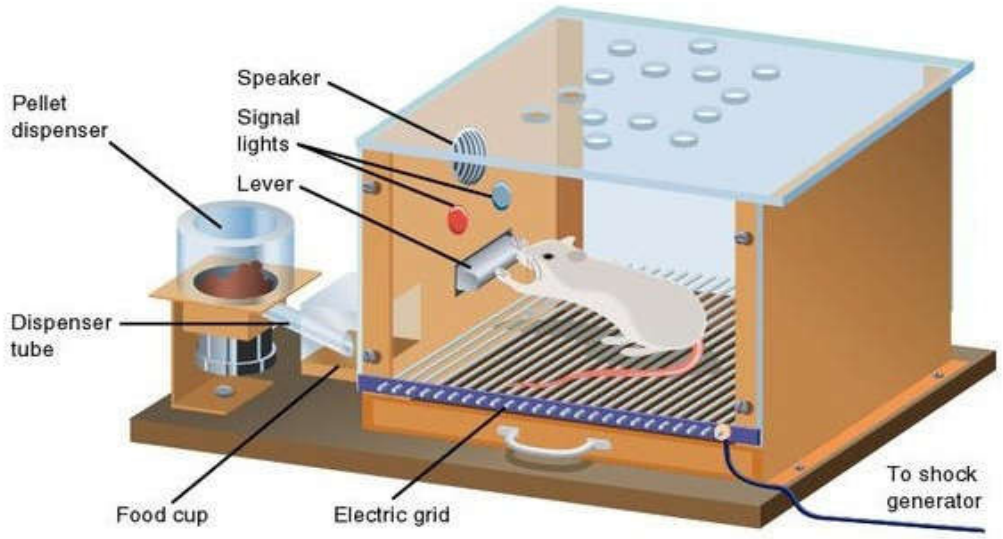

Figure 2.2.12.1 (Source: McLeod, 2007)

As illustrated above, Skinner advanced the Operant Conditioning theory by placing a hungry rat in the box. The box contained a lever in the side and, as the rat moved about the box, it would accidentally knock the lever. Immediately it did so a food pellet would drop into a container next to the lever. After repeated trials, it was revealed that the rats quickly learned to go straight to the lever after a few times of being put in the box. The pleasant experience of receiving food (positive reinforcement) if they pressed the lever elicited satisfaction that they would repeat the action again and again.

McLeod (2007) reported that Skinner identified three types of responses or operant that can follow behaviour to include

1. Neutral Operant: This refers to responses from the environment that neither increases nor decreases the probability of a behavior being repeated.

2. Reinforcers: Include responses from the environment that increase the probability of a behavior being repeated. And noted that reinforcers can be either positive or negative.
3. Punishers: These are responses from the environment that decrease the likelihood of a behavior being repeated. Punishment weakens behavior.

This spotlight is quite illuminating yet not surprising. It can be explained based on the principles of the law of effect in Thorndike's parlance and reinforcement, as propounded by Skinner. We find that the law of effect asserts that when an episode yields a desirable result, it is held firmly that the episode is bound to be repeated and if the episode results in an unpleasant experience, the tendency for a reoccurrence of the act is weakened. The function of reinforcement in the context of modifying behaviour is to either strengthen (using positive reinforcement) or weaken (using negative reinforcement) the target behaviour.

A succinct example on the significance of this theory was recapped by McLeod (2007). He hinted that positive reinforcement strengthens a behavior by providing a consequence an individual finds rewarding. Further, she noted that if your teacher gives you £5 each time you complete your homework (i.e. a reward), you are more likely to repeat this behavior in the future, thus strengthening the behavior of completing your homework.

Based on Skinner's postulations above, McLeod (2007) posited that the removal of an unpleasant reinforcer can also strengthen behavior. This is known as negative reinforcement because it is the removal of an adverse stimulus, which is 'rewarding' to the animal. Negative reinforcement strengthens behaviour because it stops or removes an

unpleasant experience. Another interesting feature of Skinner's work is that he taught the rats to avoid the electric current by turning on a light just before the electric current came on. The rats soon learned to press the lever when the light came on because they knew that this would stop the electric current being switched on.

From the foregoing, one major feature of the Operant Conditioningexperiment is the introduction of the term 'Reinforcement' which, in Thorndike's perception, was known as the Law of Effect. The major breakthrough of Skinner is his affirmation that behaviour, which is reinforced, tends to be repeated and strengthened while behaviour, which is not reinforced, tends to die out or be extinguished or get weakened.

2.2.12Criticisms and Defence of Operant Conditioning

The operant conditioning experiment has been criticised in a number of ways.for instance, Javier(2006) observed that itignores cognitive processes as it assumes that learning occurs only through reinforcement,which overlooks genetic predispositions and species-specific behavior patterns, which can interfere with learning. Another notable criticism of it is on the use of animal research. In the same vein, McLeod(2015) pinpointed that the operant conditioning studies also raise the issue of extrapolation, as some psychologists argue that we cannot generalize from studies on animals to humans as their anatomy and physiology are different from humans and they cannot think about their experiences and invoke reason, patience and memory or self-comfort.

In summary therefore, the Operant Conditioning technique is seen to be superficial in altering behaviour without touching its source. Further, it is flawed, as it fails when

problems are complex-deep-seated depressions, generalized anxiety and character disorders. It can be distasteful about the emphasis on material rewards for children and other patients.It smacks of bribery.

Notwithstanding the criticisms, the Operant Conditioning principle can be used to explain a wide variety of behaviors from the process of learning to addiction and language acquisition. It also has practical application (such as token economy), which can be applied in classrooms, prisons and psychiatric hospitals.

Behaviourist like McLeod (2015) supports the view that the major influence on human behaviour is learning from the environment. He observed that in the Skinner study, because food followed a particular behaviour, the rats learned to repeat that behavior, e.g. operant conditioning. It was viewed that the salient assertion made by Skinner and other behaviourists is that there is little difference between the learning that takes place in humans and the one in other animals. Skinner, it appears, is comfortable that research as in operant conditioning can be carried out on animals (Rats or Pigeons), as well as on humans. He proposed that the way humans learn behaviour is much the same as the way the rats learned to press a lever.

2.3 Review of Empirical Studies

2.3.1 Socioeconomic Background

In this study, students' socioeconomic background is one of the moderator variables. It is considered within the purview of how their parents' income, occupation, level of education, status of luxury and political poweraffect their attitudes towards Mathematics and Mathematics achievement. WhereasNgorosho (2011) found five key variables

(fathers' and mothers' education, house wall material, light source and the number of books for school subjects in the homes) as significant indicators of the home environment in rural eastern Tanzania, conversely, Ahawo (2009) found that in modern society, parents' influence plays a very important role in the academic life of a student. These views are quite germane and critical to this study, when taken from the context of the Nigerian situation. The impact of parents' socioeconomic background has been stressed in a number of studies, especiallyas it relates to the objectives of this study.

Udida, Ukwayi&Ogodo (2012)examined the influence of parental socioeconomic background on the academic performance of students in selected public secondary schools in Calabar Municipal Local Government Area of Cross River State, Nigeria. In the study, the multi staged stratified sampling technique was used to select 114 students from five public schools. The data they obtained was analyzed using descriptive and inferential statistical techniques. Multiple regression results revealed that parental socioeconomic background significantly influenced students' academic performance ($p<0.05$). It was further revealed that students whose parents had better jobs and higher levels of educational attainment and who were exposed to more educational and cultural resources at home tended to perform better than their counterparts without such opportunities. The study identified parental occupation as the main predictive variable influencing student's academic performance.

In a related study, Yara(2010) examined the relationship between students' socio-economic background and Mathematics achievement in some senior secondary schools in Southwest Nigeria. The descriptive survey research design was adopted with a sample

population of 1,722 Senior SecondaryII mathematics students selected from 36 schools from each of the senatorial districts in Southwestern Nigeria. The findings revealed that majority lived with their parents having the basic things needed in a house for good education. The results showed that majority recorded average academic ability in mathematics,an indication that the moderate socioeconomic background of the students, as described, exerted an average student mathematics performance.

In china for instance, Lidong, Xiaoqing& Na (2014) conducted a study on the effects of students' socioeconomic status on mathematics achievement. The result revealed that Chinese students' SES exerts a significant influence on their mathematics achievements and several important constituents of SES, such as parents' education and family income, stand out among others. The economic and social situation in China, especially the imbalanced distribution of educational resources between and within the urban and rural areas, the researchers stated, is capable of magnifying the role of SES in mathematics achievements.They attributed reasons for the result to factors, such as the values of education in traditional Chinese culture and the current important status of mathematics in modern society as well as Chinese school curriculum materials' effect on students' mathematics achievements.

2.3.2 Empirical Studies on Gender and Mathematics Achievement

Gender is the second moderator variable that received considerable attention in this study, which investigated the effects of two combined forms of behaviour modification strategies, token economy (emotional engagement) and continuous testing in Mathematics (cognitive engagement) on students' achievement and attitude towards

mathematics. Peer reviewed literature indicated that gender affects mathematics achievement in one way or the other. In some studies, male students significantly outperformed their female counterparts while in others, and in some specific topics, the female students outperformed their male counterparts in mathematics.

For instance, Anyichie&Onyedike(2012) conducted a study which investigated the effects of self-instructional learning strategy on students' achievement in solving Mathematical word problems. The research determined whether the self-instructional learning strategy has significant effects on the learning achievement of senior secondary school students. Three research questions and two null hypotheses guided the study. It utilised the non-randomized control group pre-test post-test experimental design. The sample consisted of 131 subjects with a mean age of 16.02 years from four schools chosen through simple sampling techniques. Students of the experimental group were instructed in four units of the Mathematics syllabus using self-instructional method. On the other hand, the control group was taught the same topics in Mathematics using the conventional teaching method. The Mathematics Achievement Test instrument developed and duly validated by experts was used to collect data. Data collected were analysed using mean for the research questions and Two-way Analysis of co-variance was used to test the hypotheses at the 0.05 level of significance. Major findings of the study indicated that there was a significant main effect of treatment (self-instructional learning strategy) on the student's mathematical word problem achievement. The effect of gender on mathematical word problem achievement was found insignificant. However, a significant interaction effect was observed between gender and learning strategy. Thus, males in the experimental group significantly performed better than their female counterparts. The

self-instructional learning strategy as used in the Anyichie&Onyedike's(2012) study above is viewed as closely related to the cognitive engagement in the present study since they are both forms of cognitive engagement.

Awofala&Nneji (nd) conducted a study which assessed the relative effectiveness of framing and Team Assisted Individualized (TAI) instructional strategies on students' achievement in mathematics. The subjects comprised 350 Senior Secondary II general mathematics students (183 boys and 167 girls) of varied style of categorization (140 field independent and 210 field dependent). Stratified random sampling was used to select intact classes from six equivalent coeducational secondary schools that are distantly located from one another within the city of Ibadan, Nigeria. The Mathematics Achievement Test was used for data collection. Three null hypotheses guided the study. The Mathematics Achievement Test (MAT) was used to collect data for both the pre and post test. The results indicated a significant main effect of treatment on achievement in mathematics and no significant effects of the treatments due to style of categorization and gender on students' achievement in mathematics. Also, no significant interaction effects were found. The findings revealed that TAI and framing strategies are more effective in promoting students' achievement in mathematics. Thus, these teaching strategies could serve as viable alternatives to the conventional method of teaching mathematics.

Stallworth (2009) conducted a study to examine whether gender-based mathematics instruction does have a positive impact on the achievement levels of males and females. The study was aimed at providing insight into differential approaches to teaching males and females separately and the effects the separate instruction has on mathematics achievement, so as to close the achievement gap. The independent variables in the study

were instructional leadership, teacher certification level and teacher content knowledge, teacher knowledge of primary gender learning styles, teacher expectations, gender-based instruction, teacher demographics and student demographics. Stallworth reported school enrollment for K-5 as approximately 550 students. The dependent variable was student achievement in mathematics. Anonymous surveys were completed by teachers and students. In addition, student demographic data were analyzed. The study was conducted in a Title I elementary school in Atlanta, Georgia among third, fourth and fifth grade students and teachers. The 2007 Georgia Criterion Reference Competency Test (GCRCT) data were used as pretest data prior to teachers teaching students in a gender-based setting. Eleven teachers were given professional development in male/female primary learning styles. Generally, the results of the study indicated that there was a statistically significant relationship between a teacher's content knowledge, years of experience and his or her expectations relative to student achievement in mathematics. Further, Stallworth (2009) in the regression analysis found that the most impacting variables on student achievement in gender-based classrooms were teacher expectancy, teaching experience and instructional leadership. In the study, the variables found to be the most significant in relation to student achievement in mathematics were: gender-based instruction, teacher knowledge of student learning styles and discipline.

Using an ex-post facto design Adedeji (2007) examined the impact of motivation as an independent variable on secondary schools student achievement in Mathematics. The target population for the study comprised all Senior Secondary II (SS2) students in Ibadan North-West and Ibadan South West Local Government areas of Oyo State of Nigeria. Using motivation for academic preference scale ($\alpha = 0.82$) as a measuring

instrument and Achievement Test in Mathematics (ATM), two hypotheses were tested at the 0.05 level of significance. The data obtained was analysed using t-test statistics and analysis of variance (ANOVA). A sample of 450 students was randomly drawn from selected secondary schools. The variables which Adedeji considered in the study includedthe extent of motivation at two levels, that is, highly motivated and less motivated students. The instruments used were an Academic Performance Questionnaire (MAPQ); a modified form of Motivation for Occupational Preference Scale (MOPS) by Bakare (1977) and the Motivation for Academic Study Scale by Osiki (2001). Results showed that gender difference were significant when the impact of motivation on academic achievement was compared in male and female students. Also, other results indicated a significant difference when the extent of motivation was taken as a variable of interest on academic achievement in mathematics based on the degree of their motivation.

Salman, Esere, Omotosho, Abdullahi&Oniyangi (2011) in a study to explore poor academic performance of students in Mathematics are unanimous in the fact that poor performance in Mathematics across schools has become pervasive. They have noted that the trend calls for a concerted effort for remediation. Their study set out to determine the efficacy of goal-setting and cognitive restructuring, which is equally similar to the cognitive engagement in the present study in improving the academic performance of secondary school students in mathematics. The design was a pre-test, post-test control group quasi-experimental design. The sample consisted of 120 students aged 15 to 18 years purposively sampled from a randomly selected co-educational public secondary school in the Ilorin metropolis, in Kwara state Nigeria. Participants were randomly

assigned to three experimental groups: Goal-setting: Cognitive Restructuring (treatment groups) and Control Programme (placebo). In the study, a validated Mathematics Ability Test (MAT) was administered to the three groups before and after the experimental programme, which was packaged into 8 weekly workshop sessions. Analysis of covariance ANCOVA with the Scheffe post-hoc measure was employed for the data analysis. When the treatment group was compared with the control group in an attempt to treat analysis, there were significant differences in the Mathematics performance ability of the three groups. Those in the treatment groups reported improved Mathematics performance ability than their counterparts in the control group. They observed that lack of behavioural effects on the control group could be linked to the differential quality of the delivery of intervention. The treatment gain was, however, not mediated by participants' gender. Both male and female students benefited maximally from the intervention programmes. They, therefore, reported that the result is an indication that students' Mathematical ability can be improved using psychological strategies and recommended that these should be factored in secondary school Mathematics curriculum.

Iji,Ogbole&Uka (2014) viewed that reducing poor mathematics achievement among the students was necessary. They submitted that the adoption of appropriate methods of teaching appears to be more rewarding. In their study, improvised instructional materials were used to ascertain students' geometry achievement at Upper Basic Education I. They formulated and tested two research questions asked with associated hypotheses tested at the 0.05 level of significance. Their study adopted a quasi-experimental design of non randomised pre-test post-test control group type. The research was carried out in the Markurdi metropolis with a population of 1680 UBE students out of which 139 were

sampled from four out of 22 schools. The Geometry Achievement Test was used. The analysis of covariance ANCOVA was used in analysing the data obtained from the study. The results revealed that both male and female students in the experimental group equally improved upon their geometry achievement over the control group.

Ajai&Imoko (2015) undertook to assess gender differences in mathematics achievement and retention by using Problem-Based Learning (PBL). The design of the study was pre–posttest quasi-experimental. Four hundred and twenty eight senior secondary one (SS I) students using multistage sampling from ten grant-aided and government schools were involved in the study. Two hundred and sixty one male students and one hundred and sixty seven female students were taught algebra using PBL method of instruction. The Algebra Achievement Test (AAT) constructed by the researchers was the main instrument used for data collection. Two hypotheses were raised for the study and tested using t-test at the .05 level of significance. The study revealed that male and female students taught algebra using the PBL did not significantly differ in achievement and retention scores, thereby revealing that male and female students are capable of competing and collaborating in mathematics. In addition, the finding showed that performance is a function of orientation, not gender. The studies recommend the use of PBL by mathematics teachers to overcome the male image of mathematics and enhance students' (male and female) achievement and retention.

2.4 Summary and Uniqueness of the Study

The operant conditioning theory was reviewed in view of its unique relationship with behaviour modification process. The spotlight has helped to enrich knowledge on the

central role reinforcement plays in the learning process.Evidently, the poor learning outcome in Mathematics across Nigerian schools at the Senior School certificate examinations over the years has become a pervasive phenomenon and a trend that has stalled the development of science, technology and the general growth of Nigeria. In addition, gender and students' socioeconomic background were also exposed as predictors of success in Mathematics.

One of the strengths of this study is to have affirmed the positive role of reinforcement and, by extension, motivation in enhancing effective classroom delivery. It has also confirmed the efficacy of behaviour modification,asexplained somewherein the reviewed literature, to be very effective in eliciting the desirable attitude in the classroom all with a view to bring about the desired change. By this finding, too, attitude has been implicated as a strong determinant of achievement.Further, students' socioeconomic background and gender are moderator variables in this study. The review also explored a limelight on the effects played by variables in shaping learners' attitude and achievement in Mathematics.

Findings in the review have exposed very useful facts. First, that it is possible to reinforce an organism so as to elicit the desired behaviour especially in the classroom setting, as revealed through the Token Economy programme. The findings further revealed that there is general apathy towards mathematics as a subject taught and learned across the world and that the issue of poor performance in Mathematics is a global challenge. But just as there are numerous studies resonating poor performance in Mathematics across Nigerian schools, sadly enough there is a paucity of empirical studies on how to stem the tide in order to improve performance. This is necessary especially in order to further Nigeria's dream on advancement in science and technology. To justify the imperatives of

this study, therefore, the need for research with particular focus on the Nigerian schools becomes inevitable. It is therefore hoped that the results of this study on how to handle the poor attitude towards Mathematics and on how to motivate learners towards the study of mathematics through cognitive and behavioural engagement with a view to enhance performance as revealed will be sustained.

2.4.1 Uniqueness of the Study

This study is unique in a number of ways. It has actually filled the gap orchestrated by the dearth in appropriate remedies to students' apathy towards the subject of Mathematics. Findings revealed scanty literature about the use of behaviour modification as a strategy for shaping desired attitude for learning Mathematics in the entire country. This experiment on the effect of token economy as a behaviour modification strategy is distinctbeing the first of its kindso far used in the three federal unity colleges in Kaduna state, as no literature was found to prove otherwise. Most importantly, this study has shownthe effectiveness of the independent variables,token economy and continuous testing in mathematics (emotional and cognitive engagements) on dependent variables (achievement in and attitude towards Mathematics).

The researcher,therefore,suggests that if the behaviour modification strategies, as adapted in this study, are used to teach mathematics, students could be empowered to take charge of their own learning in a highly meaningful manner. It is equally viewed that the measure will increase their store of mathematical knowledge.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the research design; the dependent, independent and moderator variables, the population of the study, and the sample and sampling technique used. This chapter also explains the treatment, the instruments (Student Mathematics Attitude Questionnaire [SMAQ] and Student Mathematics Achievement Test [SMAT]) and treatment procedures. It can also explain the procedure for data validation and how psychometric properties were established for the instruments.

3.2 Research Design

The research design for this study is a quasi-experimental pre-test post-test control group design. The quasi-experimental design, according to Mathew & Carole (2009), is such that subjects are measured pre-test (to set the base line for students), subject to the manipulation of the independent variables and measured again a post-test after the treatment. Since students were tested prior to the treatment before being exposed to emotional and cognitive engagement for eight weeks before finally taking the post tests, this description aptly fits the antecedents of this study.

This study is a 3x3x2 factorial experimental design. The first 3 in the factorial design represents the three treatments in the study. The treatments are

1. Token economy (emotional engagement)

2. Token economy combined with continuous testing in Mathematics (emotional and cognitive engagement) and

3. Control group (the traditional teaching approach)as shown in table Table 3.1.1below.

Table 3.1.1 the Factorial Matrix Table Design for the study

Treatments	Socioeconomic Background	Gender	
		Male	Female
TI	H		
	M		
	L		
T2	H		
	M		
	L		
T3	H		
	M		
	L		

Where

H= High level, M= Medium level and L= Low level.

T1= Treatment 1 (Token economy), T2= Treatment 2 (Token economy with continuous testing in Mathematics) and T3 = the Control group (The traditional teaching) approach.

3.2.1 Description of Treatments

Schedules of Reinforcement

This study adopted two forms of (Treatments) reinforcement schedules,classroom token reinforcement and the Assembly ground Token Rewards for both the emotional and cognitive treatments.

Reinforcement in Emotional Engagement

In the classroom, the secondary reinforcement was deployed wherein the research associates (teachers) were supplied with a record sheet to take statistics of students' desirable behaviour in the classroom. Next is the stimulus stickers with pre printed inscriptions such as 'Great Job', 'Excellent', 'Well done', 'Fantastic', etc. which were used to reinforce students' desirable classroom behaviours. The teachers were also

supplied with primary reinforcers like writing materials, assorted sweets and biscuits with a view to reinforce their desirable classroom behaviour. From the onset, students have been sensitised that they would be rewarded when they keep up-to-date notes, maintain the habit of prompt completion of class, homework and tests, maintain absolute silence during lessons and avoid out-of-seat movement during lesson as well as other undesirable behaviours. This reinforcement schedule was also followed up with another one at the assembly ground after every two weeks. This was done using records of students who ranked best in exhibiting the desirable classroom behaviours over the period duly collated and used to reward them accordingly.

Reinforcement in the Emotional and Cognitive Engagement

In the second experimental class, the students were exposed to both emotional and cognitive treatments. The emotional reinforcement was as described above. While in the cognitive treatment, students were exposed to continuous testing after every two weeks of teaching on topics taught within the period in question in Mathematics. Records of students' classroom token rewards on their desirable classroom behaviours over the period were collated and added to their performance in the Mathematics continuous testing. The aggregate summary of performance for respondents for both of emotional and cognitive components was then collated and used to reward them on the assembly ground every two weeks.

Description of Token Rewards

Two categories of rewards were utilised for this study to reward deserving students. The award ceremonies were conducted at the assembly ground on Monday after every two

weeks. The token prizes were three each tagged, Award of Excellence and Award of Achievement.

The Award of Excellence was designed to maximize and consolidate Mathematics achievement for high achievers, while the Achievement Award was used to improve performance low achievers on the assembly ground. The award of excellence comprised of three coloured shoulder bands with graded inscriptions. Deserving high achievers were rewarded with token tangibles in form of assorted biscuits and sweets in addition to the shoulder bands. The best high achiever was awarded with token tangibles in addition to lemon coloured shoulder band with the inscription 1st Flawless Mathematician. The second high achiever was awarded a wine coloured shoulder band with the inscription 2nd Flawless Mathematician. The third high achiever was awarded a maroon coloured shoulder band with the inscription 3nd Flawless Mathematician.

The Achievement award also presented to winners at the assembly same time was designed to assist in increasing achievement for low achievers who must have demonstrated appreciable progress in Mathematics achievement since the commencement of treatment. The best improved low achiever was rewarded with a coffee coloured wristband with the inscription 1st Improved Mathematician. The second improved low achiever was rewarded with a coffee coloured wrist band with the inscription 2nd Improved Mathematician, while the third improved low achiever was rewarded with coffee coloured wrist band with the inscription 3rd Improved Mathematician. Pictorial images and details of some winners of the Awards of Excellence and Achievement are presented in the Appendix.

3.3 Population of the Study

Table 3.3.2.1 below shows a graphical illustration of the students' population distribution across the schools used in this study.

Table 3.3.2.1 Distribution of subjects' population by School

School	Population		Totals
	Male	Female	
Federal Government College Kaduna	187	154	341
Federal Science and Technical College Kafanchan	67	40	107
Federal Government Girls' College Zaria	Nil	180	180
Totals	254	374	628

3.3.1. Population of the Study

From the Table above, the population for this study comprises a total of 628 Upper Basic II students; with 374 female students and 254 male students in the three Federal Unity Colleges in Kaduna state. The schools include Federal Government College Kaduna, Federal Science and Technical College Kafanchan and Federal Government Girls' College Zaria.

3.3.2 Sample Size

As shown in the Table below, a total of 67 students were sampled from Federal Government College Kaduna while 58 were sampled from Federal Science and Technical College, Kafanchan and 70 from Federal Government College Zaria, respectively. In all, a total of 81 male and 114 female students amounting to a grand total of 195 were utilised in this study. See the sample distribution Table below.

Table 3.3.2.2 Distribution of Samples by School and Gender

School	Sample		Total Sampled
	Male	Female	
Federal Government College Kaduna	34	33	67
Federal Science and Technical College Kafanchan	47	11	58
Federal Government Girls' College Zaria	Nil	70	70
Totals	81	114	195

3.3.3 Sampling Technique

Random sampling technique was adopted in drawing out the classes for this study. In it, two experimental classes each were drawn from the Federal Unity Colleges using the hat and draw method. From a total of 341, 107 and 180 students in each of the schools, 67, 58 and 70, as shown in Table 3.3.2.2 above.

3.4 Data Collection Instruments

Two main instruments were utilised in this study:

1. Student Mathematics Attitude Questionnaire (SMAQ) and the
2. Students' Mathematics Achievement Test (SMAT).

The Students' Mathematics Attitude Questionnaire (SMAQ)

The Students' Mathematics Attitude Questionnaire (SMAQ) is a modified form of Fennema-Sherman Mathematics Attitude Scales originally developed in 1976. The instrument has been one of the most popular instruments used in research to examine students' Mathematics attitude for decades. Two main amendments were made to the original scale. First, the five point Likert scale response format was reduced to four points to remove the midpoint response option. It was viewed that such response puts the

respondent in a state of indecision, which statistical value may limit the validity of the result in the end. In addition, the response format was changed from the "Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree" style to "Never like Me, Not often Like Me, Usually Like Me and Absolutely Like Me". The researcher perceived that the "like me" format is more suitable in assessing respondents' personal perception of the items seeking to examine their evaluation of the questions.

In all, the SMAQ scale, in addition to questions on students' Socioeconomic Background, consisted of 52 positive and negatively framed items yielding a maximum of 210 points. The main SMAQ scale comprised of a group of six sub scales of Mathematics attitude,namely:

1. Self-confidence in Mathematics scale,
2. Mathematics value scale,
3. Mathematics enjoyment scale,
4. Mathematics motivation scale,
5. Mathematics anxiety scale and
6. Parent/ Teacher expectation scale.

The Students' Mathematics Achievement Test (SMAT).

The Students' Mathematics Achievement Test (SMAT) was developed by Mathematics teachers from the selected schools. It contained 50 objective items covering the scope of syllabus of the Upper Basic II students for the period under study. Details of topics covered are illustrated in the Table of specification below.

3.5 Validation of the Instruments

Two forms of validity were established for the instruments. They include content and face validity.

3.5.1 Content Validity

In a bid to guarantee content validity for the statements and test items of the Students' Mathematics Attitude Questionnaire (SMAQ) and Students' Mathematics Achievement Test, the researcher

I. Drew up questions from the Mathematics scheme of work for first and second term of the 2014/2015 academic session.
II. Used Junior Secondary School (II) Mathematics teachers of Federal Government College Kaduna and Andal Science Academy Kano to draw up the questions.

Table 3.5.1.1 Students' Mathematics Achievement Test (SMAT) Item Allocation and Table of Specification

Topic	Cognitive Domain Level				Total
	Knowledge	Comprehension	Application	Analysis	
Equation and approximation (16%)	0	2	6	0	8
Geometry and Mensuration (26%)	2	4	6	1	13
Number and numeration (44%)	5	7	6	4	22
Proportion (6%)	0	1	2	0	3
Statistics (6%)	1	2	1	0	4
Total	8	16	21	5	50

3.5.2 Face Validity

The following steps were taken to guarantee face validity for the instruments. The items were subjected to scrutiny of

1. The researcher's supervisor, a Professor of Educational Psychology of Bayero University Kano, Nigeria.
2. A test expert and Ph.D. holder in Education Evaluation in National Open University of Nigeria (NOUN).
3. A holder of a Master of Science degree in Mathematics and a teacher in Federal Government Girls' College, Zaria. These crops of professionals were used to establish the face and content validity of the instruments.

3.5.1 Validity of the Instruments

Having ascertained the face and content validity of the instruments; Students' Mathematics Attitude Questionnaire (SMAQ) and the Students' Mathematics Achievement Test (SMAT) with the test experts, a further attempt was made to ascertain the validity in a pilot study. For the pilot study, both instruments were administered to 38 Junior Secondary School [II] students of Federal Government Girls' College,Kazaure in JigawaState on November 7, 2014, the school is situated outside Kaduna state where the main study was carried out.

3.5.2 Reliability of the Instruments

The data emanating from the pilot study was also used to establish the reliability coefficients of the instruments as modified. As reported earlier, the Students' Mathematics Attitude Questionnaire (SMAQ) adopted for this study is a modified form of the Fennema and Sherman's Mathematics Attitude Scale. The Students' Mathematics Attitude Questionnaire (SMAQ) revealed a Cronbach's Alpha of .711 in the pilot test aimed to validate the instruments. WhereasFennema& Sherman (1976) reported initial

internal reliability range of .83 to .96. Also, Mulhern& Rae in Albert, Mustapa& Michael(2007) reported an internal reliability range of .83 to .93.

In addition and still from the pilot study, the six subscales of SMAQ yielded Cronbach's Alpha internal consistency reliability coefficients as follows: Self confidence in Mathematics subscale = .668, Mathematics value subscale = .760, Mathematics enjoyment subscale = .591, Mathematics motivation subscale = .663, Mathematics anxiety subscale = .643 and Parent/Teacher expectation subscale = .642

Also, analysed statistics from the pilot study revealed a Kuder Richardson's reliability coefficient KR-20 = .7125 for the Students' Mathematics Achievement Test (SMAQ). For these reasons, the instrumentsSMAQ and SMATwere considered suitable for this study.

3.6 Procedure for Data Collection

Prior to the commencement of treatment, the researcher visited Federal Government Girls' College, Zaria and FSTC, Kafanchan to meet with the school authorities for the purpose of establishing rapport and introducing the research. The visit was used to explain the purpose, objectives and then the gains the schools stood to gain in the course of the study. The same opportunity was used to meet and select teachers whose classes were to be used for the experiment. Another visit was made to meet and educate the teachers on how to administer the token economy treatments, as well as the pre-test of both instruments. As for FGC, Kaduna, this was done at the researcher's convenience due to the school's proximity to him.

Thereafter, the materials used for token reinforcement were then handed over to the teachers with instructions on how to use them. The researcher would also go to hand over the token rewards to be awarded to students on the assembly every fortnight. This continued until the end of the study when the post-test was also administered.

3.7. Procedure for Data Analysis

Data obtained from the study were analysed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, mean and standard deviation were used to analyse the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses for the main effect and interaction effect of the independent variables on the dependent variables, respectively. Students' pre-test scores in the Mathematics Achievement Test as well as theStudents' Attitude Questionnaire(SMAQ)were used as covariates to control for differences in the entry level of students for the scales under investigation. In addition, Scheffe's Post-hoc analysis was done on the Attitude (SMAQ) and Achievement (SMAT) tests to gain in-depth insight and to allow multiple pair wise comparison of the variables. This also revealed the intensity and direction of interaction between treatment and the dependent variables.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This study investigated the effects of two forms of behaviour modification strategies, token economy and token economy with continuous testing in mathematics on students' achievement and attitude towards mathematics. To do this, six (6) research questions and fourteen (14) research hypotheses were formulated and tested in all. The results of findings are hereby presented in this chapter.

4.2 **Data Presentation**

Below is the summary of Analysis of Covariance (ANCOVA) showing both the main and interaction effects of treatment on students' treatment and achievement in Mathematics

Table 4.2.1 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment, socioeconomic background and gender.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment	208.835	2	104.417	7.403	.001*	.076
Socioeconomic	15.646	2	7.823	.555	.575ns	.006
Gender	8.269	1	8.269	.586	.445ns	.003
Treatment*	48.517	4	12.129	.860	.489ns	.019
Socioeconomic	69.886	1	69.886	4.955	.027*	.027
Treatment* Gender	31.666	2	15.833	1.123	.328ns	.012
Socioeconomic* Gender						
Treatment*	34.096	1	34.096	2.417	.122ns	.013
Socioeconomic* Gender						
	2538.833	180	14.105			
Error	58739.000	195				
Total	4338.749	194				
Corrected Total						

a R Squared=.415 (adjusted R Squared= .369)

* = Significant, ns = Not Significant at p<0.05

Below is the summary of Scheffe's Post Hoc pair wise comparison showing the effects of treatment on students' achievement in Mathematics.

Table 4.2.2: Scheffe's Post Hoc pair wise comparison of students' achievement in mathematics by treatment.

Treatment (I)	Treatment (J)	Mean Difference (I-J)	Standard Error	P
Token Economy,	Token economy with Continuous Testing.	-2.155*	.797	.028
	Control.	1.835	.789	.070
Token Economy With Continuous Testing	Token economy.	2.155*	.797	.028
	Control.	3.990*	.760	.000
Control.	Token economy.	-1.835	.789	.070
	Token economy with continuous testing.	-3.990	.760	.000

*= mean difference is significant at p<0.05

Below is the summary of Analysis of Covariance (ANCOVA) showing both the main and interaction effects of treatment on attitude towards Mathematics.

Table 4.2.3 Analysis of Covariance (ANCOVA) of students' attitude towards mathematics by treatment, socioeconomic background and gender.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271
Intercept	48255.095	1	48255.095	363.420	.000	.669
Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Treatment	964.675	2	482.337	3.633	.028*	.039
Socioeconomic	233.240	2	116.620	.878	.417ns	.010
Gender	2.815	1	2.815	.021	.884ns	.000
Treatment*	634.374	4	158.594	1.194	.315ns	.026
Socioeconomic	102.876	1	102.876	.775	.380ns	.004
Treatment* Gender	338.953	2	169.477	1.276	.282ns	.014
Socioeconomic* Gender	.260	1	.260	.002	.965ns	.000
Treatment* Socioeconomic* Gender	23900.501	180	132.781			
	3468590.000	195				
Error	32787.662	194				
Total						
Corrected Total						

a R squared=.271 (adjusted R squared= .214)

* = Significant, ns = Not significant at p<0.05

Overleaf, is the summary of Scheffe's Post Hoc pair wise comparison showing the effects of treatment on students' attitude towards Mathematics.

Table 4.2.4: Scheffe's Post Hoc pair wise comparison of students' attitude towards Mathematics by treatment.

Treatment (I)	Treatment (J)	Mean Difference (I-J)	Standard Error	P
Token Economy,	Token Economy with Continuous Testing.	11.437*	2.172	.000
	Control.	2.558	2.150	.494
Token Economy With Continuous Testing	Token Economy.	-11.437*	2.172	.000
	Control.	-8.879*	2.069	.000
Control.	Token Economy.	-2.558	2.150	.494
	Token Economy with Continuous Testing.	8.879*	2.069	.000

*= mean difference is significant at p<0.05

4.3 Data Analysis

The data which emanated from this study were analysed as presented below.

4.3.1 Answer to Research Questions

Research Question 1: To what extent do the behaviour modification strategies (token economy and token economy with continuous testing) influence students' achievement in mathematics?

Table 4.3.1: Description of students' achievement in mathematics by treatment

Treatment	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Token Economy	16.41	4.550	.597	16.62	4.254	.559	0.21
Token Economy With Continuous Testing	17.84	5.632	.688	18.78	5.431	.661	0.94
Control	15.53	3.863	.462	14.79	3.464	.414	-0.74

Table 4.1 and figure 4.1 revealed that students in the token economy group had a mean pretest score of 16.41 and posttest score of 16.62 while those in token economy with continuous testing had a mean pretest score of 17.84 and a mean post test score of 18.78. Students under the conventional strategy (control group) also had a mean pretest score of 15.53 and mean post test score of 14.79. Therefore, it was held that students who were exposed to the token economy with continuous testing treatment manifested the highest positive achievement gain in mathematics after exposure to the treatment.

Research Question 2: To what extent do the behaviour modification strategies (token economy and token economy with continuous testing) influence students' attitude toward mathematics?

Table 4.3.2: Description of students' attitude towards mathematics by treatment.

Treatment	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Token Economy	137.59	11.030	1.448	139.31	10.795	1.417	0.235
Token Economy With Continuous Testing	108.82	27.339	3.340	126.15	11.740	1.434	15.559
Control	132.94	14.862	1.776	135.03	13.411	1.603	1.451

Table 4.2 and figure 4.2 Show that students in the token economy group had a mean pretest score of 139.31 and a posttest score of 137.59 while those in token economy with continuous testing had a mean pretest score of 108.82 and a mean post test score of 126.15.Students under the conventional strategy (control group) also had a mean pretest score of 132.94 and a mean post test score of 135.03. Therefore, students under the token economy with continuous testing had the highest post test post test score and also had the

highest mean gain after exposure to the treatment. This is followed by students that were exposed to token economy while those under the control group had the least improvement in mathematics achievement.

Research Question 3: How does student socio economic background influence his/her achievement in mathematics?

Table 4.3.3: Description of students' achievement in mathematics by socio economic background.

Socioeconomic Background	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Low	17.10	5.325	.574	17.45	4.762	.513	0.35
Medium	15.70	4.244	.504	15.90	4.514	.536	0.20
High	17.05	4.441	.721	16.50	4.903	.795	-0.55

Table 4.3.3 revealed that students of low socioeconomic background had a pretest mean score of 17.10 and a posttest mean score of 17.45, while those in medium socioeconomic background group had a mean pretest score of 15.70 and a mean post test score of 15.90.Students under the high socioeconomic background group also had a mean pretest score of 17.05 and a mean post test score of 16.50. Consequently, students with low socioeconomic background recorded the highest mean gain of 0.35 followed by medium, but students of the high socioeconomic background had a negative mean gain of -0.55.

Research Question 4: How does students' socioeconomic background influence their attitude towards mathematics?

Table 4.3.4: Description of students' attitude towards mathematics by socioeconomic background.

Socioeconomic Background	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Low	129.26	22.591	2.436	133.4	11.893	1.282	4.18
Medium	125.56	20.168	2.393	131.85	13.245	1.572	6.29
High	122.26	29.233	4.742	132.82	15.055	2.442	10.56

Table 4.3.4 showed that students of low socioeconomic background had a pretest mean score of 129.26 and a posttest mean score of 133.4 while those in medium socioeconomic background group had a pretest mean score of 125.56 and a post test mean score of 131.85.Students under the high socioeconomic background with group also had a mean pretest score of 122.26 and a mean post test score of 132.82. Accordingly, students with high socioeconomic background recorded the highest mean gain of 10.56 followed by medium and low socioeconomic background after exposure to treatment.

Research Question 5: To what extent do gender influence students' achievement in mathematics?

Table 4.3.5: Description of students' achievement in mathematics by gender.

Gender	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Male	17.41	5.101	.567	17.83	5.403	.600	0.42
Female	16.00	4.523	.424	15.90	4.022	.377	-0.1

Table 4.3.5 pointed out that male subject had a mean pretest score of 17.41and a posttest score of 17.83 while the female subjects had a mean pretest score of 16.00 and a mean

post test score of 15.90. It showed that female students recorded a negative mean gain while the boys had a positive mean gain. Therefore, it was held that male students had better achievement in mathematics following their exposure to the treatments.

Research question 6: To what extent does gender influence students' attitude towards mathematics?

Table 4.3.6: Description of students' attitude towards mathematics by gender.

Gender	Pretest			Posttest			Mean Gain
	Mean	Sd	Std Error	Mean	Sd	Std Error	
Male	127.11	23.977	2.664	132.70	13.182	1.465	5.59
Female	126.15	22.818	2.137	132.76	12.928	1.211	6.61

Table 4.3.6 revealed that male subjects obtained a mean pretest score of 127.11 and a posttest score of 132.70 while the female subjects had a mean pretest score of 126.15 and a mean post test score of 132.76. It was affirmed that female students recorded a slightly higher mean gain than the boys across the groups.

4.3.2 Hypothesis Testing

Hypothesis 1: There is no significant main effect of treatment (Token economy and Token Economy with Continuous Testing in Mathematics) on students' achievement in Mathematics.

Table 4.3.2.1 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment	208.835	2	104.417	7.403	.001*	.076
Error	2538.833	180	14.105		.	.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table 4.3.2.1 shows ANCOVA results of the effects of treatment on students' achievement in mathematics. It is shown that the F- value of 7.403 with P value of .001 was significant since p value was less than 0.05. Therefore, there is a significant effect of treatments (token economy and token economy with continuous testing) on students' achievement in mathematics ($f(2,180) = 7.403$, $P<0.05$). Consequently, hypothesis 1 was rejected. The partial eta squared value of .076 depicts that treatments contributed 7.6% of the variance observed in students' achievement in mathematics.

Hypothesis 2: There is no significant main effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) on students' attitude toward mathematics.

Table 4.3.2.2. Analysis of covariance (ANCOVA) of attitude towards mathematics by treatment

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271
Intercept	48255.095	1	48255.095	363.420	.000	.669
Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Treatment	964.675	2	482.337	3.633	.028*	.039
Error	23900.501	180	132.781			
Total	3468590.000	195				
Corrected Total	32787.662	194				

a R squared=.271 (adjusted R squared= .214)
* = Significant, ns = Not significant at p<0.05

Table 4.9 shows ANCOVA results of the main effects of treatment on students' achievement in mathematics. It is shown that the F-value of 3.633 with p value of .028 was significant since p value was less than 0.05. Therefore, there is a significant main effect of treatments (token economy and token economy with continuous testing) on students' achievement in mathematics (f (2,180) = 3.633, P<0.05). Consequently, Hypothesis 2 was rejected. The partial eta squared value of .039 means that treatments contributed 3.9 % of the variance observed in students' attitude towards mathematics.

4.3.2.3 shows the significant differences of mathematics attitude mean for the treatment groups. It is revealed that a significant difference was noticed between students exposed x difference= 11.437, P<0.05).Also, there exists a significant mean difference between x difference = 8.879, P<0.05). But between token economy and control groups, the

x difference = 2.558, P<0.05).

Hypothesis 3: There is no significant main effect of students' socioeconomic background on their achievement in mathematics.

Table 4.3.2.3 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Socioeconomic	15.646	2	7.823	.555	..575ns	.006
Error	2538.833	180	14.105		.	.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table 4.3.2.3 shows ANCOVA results of main the effects of treatment on students' socioeconomic background. It is revealed that the F-value of .555 with p value of .575 was not significant since p value was greater than 0.05. Therefore, it was taken that there is no significant effect of students' socioeconomic background on their achievement in mathematics (f (2,180) = .555, P>0.05). Consequently, hypothesis 3 was not rejected. The partial eta squared value of .006 depicts that socioeconomic background contributed 0.6% of the variance observed in students' achievement in mathematics.

Hypothesis 4: There is no significant main effect of students' socio economic background on their attitude towards mathematics.

Table 4.3.2.4. Analysis of covariance (ANCOVA) of attitude towards mathematics by treatment

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271
Intercept	48255.095	1	48255.095	363.420	.000	.669
Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Socioeconomic	233.240	2	11.620	.878	.417ns	.010
Error	23900.501	180	132.781			
Total	3468590.000	195				
Corrected Total	32787.662	194				

a R squared=.271 (adjusted R squared= .214)
* = Significant, ns = Not significant at p<0.05

Table 4.3.2.4 indicates ANCOVA results of the main effects of treatment on students' socioeconomic background. It is revealed that the F-value of .878 with p value of .417 was not significant since P value was greater than 0.05. Therefore, it was decided that there is no significant main effect of students' socioeconomic background on attitude towards mathematics (f (2,180) = .417, P<0.05). Consequently, Hypothesis 4 was accepted. The partial eta squared value of .010 depicts that treatments contributed 1.0 % of the variance observed in students' attitude towards mathematics.

Hypothesis 5: There is no significant main effect of gender on student achievement in mathematics.

Table 4.3.2.5.Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Gender	8.269	1	8.269	.586	.445ns	.003
Error	2538.833	180	14.105		.	.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
ns=> notsignificant, at p<0.05

Table 4.3.2.5.shows ANCOVA results of the main effects of treatment on students' gender. It is revealed that the F-value of .586 with p value of .445 was not significant since P value was greater than 0.05. Therefore, it was taken that there is no significant effect of treatment on students' gender (f (1,180) = .445, p>0.05). Consequently, Hypothesis 5 was accepted. The partial eta squared value of .003 means that gender contributed 0.3 % of the variance observed in students' achievement in mathematics.

Hypothesis 6: There is no significant effect of gender on students' attitude towards mathematics.

Table Table 4.3.2.6 Analysis of covariance (ANCOVA) of students' attitude towards mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Gender	2.815	1	2.815	.021	.884ns	.000
Error	2538.833	180	14.105		.	.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table Table 4.3.2.6 shows the ANCOVA results of the main effects of treatment on students' gender. It is revealed that the F-value of .021 with p value of .884 was not significant since p value was greater than 0.05. Therefore, it was taken that there is no significant effect of treatment on students' gender (f (1,180) = .021, p>0.05). Consequently, Hypothesis 6 was not rejected. The partial eta squared value of .000 depicts that gender has no contribution to variance observed in attitude of students to mathematics.

Hypothesis 7: There is no significant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) and students' socioeconomic background on their achievement in mathematics.

Table Table 4.3.2.7 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta

						Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment* Socioeconomic	48.517	4	12.129	..860	.489ns .	.019 .
Error	2538.833	180	14.105			
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table 4.3.2.7 shows the ANCOVA results of interactive effect of treatment and socioeconomic background on students' achievement in mathematics. It is revealed that the F- value of .860 with P value of .489 was not significant since P value was greater than 0.05. Therefore, this implies that there is no significant interaction effect of treatment and socioeconomic background on students' achievement in mathematics (f (4,180) = .860, p>0.05). Consequently, Hypothesis 7 was accepted. The partial eta squared value of .019 depicts that interaction of treatments and socioeconomic background contributed 1.9 % of the variance observed in students' achievement in mathematics. It is taken that the treatments are not sensitive to gender when using them to improve achievement in mathematics.

Hypothesis 8: There is no significant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) and students' socioeconomic background on their attitude towards mathematics.

Table 4.3.2.8 Analysis of covariance (ANCOVA) of students' attitude towards mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment* Socioeconomic	634.374	4	158.594	1.194	.315ns .	.026 .
Error	2538.833	180	14.105			
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table 4.3.2.8 shows the ANCOVA results of interactive effects of treatment and students' socioeconomic background on their attitude to mathematics. It is revealed that the f- value of 1.194 with p value of .315 was not significant since P value was greater than 0.05. Therefore, it was taken that there is no significant interaction effect of treatment and students' socioeconomic background (f (4,180) = 1.194, p>0.05). Consequently, Hypothesis 8 was not rejected. The partial eta squared value of .026 depicts that interaction of treatment and socioeconomic background contributed 2.6 % of the variance observed in their attitude towards mathematics.

Hypothesis 9: There is nosignificant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) and gender on students'achievement inmathematics.

Table 4.3.2.9 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	**Type III Sum Of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**

Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415
Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment* Gender	69.886	1	69.886	4.955	.027*	.027
Error	2538.833	180	14.105		.	.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
* = Significant, at p<0.05

Table 4.3.2.9 shows the ANCOVA results of interactive effect of treatment and gender on students' achievement in mathematics. It was revealed that the f- value of 4.955 with p value of .027 was significant since p value was less than 0.05. Therefore, it was upheld that there is a significant interaction effect of treatment and gender on students' achievement in mathematics (f (1,180) = .445, p<0.05). Consequently, hypothesis 9 was not rejected. The partial eta squared value of .027 depicts that interaction treatments and gender contributed 2.7 % of the variance observed in achievement in mathematics.

Hypothesis 10: There is no significant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics) and gender on students' attitude towards mathematics.

Table 4.3.2.10 Analysis of covariance (ANCOVA) of attitude towards mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared

Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271
Intercept	48255.095	1	48255.095	363.420	.000	.669
Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Treatment* Gender	102.876	1	102.876	.775	.380ns	.004
Error	23900.501	180	132.781			
Total	3468590.000	195				
Corrected Total	32787.662	194				

a. R squared=.271 (adjusted R squared= .214)

Table 4.3.2.10 shows the ANCOVA results of the interactive effect of treatment and gender on attitude towards mathematics. It is revealed that the f- value of .775 with p value of .380 was not significant since p value was greater than 0.05. Therefore, there is no significant interaction effect of treatment and gender on achievement in mathematics (f (1,180) = .775, p>0.05). Consequently, Hypothesis 10 was not rejected. The partial eta squared value of .004 depicts that interaction of treatment and gender contributed .4 % of the variance observed in student attitude toward mathematics.

Hypothesis 11: There is no significantinteractive effect of students' socio economic background and gender on their achievement in mathematics**.**

Table 4.3.2.11 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model						

Intercept	1799.916[a]	14	128.565	9.115	.000	.415
Pre SMAT	885.994	1	885.994	62.816	.000	.259
Socioeconomic*Gender	1021.045	1	1021.045	72.391	.000	.287
Error	31.666	2	15.833	1.123	.328ns.	.012
Total	2538.833	180	14.105			.
Corrected Total	58739.000	195				
	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
ns => not significant, at p<0.05

Table 4.3.2.11 shows the ANCOVA results of interactive effect of socioeconomic background and gender. It is revealed that the f- value of 1.123 with p value of .328 was not significant since p value was greater than 0.05. Therefore, it was discovered that there is a significant interaction effect of socioeconomic background and gender (f (1,180) = 1.123, p<0.05). Consequently, hypothesis 11 was not rejected. The partial eta squared value of .012 depicts that interaction of socioeconomic background and gender contributed 1.2 % of the variance observed in students' achievement in mathematics.

Hypothesis 12: There is no significant interactive effect of socio economic background and gender on students' attitude towards mathematics**.**

Table 4.3.2.12 Analysis of covariance (ANCOVA) of attitude towards mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271

Intercept	48255.095	1	48255.095	363.420	.000	.669
Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Socioeconomic* Gender	338.953	2	169.477	1.276	.282ns	.014
Error	23900.501	180	132.781			
Total	3468590.000	195				
Corrected Total	32787.662	194				

a. R squared=.271 (adjusted R squared= .214)
ns => not significant, at p<0.05

Table 4.3.2.12 shows the ANCOVA results of the interactive effect of socioeconomic background and gender on students' attitude towards mathematics. It is revealed that the f- value of 1.276 with P value of .282 was not significant since P value was greater than 0.05. Therefore, it was revealed that there is no significant interaction effect of socioeconomic background and gender (f (2,180) = 1.276, p>0.05). Consequently, Hypothesis 12 was not rejected. The partial eta squared value of .014 depicts that the interaction effect of socioeconomic background and gender contributed 1.4 % of the variance observed in students' attitude towards mathematics.

Hypothesis 13: There is no significant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing), socio economic background and gender on students' achievement in mathematics**.**

Table 4.3.2.13 Analysis of covariance (ANCOVA) of students' achievement in mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1799.916[a]	14	128.565	9.115	.000	.415

Intercept	885.994	1	885.994	62.816	.000	.259
Pre SMAT	1021.045	1	1021.045	72.391	.000	.287
Treatment* Socioeconomic* Gender	34.096	1	34.096	2.417	.122ns.	.013
Error	2538.833	180	14.105			.
Total	58739.000	195				
Corrected Total	4338.749	194				

a R Squared=.415 (adjusted R Squared= .369)
ns=> not significant, at p<0.05

Table 4.3.2.13 shows the ANCOVA results of the interactive effects of treatment, socioeconomic background and gender on students' achievement in mathematics. It is revealed that the F- value of 2.417 with P value of .122 was not significant since P value was greater than 0.05. Therefore, there is no significant interaction effect of treatment, socioeconomic background and gender on students' achievement in mathematics (f (1,180) = 2.417, p<0.05). Consequently, Hypothesis 13 was not rejected. The partial eta squared value of .013 depicts that interaction of treatment, socioeconomic background and gender contributed 1.3 % of the variance observed in students' achievement in mathematics.

Hypothesis 14: There is no significant interactive effect of treatment (Token Economy and Token Economy with Continuous Testing in Mathematics), socioeconomic background and gender on students' attitude towards mathematics.

Table 4.3.2.14 Analysis of covariance (ANCOVA) of attitude towards mathematics by treatment.

Source	Type III Sum Of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8887.161[a]	14	634.797	4.781	.000	.271
Intercept	48255.095	1	48255.095	363.420	.000	.669

Pre SMAQ	2844.030	1	2844.030	21.419	.000	.106
Treatment* Socioeconomic* Gender	.260	1	.260	.002	.965ns	.000
Error	23900.501	180	132.781			
Total	3468590.000	195				
Corrected Total	32787.662	194				

a. R squared=.271 (adjusted R squared= .214)
ns => not significant, at p<0.05

Table 4.3.2.14 shows the ANCOVA results of the interactive effects of treatment, socioeconomic background and gender on students' attitude towards mathematics. It is revealed that the F- value of .002 with P value of .965 was not significant since P value is greater than 0.05. Therefore, it was decided that there is no significant interaction effect of treatment, socioeconomic background and gender (f (1,180) = .002, p>0.05). Consequently, Hypothesis 14 was accepted. The partial eta squared value of .000 depicts that interaction of treatment, socioeconomic background and gender had no contribution variance observed in attitude towards mathematics.

4.4 Summary of Findings

The findings in this study revealed that:

- Significant effects oftreatment; Token Economy and Token Economy with Continuous Testing in Mathematics on students' achievement in Mathematics.

- Significant effects of treatment; Token Economy and Token Economy with Continuous Testing in Mathematics on students' attitude towards Mathematics.
- No significant effect of students' socioeconomic background on their achievement in Mathematics.
- No significant effect of students' socioeconomic background on their attitude towards Mathematics.
- No significant effect of gender on students' achievement in Mathematics.
- No significant effect of gender on students' attitude towards Mathematics.
- No significant interactive effect of behaviour modification strategies (Token Economy and Token Economy with Continuous Testing in Mathematics) and students' socioeconomic background, on their achievement in Mathematics.
- No significant effect due to interaction of treatment; Token Economy and Token Economy with Continuous Testing in Mathematics and students' socioeconomic background, on their attitude towards Mathematics.
- Significant effectsdue to interaction of treatment; Token Economy and Token Economy with Continuous Testing in Mathematics and gender on students' achievement in Mathematics.
- No significant effect was established due to the interactionof treatment,Token Economy and Token Economy with Continuous Testing in Mathematics and gender on students' attitude towards Mathematics.

- No significant interactive effect of students' socioeconomic background and genderontheir achievement in Mathematics.
- No significant interactive effect of students' socio economic background and gender on their achievement in Mathematics.
- No significant interactive effect of treatment; Token Economy and Token Economy with Continuous Testing in Mathematics, students' socioeconomic background and gender on their achievement in Mathematics.
- No significant interactive effect of treatment; Token Economy and Token Economy with Continuous Testing in Mathematics, students' socioeconomic background and gender on their attitude towards Mathematics.

In summary, the results in this study provided empirical evidence that students' performance in, and attitude towards, mathematics were influenced by behaviour modification strategies,Token Economy and Token Economy with Continuous Testing in Mathematics. Specifically, the behaviour modification strategies have only exerted the greatest positive main effect on students' achievement and attitude towards mathematics. Equally, a significant interaction effect was found only between treatment and gender in favour of boys on students' achievement in mathematics and no interaction effect was established between treatment and attitude towards Mathematics. It can, therefore, be concluded that gender and the socioeconomic status of students, whether male or female, do not seem to have any influence on the effectiveness of any of the treatments employed

in the study. This is an indication that, if the treatments or strategies are used effectively for male and female, they are likely to produce the same result.

4.5 Discussion

This study has generatedfindings that are noteworthy in key areas of interest.Certainly, students' engagement in token economy and token economy with continuous testing in mathematics has exerted profound effects on students' learning outcomes in Mathematics.

The hypothesis, which examined the effect of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics on students' achievement in Mathematics, revealed significant effects of treatment. This result is in harmony with a good number of studies. For instance, in the studies conducted by Orji, Victoria &Dimkpa (2011) andKurumeh, Omenka& Mohammed (2013), all are unanimous in stating that the groups exposed to token economy treatment, as was the case in the present study, did put up higher academic achievement than the control group. This is an indication that token economy has, as expected, exerted positive effects on the learning outcomes of the experimental groups. The explanation to this can be attributed to the quality and then quantity of treatment. As it were, the token economy with continuous testing treatment combined two major components of attitude, emotional and cognitive components.The fact that token economy alone did not elicit as much impact goes to suggest that, to strengthen and ensure a successful behaviour modification exercise, emotional engagement alone is not strong enough to bring forth the desired change in behaviour, unless it is combined with cognitive engagement.

The hypothesis which examined the main effect of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics on students' attitude towards Mathematics, revealed a statistically significant main effect of treatment.This finding is consistent with a number of studies. Researchers such as Andile&Moses (2006), Aimee (2003)andLeblanc (2004) submitted thatin educational settings emotional engagement, such as the token economy programme utilised in this study, assists in raising learners' intrinsic motivation. An explanation on this finding is quite essential. It is logical to speculate that, when learners are reinforced in the form of token tangibles, as utilised in this study, and contingent upon manifestation of desirable attitudes, there is the likelihood that there will be a corresponding increase in their mathematics attitudinal dispositions. This result is equally in consonance with Thorndike's law of effect, a well known theory. It holds that when a behavior is reinforced, it tends to be strengthened. Therefore, it is not unusual to find a corresponding increase in learners' attitude towards Mathematics.

Further, the hypothesis that aimed to examine the effects of students' socioeconomic background on their achievement in Mathematics following their exposure to treatment did not yield any significant effect. Another insight comes from the descriptive statistics on the influence of students' socioeconomic background, which revealed a negative mean gain in favour of students with high socioeconomic background. This finding is in tandem with some studies and in some instances incongruent with some others. While Yara's (2010) study carried out in some senior secondary schools in Southwest Nigeria reported that majority of the students who lived with their parents that are privileged to have the basic things needed in a house for good education and that majority of the students recorded average academic ability in mathematics. Conversely, Udida,

Ukwayi&Ogodo (2012) conducted their study in selected public secondary schools in Calabar Municipal Local Government Area of Cross River State, Nigeria. The result also revealed that parental socioeconomic background significantly influenced students' academic performance. These findings are equally in tandem with studies conducted elsewhere. For instance, Lidong, Xiaoqing and Na's (2014) study, which was carried out in Chaina, revealed that Chinese students' socioeconomic status, such as parents' education and family income, exerts a significant influence on their mathematics achievements, wherein the economic and social situation in China, especially the imbalanced distribution of educational resources between and within the urban and rural areas, they said, is capable of magnifying the role of SES in mathematics achievements.

The explanation on this may not be farfetched. This finding is consistent with coherent logical reasoning when viewed from the standpoint that students of the Federal Unity Colleges used for this study, do, on the average, come from homes with relatively moderate socioeconomic backgrounds, as against students of other public schools. This is precipitated on the assumption that parents of the students used in this study, in view of their parents' level of education and awareness will naturally provide their children with the necessary educational support, which will put the students at anadvantage. As for statistics emanating from the descriptive statistics and prior to the study, there was the strong tendency to have speculated that the high socioeconomic cluster would exert the greatest impact on achievement. The result turned out to the contrary.This is to mean that the socioeconomic status of the subjects used in this study is not a good predictor of their mathematics achievement. In clearer terms, the home background of students of Federal

Unity Colleges in Kaduna State is not a reliable predictor of their learning outcomes in mathematics.

Regarding the hypothesis which tested the effects of students' socioeconomic background on students' attitude towards Mathematics, the study revealed no significant main effect. In addition, the descriptive statistical analysis in this study revealed that the high socioeconomic group recorded a negative mean gain while the low and medium groups recorded marginal positive mean gain even though not significantly, as it turned out. This finding is quite instructive in that the socioeconomic status of parents was chosen as one of the moderator variables for this study. The intention, however, was to verify if there will be concurrence with other studies already cited in this study. But on the contrary, this study has revealed otherwise. The simple reason that can be adduced to this finding is the understanding that the majority of students of the Federal Unity Colleges used in this study hail from homes with average parental wealth. This portends that the spread of student population along socioeconomic lines was homogeneous. It can, therefore, be concluded that socioeconomic factors are not good predictors of Kaduna state Federal Unity College students' attitude towards Mathematics. Rather, it is speculated that the measure of learners' attractiveness or repulsiveness towards mathematics predetermines their success or otherwise in it.

Conversely, no significant main effect of gender was found on students' achievement in Mathematics. This result is consistent with the study carried out by Salman, Esere, Omotosho, Abdullahi&Oniyangi, (2011) who reported that treatment gain was not mediated by participants' gender. Butit is inconsistent with the study conducted by Adedeji (2007) who examined the impact of motivation, which is similar to the token

reinforcement strategy deployed in this study as an independent variable on secondary schools student achievement in Mathematics. He found that gender differences were significant when the impact of motivation on academic achievement was compared in male and female students.

The fact that earlier studies on the effect of gender on students' achievement in Mathematics revealed bipolar resultsis quite instructive. The explanation that can be offered on the result of this study is that the effects of treatment on students' achievement transcend gender. This cognition is supported by Bandura (1977), who opined that attitude is often used in conjunction with motivation to achieve and not gender, as hypothesised in this study. In the same vein, students' gender did not exert any significant effect on students' attitude towards Mathematics.

This study is in harmony with the studies carried out by Anyichie&Onyedike(2012) in addition to the study by Awofala&Nneji (nd). This result is not strange, since there was no significant effect of gender on mathematics achievement.There is a concurrence in both findings to reveal equally a result that is not significant on students' attitude towards mathematics. As stressed earlier in this study, if the learners are spread along equilibrium socioeconomic lineages, it is reasonable to speculate that there may be no gender preference to come from parents as to warrant an advantage to any sex. As such, the result not being in favour of any sex is understandable. This notion is supported by Stallworth (2009), who submitted that rather the most impacting variables on student achievement in gender-based classrooms were teacher expectancy, teaching experience and instructional leadership, teacher knowledge of student learning styles, and discipline.

The hypothesis which investigated interactive effect of behaviour modification strategies (Token Economy and Token Economy with Continuous Testing in Mathematics) and students' socioeconomic background on students' achievement in Mathematics did not yield a significant effect on students' achievement in Mathematics.

This result is not strange. Aside the fact that this finding concurs with the earlier result on the hypothesis, which investigated the main effect of socioeconomic background on achievement and which yielded no significant effect, the result goes to affirm the assumption that if the respondents are homogeneously distributed along socioeconomic lineages, there is the likelihood that socioeconomic status will not mediate students' achievement.In a similar vein, no significant effect due to interaction of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics and students' socioeconomic background, was found on students' attitude towards Mathematics. This result also conforms tothe hypothesis which sought to examine the main effect socioeconomic background on students' attitude, which was equally not significant. Every reason adduced for main effect can also be put forward to have accounted for the lack of significant interaction effect on attitude. The good thing about this study is the finding that resulted from an empirical process and not mere speculation, as may have been done if socioeconomic background were not selected as a moderator variable that was subjected to testing in this study.

The hypothesis investigating interaction of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics and gender on students' achievement in Mathematics, revealed a significant effect. The direction of influence was shown by the Sheffe's test and the descriptive statistics, which pointed to the side of the boys. This

result is quite striking for two reasons. First, is the fact that it runs contrary to the hypothesis with tested for main effect. The second reason can be explained from the standpoint that the students' engagement in both emotional and cognitive treatments was in favour of the boys. This goes to say that the boys were more sensitive to the magnitude and nature of the token reinforcements deployed for this study.

No significant effect was established due to interaction of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics and gender on students' attitude towards Mathematics. Again, this finding concurs with the earlier hypothesis on main effect. It has been elaborated in this same study how learners' demographic descriptions support the uniformity of parental wealth, which was described as uniform across the student population; the same reason which accounted for the lack of gender effect.

No significant interactive effect of students' socioeconomic background and gender on students' achievement in Mathematics. This finding is quite incisive. This hypothesis was aimed at assessing how the two moderator variables in this study would mediate for achievement. The result has clearly shown that gender and students' socioeconomic background are not precursors to students' achievement in mathematics.

There was no significant interactive effect of students' socio economic background and gender on students' attitude towards Mathematics. This finding is equally as insightful. This hypothesis was aimed at assessing how the two moderator variables in this study would mediate for students' attitude towards mathematics. The result has clearly shown

that gender and students' socioeconomic background are not good predictors of students' attitude towards mathematics.

No significant interactive effect of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics, students' socio economic background and gender on students' achievement in Mathematics. This hypothesis actually examined three-way interactions between the independent variable and the two moderator variables,socioeconomic status and gender in this study. The results portend that the variables did not interact enough to exert a significant effect on students' achievement. What this means is that the treatment in isolation did exert a positive effect on learners' achievement in mathematics but when put together they do not do same.

No significant interactive effect of treatment, Token Economy and Token Economy with Continuous Testing in Mathematics, students' socio economic background and gender on students' attitude towards Mathematics. The result implies that treatment, socioeconomic status and gender did not interact enough to elicit any significant effect to influence students' attitude towards mathematics. But it is seen that the treatment in isolation did exert a positive effect on learners' attitude towards mathematics but when merged they do not interact to determine the magnitude of their attitude towards it.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study has examined the effects of two forms of behaviour modification techniques on students' achievement and attitude towards mathematics. This chapter presents an overview of the results of the study. This is done by presentinga summary of the major findingsand recommendations from the study and for future research were made.

5.2 Summary

This study set out to examine effects of two behaviour modification strategies, token economy and token economy with continuous testing in Mathematics on students' attitude and Mathematics achievement in Federal government college, Kaduna, Federal Science and Technical college, Kafanchan and Federal Government Girls' College, Zaria, all in Kaduna state. The main purpose was to fill the gap in the instructional strategies aimed at stemming the tide of underachievement occasioned by poor attitude towards Mathematics instruction at national examinations. They include mainly the West African Examinations Senior School Certificate Examination (WASSCE) and National Examinations Council Examinations (NECO). To carry out this study, six research objectives and research questions each were drawn and in addition a total of 14 research hypotheses were formulated to guide the study.

The review of related literature threwa spotlight on major variables in the study. The main variables reviewed include token economy and reinforcement. These are components of behaviour modification the major variable, which anchored this study. As revealed, behaviour modification derived its root from Skinner's operant conditioning experiment wherein the modifier replaces undesirable behaviors with more desirable ones through positive or negative reinforcement. A good number of researchers actually implicated attitude as a prominent variable that is capable of predicting academic success.

The literature also hinted thatattitudinal disposition, such as students' confidence, interest, perseverance and curiosity in learning mathematics is particularly important for the attainment of positive learning outcomes in Mathematics. The review of literature also showed that token economy has proved to be very effective in classroom settings to have elicited the desirable behaviour and also enhanced learning. The study also revealed that gender and students' socioeconomic backgrounds have proved to influence learning somehow but not always.

The research design for this study is a quasi-experimental pre-test post-test control group design. In a 3x3x2 factorial experimental design, 195 students were randomly sampled across the three schools. Two main instruments, astudents' Mathematics Attitude Questionnaire and a students' mathematics achievement test were validated and used to elicit information from the respondents. Data emanating from the study were analysed using means standard deviation and Analysis of Covariance; the Sheffe's post hoc test was also done to examine multiple pair wise comparisons of the variables.

The data collected in this study was presented and analysed. The descriptive statistical tools, means and standard deviation were used to analyse the research questions while inferential statistics; Analysis of Covariance (ANCOVA) along with Sheffe's post hoc test were also used.

Results emanating from descriptive statistics revealed that students in the token economy with continuous testing in mathematics experimental class recorded the highest mean gain both in attitude and achievement in mathematics following their exposure to the treatment, where the control group recorded negative achievement gain in mathematics. Surprisingly, students of the high socioeconomic background recorded negative

achievement gain upon exposure to the treatment. Similarly, gains in achievement due to gender were in favour of boys where the girls were found returning negative gain in the course of the study.In hypotheses testing, a significant main effect of treatment was revealed on students' achievement and attitude towards Mathematics. No significant main effect of gender and socioeconomic background was found on both achievement and attitude towards Mathematics. Investigation on the interaction effects of token economy with token economy and continuous testing in Mathematics revealed no significant interaction effect on attitude and achievement. The only interaction effect was found in gender in favour of boys, as revealed by the Sheffe's test. Consequently, no interaction effect was found between treatment, gender (for girls) and socioeconomic background on attitude and achievement in Mathematics.

5.3 Conclusions

Based on the findings, the following conclusions were made.The extent of mathematics achievementand students' attitude towards Mathematics following exposure to emotional and cognitive engagement increased significantly.

1. The extent of mathematics attitude following exposure to token economy and token economy with continuous testing in mathematics elicited a positive influence more than the token economy treatment alone. But the control group also recorded a positive increase in their mathematics attitude scale.
2. Subjects' achievement in mathematics was minimally positive for the low and medium socio-economic cluster. But a negative measure of achievement was recorded for the high socio economic group.

3. Subjects' attitudinal disposition towards mathematics was highest for the high socioeconomic group followed by medium and lastly the low socioeconomic background group.
4. The extent of academic achievement due to gender is minimally positive for the boys and negative for the girls.
5. Subjects' attitudinal disposition towards mathematics in respect of gender was positive across boys and girls but the difference was slightly in favour of the female students.
6. The token economy and token economy with continuous testing treatments elicited a significant effect on students' achievement in mathematics.
7. The token economy and token economy with continuous testing treatments exerted a significant effect on students' attitude towards mathematics.
8. The students' socio economic background did not produce any positive effect on students' achievement in mathematics.
9. The students' socioeconomic background did not bring into being any positive effect on their attitudinal disposition towards mathematics.
10. The students' gender did not elicit any significant effect on their achievement in mathematics.
11. The students' gender did not exert a significant effect on their attitudinal disposition towards mathematics.
12. The students' family background did not interact with the token economy and token economy with continuous testing treatment to produce any increase in their achievement in mathematics.

13. The students' family background did not interact with the token economy and token economy with continuous testing treatment to yield an increase in students' achievement in mathematics
14. The students' gender exerted a significant effect on their achievement in mathematics.
15. The subjects' gender did not exert any significant effect on their attitude towards mathematics.
16. The students' socioeconomic background and gender did not bring forth any significant interaction on their achievement in mathematics.
17. The students' socioeconomic background and gender did not account for any positive change on their attitude towards mathematics.
18. Treatment (token economy and token economy with continuous testing), students' socioeconomic background and gender did not interact to account for any significant effect on their achievement in mathematics.
19. Treatment (token economy and token economy with continuous testing), students' socioeconomic background and gender did not interact to account for any significant effect on their attitude toward mathematics.

5.4 Recommendations

Trends about poor performance of Nigerian students in Mathematics at all levels portray danger for a country in quest of technological advancement. In view of the major findings of this study and considering the pivotal role mathematics plays in students'

academic life, science, technology and society and to a large extent development, the following recommendations were made.

5.4.1Recommendations from the Study

In order to put to use the findings in this study, it is recommended that school authorities should, as a matter of urgency, strive to build teachers' capacity on the use of token programmes for use in the classroom. It is viewed that the measure will enhance Mathematics instruction in schools.

School authorities should setup special token utilisation committees that will oversee the proper planning, implementation and management of token reinforcementprogrammes with a view to improveclassroom instruction and enhance the effective delivery of Mathematics instruction. In essence, the concept of classroom token should be made an integral part of the teacher training course, so as to instill the principle in them even at the formative stage of professional training.

The token economy package utilised in this study should be given adequate advocacy and spread to more states in the federation, so that its impact would become more noticeable in the junior and senior school level mathematics examinations.

School authorities should collaborate with government to make provision for special classroom reinforcement allowances to teachers that will facilitate their willingness and frequency of usingclassroom token rewards. It is viewed that this will ease the financial burden on the teachers' meager salaries.

5.4.2 Recommendations for Further Study

One major finding emanating from this study is the fact that the treatment utilised is gender sensitive in favour ofboys.For that reason, it is recommended thatstudies should

be conducted to expose the appropriate reinforcement schedule that is most suitable for girls so as to balance the effect on both sexes.

The major breakthrough of this study is to have confirmed the efficacy of the token economy treatments. As such, it is recommended that the use of token economy reinforcement should be made an integral part of teaching Mathematics in schools across the country, so as to diminish the gap orchestrated by students' poor attitude towardsMathematics instruction.

In view of the efficacy of the token reinforcement utilised in this study, two kinds of token economy models derived from this study are hereby recommended for use in schools. The models are

1. The teacher should take time to identify desirable classroom behaviours in any given circumstance and rewardappropriate behaviours and reinforceinappropriate academic attitudes appropriately. To do this, the teacher keeps a large token record board in class where statistics of progress made by the participants isdisplayed for them to see the overall appropriate behavior, such as appropriate social interactions, work completion trend and working on a difficult task without embarking on inappropriate behaviours that inhibit learning. At the end of a stipulated period, deserving students are singled out and rewarded accordingly. Two categories of reward may be used. One to be called Award of Achievement for rewarding low achievers who may have exhibited improvement and the other for high achievers to be called Award of Excellence.

2. The second is recommended for the entire school population. In it, a summary of the awards is taken across the streams for the stipulated classes and in mathematics. Again, deserving students are identified and rewarded accordingly. This way, the participants are motivated to work toward involvement in school functions, including field trips and extracurricular activities. Working with the participants to earn these items may positively affect their behaviors as well.

In the light of the above and in order to enhance positive learning outcomes, especially in view of the efficacy of emotional and cognitive engagement revealed in this study, it is worthwhile to sustain the advocacy.

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APPENDICES

APPENDIX I
STUDENT MATHEMATICS ATTITUDE QUESTIONNAIRE [SMAQ]

SCHOOL:…… TALLY NO:…….....
SEX: Male ☐ Female ☐ PLEASE TICK

Dear student,
This questionnaire is designed to identify your Attitude towards Mathematics and to see how the attitude might change over the course of the study. There is no right or wrong

answer. Your answers only describe your present attitude towards Mathematics. Just write (X) in the box that best describes you at THIS MOMENT.

EXAMPLES: In the sentences,

Never like me means: the statement is never TRUE like you.
Not often like me means: the statement is a few times NOT TRUE like you.
Usually like me means: the statement is some of the times TRUE like you.
Absolutely like me means: the statement is VERY TRUE like you.

GENERAL INSTRUCTION:

Remember to mark only one box for each sentence and answer all the statements.

Please, DO NOTrespond in terms of your agreement or disagreement with the statements; rather, respond in terms of how the statements best describe YOUR personal judgment at THIS MOMENT.

1. SELF-CONFIDENCE: I think	Never like me	Not often like me	Usually like me	Absolutely like me
I am confident that I can learn Mathematics.				
Mathematics is difficult.				
I can handle most subjects but not Mathematics.				
Mathematics ismy worst subjects.				
Mathematics is science based.				
During Mathematics classes, I always feel terribly tensed up.				
I am confident that I can handle more difficult Mathematics problems.				
I cannot do well in Mathematics.				

2. ENJOYMENT: I think	Never like me	Not often like me	Usually like me	Absolutely like me
I have usually enjoyed studying Mathematics in school.				
I like doing Mathematics.				
I get good grades in Mathematics.				
Mathematics is dull and boring.				
I am usually delighted in the Mathematics classes than in any other.				
I am happier solving Mathematics				

problems				

3. VALUE: I think	Never like me	Not often like me	Usually like me	Absolutely like me
Mathematics is important in everyday life.				
Mathematics teaching in my school is of poor quality.				
I will not need much Mathematics when I get out of school.				
I will need Mathematics in my future career.				
Maths is an important subject to learn.				
Maths relates to all field of study.				
Mathematics will help me earn a living.				
I don't need Mathematics to survive.				

4. MOTIVATION: I think	Never like me	Not often like me	Usually like me	Absolutely like me
I am confident in myMathematics lessons.				
I have self-assurance that I can solve Mathematics problems easily.				
My teacher has always inspired me to Study Mathematics.				
My teacher has always encouraged me to study Mathematics.				
I am willing to take more than the required amount of Mathematics.				
My teacher has always rewarded me when I do well in Mathematics.				

5. ANXIETY: I think my	Never like me	Not often like me	Usually like me	Absolutely like me
I fell nervous solving Mathematics problems.				
Studying Mathematics makes me feel worried.				
Maths doesn't scare me at all.				
I am always at easein Mathematics lessons.				
I am concerned about my low				

scores in Mathematics tests and examinations.				
I am always uncomfortable during Mathematics lessons.				
I am tensed up writing Mathematics tests and examinations.				

6. PARENTS' & TEACHERS' EXPECTATION: I think my	Never like Him/ Her	Not often like Him/ Her	Usually like Him/ Her	Absolutely like Him/ Her
Mathematics teacher is happy with my performance in Mathematics.				
Mathematics teacher makes the lessons easy for me to understand.				
Mathematics teacher makes the lessons very interesting for me.				
Father is happy with my performance in Mathematics.				
Father encourages me to study Mathematics.				
Mother is happy with my performance in Mathematics.				
Mother encourages me to study Mathematics.				

STUDENT SOCIOECONOMIC BACKGROUND SCALE [SSBS]

From statements 1 and 2, TICK one option that MOSTLY describes you.

1. My house is:

A government quarter ☐ A rented apartment ☐ A personal house for the family ☐

2. I live in: A two room apartment ☐ A two or three bedroom apartment ☐ ☐

A Duplex; having the kitchen and living room at the ground floor and bedrooms up stairs.

1. In my house:	Never	Not often	Usually	Absolutely
3. We cook with fire wood				
4.We cook with kerosene stove				
5.We use gas cooker for cooking				
6.We use DSTV decoder				
7.We use Star Times decoder				
8.We listen to news from NTA and DITV only				
9.We use a flat screen TV set				
10.We use the box-type TV set				
11.We wash our clothes with washing machine				
12.We wash our clothes by ourselves				
13.We use the dry cleaner to wash our clothes				
14. A house cleaner is employed to clean the home				
15.The family driver drops me at school daily				
16.Daddy has his personal car				
17.Mummy has her personal car				
18.There is a standby generator				
19.We on the generator when there is power outage				
20. We put on the generator only at night				
21.We use an inverter when there is power outage				

APPENDIX II

STUDENTS' MATHEMATICS ACHIEVEMENT TEST [SMAT]

INSTRUCTIONS: Answer all the questions in the OMR FORM given. Just shade the correct Option (A-E). TIME: 1 Hour 30 Minutes.

1. A line that divides a circle into two equal parts is known as

A. Chord B. Diameter C. Radius D. Sector E. Segment

2. Find the simple interest on N800.00 at 4% for six years

A. N32.00 B. N48.00 C. N192.00 D. N224.00 E. N240.00

3. Express 33% as a decimal number

A. 0.30B. 0.31 C.0.32 D.0.33 E. 0.34

4. Approximate 13075 to the nearest thousand

A. 13075 B. 13065 C. 13045 D. 13015 E. 13000

5. Which of the following is NOT a perfect square?

A. a^2 B. $4y^2$ C. $16b^3$ D. 36 E. 100

6. Find the L.C.M. of 15 and 45

A. 15 B. 30 C. 45 D. 60 E. 75

7. Express 0.0004107 in standard form.

A. $4107X\ 10^7$ B. $4107X\ 10^5$ C. $4107X\ 10^4$ D.$4107X\ 10^{-5}$ E. $4107X\ 10^{-4}$

8. In a class of 25 students 15 are boys. What percentage are girls?

A. 10% B. 15% C. 20% D.30% E. 40%

9. The following are quadrilaterals EXCEPT

A. Circle B. Parallelogram C. Rectangle D. Square E. Trapezium

10. A trader bought an electric iron for N1, 200.00 and sold it for N1, 680.00. What was the percentage profit?

A. 0.4% B. 29% C. 40% D.48% E. 71%

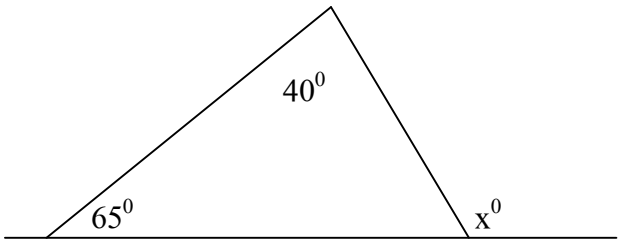
Take $\pi=227$

A. 6 m^2 B. 14m^2 C. 22m^2 D.30m^2 E. 38 m^2

12. A coach can take 79 people. How many people can 37 coaches take?

A. 3923 B. 4920 C. 2923 D. 3291 E. 3219

13. Calculate the value of x^0 in the figure below

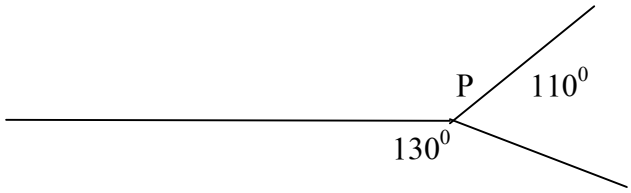


A. 50^0 B. 95^0 C. 75^0 D. 55^0 E. 35^0

14. 14 students share a total of N97, 720.00 equally. How much does each of the students get?

A. 6980B. 720C. 690 D. 115 E. 810

15. Find the value of P in the figure below.



A. 110^0 B.120^0 C. 130^0 D. 140^0 E. 150^0

16. Express $5.2m^2$ in cm^2

A. $52000cm^2$ B. $5200cm^2$ C. $520cm^2$ D. $52cm^2$ E. $5.2000cm^2$

17. Reduce 72 in the ratio of 3:4

A. 54 B. 50 C. 53 D.45 E. 41

18. Which of the following is NOT true of a parallelogram?

A. Opposite sides are parallel and equal in length. B. There are two lines of symmetry C. Opposite angles are equal. D. The diagonals bisect each other

E. There is no line of symmetry.

19. Calculate the exterior angle of a regular pentagon.

A. 72^0 B.60^0 C. 51.4^0 D. 45^0 E. 40^0

20. A regular polygon has the sum of its interior angles 3240^0. Find the number of sides of the polygon

A. 16 B.20 C. 22 D. 26 E. 30

21. Add N4.20, N3.60 and N2.20 and give your answer in kobo.

A. 10K A. 100K A. 1,000K A. 10,000K A. 100,000K

22. Find the sum of all prime numbers between 1 and 10.

A. 2 B.3 C. 5 D. 7 E. 17

23. Express 52 as a product of its prime factors in index form.

A. $2x\ 13^2$ B. 2X 26 C. 2x2x 13 D. 2^2x13 E. 4x 13

24. What is the value of each exterior angle of a regular octagon?

A. 450^0 B.150^0 C. 100^0 D. 90^0 E. 45^0

25. One of the interior angles of a regular polygon is 144^0 . Find the number of sides of the polygon.

A. 6 B. 8 C. 10 D. 12 E. 14

26. Dande and Maji are 12 and 10 years respectively. N9152.00 is shared between them in the ratio of their ages. How much does Dande get?

A. N4160.00 B. N4670.00 C. N4860.00 D.N4900.00 E. N4992.00

27. A student spends 37.5% of his money on food, 28.75% on rent and 15% on books. What percentage of her money is left to spend on other things?

A. 18.70% B. 18.71% C. 18.72% D. 18.75% E. 81.25%

28. Find one-quarter of the difference between 16 and the square of 2.

12 E. 3

29. If 10 men can do a job in 15 hours, how long will it take 15 men?

A. 12 hrs B. 13 hrs C. 10 hrs D. 17 hrs E. 20 hrs

30. What is the coefficient of 'b' in the expression: b^2- 5b + 18?

A. -18 B. -5 C. 1 D. 5 E. 18

1156+□=16□+3.

23 D. - *23* E. -1

4□+1=1□

13 B. *17* C. *16* D. *15* E. *13*

33. What is the value of x if 12x + 3= 4x - 1?

12 B. *14* C. *12* D. 2 E. *4*

34. From the English alphabet A-Z a letter is chosen at random. What is the probability that it is a vowel?

126 B. *526* C. *121* D. *521* E. *226*

35. The H.C.F. of 36 and 60 is

A. 10 B. 6 C. 12 D. 8 E. 30

36. Solve the linear inequality 2x-3> 11

37. A car travels 56 km using 8 liters of petrol. What distance will it travel with 13 liters of petrol?

A. 78 Km B. 91 Km C. 104 Km D.117 Km E. 130 Km

12 x (-6)

A. 6 B.3 C.2 D. 5 E.9

39. The Roman numeral CXCIV represents the number

A. 194 B. 196 C. 214 D. 215 E. 130

40. Calculate the ratio 3:5 as percentage

A. 40% B. 60% C. 55% D. 35% E. 75%

*12*hours is

A. 30 min B. 45 min C. 90 min D. 75 min E. 85 min

42. There are 21 match sticks left in a match box. Originally, there were M match sticks in the box and 27 have been used. What is the value of M?

A. 46 B. 45 C. 47 D. 48 E. 85

43. The perimeter of a rectangle is 36cm. If it is 12cm long, find its breath.

A. 7 B. 6 C. 12 D. 10 E. 15

*17*is expressed as an improper fraction, its numerator will be

A. 8 B. 12 C. 36 D. 35 E. 15

45. Subtract 10_{two} from 11_{two}

A. 01_{two} B. 10_{two} C. 11_{two} D. 12_{ten} D. 101_{two}

46. Find the product of 0.04 and 0.8

A. 0.00032 B. 0.0032 C. 0.O32 D.0.32 E.32

Use these set of numbers to answer questions 47 to 49

1, 2, 2, 2, 3, 5, 6, 7, 8, 9, 10.

47. The Mode of the numbers is

A. 2 B. 3 C. 5 D. 6 E. 7

48. The Median of the numbers is

A. 2 B. 3 C. 5 D. 6 E. 7

49. The Mean of the numbers is

A. 2 B. 3 C. 5 D. 6 E. 7

50. Simplify 3p+4p-2p

A. 4p B.7p C. 6p D. p E.5p

APPENDIX III
SUMMARY OF DESCRIPTIVES

Table 1.01: Summary of treatments by Achievement and Attitude

Descriptive Statistics

Treatment		N	Minimum	Maximum	Sum	Mean		Std. Deviation
		Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Economy	Pretest Achievement	58	5	25	952	16.41	.597	4.550
	Post test Achievement	58	7	27	964	16.62	.559	4.254
	Pretest Attitude	58	110	162	8080	139.31	1.448	11.030
	Post test Attitude	58	112	162	7980	137.59	1.417	10.795
	Valid N (listwise)	58						
Token with Continuous Testing	Pretest Achievement	67	7	29	1195	17.84	.688	5.632
	Post test Achievement	67	8	31	1258	18.78	.661	5.413
	Pretest Attitude	67	57	167	7291	108.82	3.340	27.339
	Post test Attitude	67	98	150	8452	126.15	1.434	11.740
	Valid N (listwise)	67						
Control	Pretest Achievement	70	6	25	1087	15.53	.462	3.863
	Post test Achievement	70	6	24	1035	14.79	.414	3.464
	Pretest Attitude	70	67	155	9306	132.94	1.776	14.862
	Post test Attitude	70	81	153	9452	135.03	1.603	13.411
	Valid N (listwise)	70						

Table 1.02: Summary of Socioeconomic Background by Achievement and Attitude

Descriptive Statistics

Socio-economic Background		N	Minimum	Maximum	Sum	Mean		Std. Deviation
		Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Low	Pretest Achievement	86	5	29	1471	17.10	.574	5.325
	Post test Achievement	86	7	31	1501	17.45	.513	4.762
	Pretest Attitude	86	63	162	11116	129.26	2.436	22.591
	Post test Attitude	86	102	162	11476	133.44	1.282	11.893
	Valid N (listwise)	86						
Medium	Pretest Achievement	71	6	28	1115	15.70	.504	4.244
	Post test Achievement	71	6	30	1129	15.90	.536	4.514
	Pretest Attitude	71	67	155	8915	125.56	2.393	20.168
	Post test Attitude	71	81	153	9361	131.85	1.572	13.245
	Valid N (listwise)	71						
High	Pretest Achievement	38	10	27	648	17.05	.721	4.441
	Post test Achievement	38	10	29	627	16.50	.795	4.903
	Pretest Attitude	38	57	167	4646	122.26	4.742	29.233
	Post test Attitude	38	98	154	5047	132.82	2.442	15.055
	Valid N (listwise)	38						

Table 1.03: Summary of Gender by Achievement and Attitude

Descriptive Statistics

Gender		N	Minimum	Maximum	Sum	Mean		Std. Deviation
		Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Male	Pretest Achievement	81	5	28	1410	17.41	.567	5.101
	Post test Achievement	81	7	31	1444	17.83	.600	5.403
	Pretest Attitude	81	59	166	10296	127.11	2.664	23.977
	Post test Attitude	81	100	162	10749	132.70	1.465	13.182
	Valid N (listwise)	81						
Female	Pretest Achievement	114	6	29	1824	16.00	.424	4.523
	Post test Achievement	114	6	27	1813	15.90	.377	4.022
	Pretest Attitude	114	57	167	14381	126.15	2.137	22.818
	Post test Attitude	114	81	153	15135	132.76	1.211	12.928
	Valid N (listwise)	114						

Table 1.04: Summary of Distribution of Respondents based on Treatment, Socioeconomic Background and Gender by Post Test Attitude

Descriptive Statistics

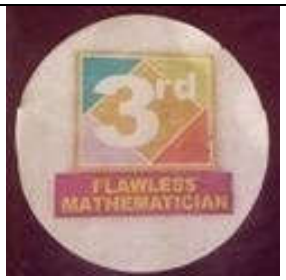
Dependent Variable: Post test Attitude

Treatment	Socio-economic	Gender	Mean	Std. Deviation	N
Economy	Low	Male	137.00	10.936	35
		Female	140.17	4.167	6
		Total	137.46	10.252	41
	Medium	Male	137.90	8.774	10
		Female	132.00	16.867	5
		Total	135.93	11.793	15
	High	Male	152.50	2.121	2
		Total	152.50	2.121	2
	Total	Male	137.85	10.651	47
		Female	136.45	11.861	11
		Total	137.59	10.795	58
Token with Continuous Testing	Low	Male	121.36	13.448	11
		Female	127.31	10.499	16
		Total	124.89	11.917	27
	Medium	Male	128.92	8.231	13
		Female	127.36	7.540	11
		Total	128.21	7.791	24
	High	Male	125.90	17.489	10
		Female	124.00	14.711	6
		Total	125.19	16.018	16
	Total	Male	125.59	13.161	34
		Female	126.73	10.245	33
		Total	126.15	11.740	67
Control	Low	Female	137.11	8.560	18
		Total	137.11	8.560	18
	Medium	Female	132.66	16.409	32
		Total	132.66	16.409	32
	High	Female	136.95	11.436	20
		Total	136.95	11.436	20
	Total	Female	135.03	13.411	70
		Total	135.03	13.411	70
Total	Low	Male	133.26	13.267	46
		Female	133.65	10.252	40
		Total	133.44	11.893	86
	Medium	Male	132.83	9.442	23
		Female	131.38	14.793	48
		Total	131.85	13.245	71
	High	Male	130.33	18.918	12
		Female	133.96	13.177	26
		Total	132.82	15.055	38
	Total	Male	132.70	13.182	81
		Female	132.76	12.928	114
		Total	132.74	13.000	195

APPENDIX IV

SAMPLES OF USED TOKEN REINFORCEMENT REWARDS

Table for Award of Excellence

Description	Shoulder Type Award Tags	Muslim Girls' Hanging Type
1st in mathematics achievement and attitude		
2nd in mathematics achievement and attitude		
3rd in mathematics achievement and attitude		

Achievement award

Description	Wrist Band Award Tags
1st Improved Mathematician	
2nd Improved Mathematician	
3rd Improved Mathematician	
4th Improved Mathematician	

5th Improved Mathematician	

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Faculty of Arts and Islamic Studies
Department of English and Literary Studies

VICE CHANCELLOR: Prof. Muhammad Yahuza Bello, PhD (Arkansas), M.Sc. (BUK)

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9th December, 2016

TO WHOM IT MAY CONCERN

I write to state that i have edited the PhD dissertation in Educational Psychology written by O. K Abarkaka.

Aliyu Kamal, PhD

Prof. Of Applied Linguistics