

**IMPACT OF AGE DIFFERENCE ON THE ACADEMIC PERFROMANCE  
AMONG SENIOR SECONDARY SCHOOL CHEMISTRY STUDENTS IN  
BOSSO LOCAL GOVERNMENT AREA OF NIGER STATE.**

**BY**

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## **ABSTRACT**

The study investigated the impact of age difference on the academic performance among senior secondary school chemistry students in Bosso local government area of Niger state. The purpose of the study was to determine the effect of age on the academic performance of senior secondary chemistry students and to determine the effect of age difference on the academic performance of chemistry students. Two research questions were formulated to guide this study. Ex-post facto research design was adopted for the study. A sample size of two hundred and fifty (250) senior secondary school students from five schools in Bosso local government area of Niger state were used. The data was collected using the academic performance report booklet of each student in the selected schools and analysed using percentage and mean. The hypothesis were tested at 0.05 level of significance using one-way Analysis of Variance (ANOVA). The study revealed that age does not have any significant effect on the academic performance of senior secondary chemistry students , age difference does not have any significant effect on the academic performance of male and female chemistry students. The researcher recommended that teachers, parents, administrators and stake holders should participate in involvements in school and at home, that can improve the quality of learning and therefore boost the students' academic performance. Also chemistry students in senior secondary schools in Bosso local government area should be treated equally irrespective of their age differences.

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## **CHAPTER ONE**

### **1.0 INTRODUCTION**

#### **1.1 Background to the Study**

The name Niger state was derived from River Niger, the third largest river in Africa after the Nile and Congo rivers. The state houses three major hydro-electric power stations in Nigeria namely; Kainji, Jebba and Shiroro hydro electric power stations respectively. Niger state is situated in the North-Central Geopolitical zone of Nigeria with Minna as its capital. Education in Niger state like that in other developing nations, particularly in the Sahelian region of Africa, faces challenges from poverty to poor access to schools. Although education is compulsory between the ages of seven and fifteen, Niger state has one of the lowest literacy rates in the world. The problems facing the Niger state educational system are immense but are not insurmountable. It will take considerable commitment, effort and the involvement of all if the current situation is to be addressed. The problems associated with the education system at all levels can be attributed to many factors which have not been properly addressed over the years. It will therefore take time to resolve the numerous dimensions of this very complex situation in the education system. However, the Niger state Government is taking measures to address the problems within the education system of the state.

Science has a significant function in this recent age of technology worldwide. Acquisition of suitable scientific and technological skills is necessary to handle the challenges presented by the changing needs of modern work place in the field. Olagungu, Aesoji, Iroegbu and Ige (2003) stated that there is a great importance of scientific knowledge in boosting national income and international rating of the country. In Nigeria science is so important that a lot of emphasis has

been laid on its teaching and learning with a significant aim of science education as contained in the national policy on education(NPE 2008).

Within the background of science education, chemistry has been identified as one of the most important science subject taught at the senior secondary school(SSS) level. It is defined as the branch of natural science that deals with the composition and constitution of substances and the changes that they undergo as a consequence of alterations in the constitution of their molecules. Chemistry is believed to be of high importance to almost all fields in science and technology. For instance, the knowledge of chemistry is seen in the production of plastics, medicine, fertilizers, insecticides and fungicides. It is a core subject in the study of many science courses like medicine, pharmacy, biochemistry, microbiology among others and this calls for the need to teach it effectively.

Despite this significant position of chemistry among other science and related courses, studies showed that academic performance of students in chemistry at senior secondary school certificate examination (SSSCE) has been invariably poor and unimpressive.

Okegbile (2007) described academic achievement as a general terminology used while determining learners' success in formal education which is measured through reports, examinations, researches and ratings with numerous extraneous factors or variables exerting influences. A successful performance result shows the level of students' achievements and ascertains their capabilities.

Ali(2013) defined academic performance as a measure of the degree of success in performing specific tasks in a subject or area of study by students after a learning experience. It is the result of education that shows how well or not a student or class of students is doing academically. Academic achievement is a significant issue to teachers, students, parents and guardians as well

as other stakeholders in the education sector. It is a multifaceted activity and the most important notion in the area of educational psychology. Academic performance is often portrayed by marks or grades in tests and examinations.

Learning widens through all levels of life. The ability to memorize, process information and learn is different between younger and older individuals. Age can be regarded as a factor that can greatly affect the academic performance of students. This is because age related factors like cognitive development, motivation and readiness to learn are important for a good performance of a student. As a student is biologically aging, regardless of personal experience, various developmental changes take place physically, neutrally and intellectually, so the student's ability to perceive a problem and solve it with relative ease improves. Younger students can store and organize information better than older students, while in older students studies have shown that they have better time management skills and a large amount of prior knowledge. Therefore the older students use their knowledge and skills in handling day by day problems better than the younger students. However it is essential to examine and re-examine how this significant variable affects academic performance especially as sometimes it appears that findings in this regard are not all corroborative.

## **1.2 Statement of the Problem**

Educators have an important function in helping students become successful in school and in life. Students need to obtain a solid base of academic, social and emotional skills in order to actualize success in school and in life.

The work parents, teachers and government are putting into the education of students at secondary school level is to make sure that both male and female obtain expected cognizance and skills that will make them beneficial to themselves and their society at large. In Nigeria

there is no discrimination of age in the acceptance of students into secondary schools. This is to give fair educational opportunity to all students regardless of their age.

Nevertheless, despite the fact that parents, teachers and government want both male and female students to do well in school, significant relationship still exist in the age and academic performance of students in many subjects. Many researchers have established this relationship. However, there are other researchers who did not find significant differences in the age and student's academic performance in school subjects. Thus an investigation into the effects of age and academic performance still needs attention of researchers. Hence this study sought to investigate the impact of age differences on the academic performance among senior secondary school chemistry students in Bosso Local Government Area of Niger state.

### **1.3 Purpose of the Study**

The main objective of this study is to find out the impact of age difference on the academic performance among senior secondary school students in chemistry.

More specifically the study aims to:

- i. Determine the influence of age on the academic performance among Senior Secondary School Students of different age.
- ii. Determine the influence of age difference on the academic performance among male and female Senior Secondary School Students.

### **1.4 Research Questions**

This study will be guided by the following questions;

- i. What is the influence of age on the academic performance among Senior Secondary School Students of different age in chemistry?
- ii. Is there any influence of age on the academic performance among male and female Senior Secondary School Students in chemistry.

### **1.5 Null Hypothesis**

**HO<sub>1</sub>:** There is no significant influence of age on the academic performance of Senior Secondary School Students of different age.

**HO<sub>2</sub>:** There is no significant gender difference of age in the academic performance of Senior Secondary School Students of chemistry.

### **1.6 Significance of the Study**

Performance is a major focus of education in every teaching and learning activity.

The study on the impact of age difference on the academic performance of senior secondary school students in chemistry can be very useful to both educational and policy makers in giving direction to the government on necessary steps to embark on to promote the academic performance of students of all ages.

This study will help the parents to realize the very important roles they play for their children to perform well in school.

The findings may also be useful feedback to curriculum planners and implementers into the kind of experiences in senior secondary school needed to aid successful academic performance.

### **1.7 Scope of the Study**

This study was carried out to find the impact of age difference among senior secondary school students in chemistry in Bosso local government area of Niger state. Five secondary schools were selected. The class of interest is senior secondary three chemistry students.

### **1.8 Definition of Major Terms**

**IMPACT:** A significant or strong influence.

**AGE:** The length of time that a person has lived or a thing has existed.

**DIFFERENCE :** A point or way in which people or things are not the same.

**PERFORMANCE :** This is the achievement of a student measured through test and examinations.

**CHEMISTRY:** the branch of science that deals with the composition, properties and uses of matter.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

The chapter deals with the concepts related to the topic of the study. It was categorized into Conceptual Framework, Theoretical Framework, Empirical Studies and Summary of Literature review.

#### 2.1.1. Performance in Secondary Schools

There are several features of students' academic performance. These include active engagement in the learning process, acquisition of the necessary skills and knowledge, contentment, completion of set goals, post-college performance and accomplishment of educational outcomes (York, Gibson, & Rankin, 2015). It is obvious that linked with the definition of performance is the healthy cognitive development, self-regulation and emotional well-being of the students in question. Self-regulation is the ability to manage feelings and behaviors. Emotional well-being and self-regulation facilitate a child in becoming independent, managing stressful tasks, concentrating and paying attention to what is being said, adaptability and persistence; all of these facilitate their learning process. In preschool years, the self-regulation skills are still developing and keep fluctuating (Gillespie & Seibel, 2006). Thus, this study tends to determine impact of age difference on the academic performance among senior secondary school chemistry students in Bosso local Government area of Niger state.

A research was carried out in New Zealand by Suggate, Schaughency and Reese (2009) comprising two groups of English speaking teenagers to see if the reading fluency in children who learnt to read later was different from those who received reading instructions earlier. The

two groups comprised five children each; aged seven and five. The study was conducted in two parts over a period of two years. First, the reading fluency, word and passage reading were tested to find out that the group showing better results was the one that had received the early reading instructions. This analysis included parental income and their education, classroom environment, school-community affluence, home environment, age and self-perceptions.

Group had superior reading ability, word, non-word and passage reading in the first few years of school; however, when these students reached grade four, it was observed that there was no difference in the reading ability of the two groups. The financial background, parental education, school and home environment, students' age and their self-perceptions were included in the analysis. Another study was conducted on an additional 83 students, to compare the reading fluency and comprehension skills between the two groups. It was found that there was no difference in the two; however, the late starters showed better reading comprehension (Suggate, Schaughency & Reese, 2013). Introducing math lessons in the early years is detrimental to the reasoning capacity of children and it also separates common sense from arithmetic concepts. According to Benezet (2011), if math lessons were given in the later years, children would better be able to understand and also would be able to apply these concepts to real life situations. The academic tests show the benefits of early schooling initially, though in long term, there seems to be no advantage of an early school start.

Furthermore, in case of boys, early schooling demotivates them and usually they are mentally absent in the class even though are present physically and in worst cases they even dropout. Thus, for them early schooling distances them from the very objective of school (Katz, 2010). The persistence of the beneficial effects of early years schooling was tested in a research conducted by the Center for Research in Children, Georgetown University (2012). It was found

that the advantage in reading skills disappeared in the later years, whereas the persistence of the benefits in mathematic skills was found to be present, but just in case of boys and not girls. (Hill, Gormley & Adelstein, 2012). However, according to some studies early childhood education helps the underprivileged. Several studies were conducted on individuals from underprivileged families and it as found that people who had attended early childhood school programs had a greater percentage of school graduation as compared to the ones from the same background who had not (Fuerst & Fuerst, 1993). Piaget's cognitive development theory, explains the different stages of the development of human intelligence. He emphasizes on the role of early childhood in the development of a person and suggests that cognitive development depends on biological as well as environmental factors (McLeod, Developmental Psychology; Jean Piaget, 2009). According to Piaget, there are four distinct stages of cognitive development. It is in the third stage, called the concrete operational stage when children's thinking process begins to mature and only in this stage they begin to make use of logic, which is between seven to eleven years (McLeod, 2010). Another important research finding in this regard is the significance of play in early childhood and its role in the cognitive development and the development of self- regulation in children. Experts suggest that for small children, the time spent in playing is much more important for their cognitive development than the time spent in the classroom as they learn to regulate emotions and acquire language skills (Copple & Bredekamp, 2009).

Thus, Future academic performance also requires a person to have developed emotional skills and a healthy mind. Research suggests that play helps children develop social and emotional skills (Gray,2011) and is crucial for social, cognitive and emotional well-being of children (Ginsberg, 2007). Moreover, research findings suggest that play initiated by children themselves as opposed to school-directed play, enhances the literacy and language development in children.

This is due to the numerous opportunities to practice language in play (Bodrova, 2007). Another important aspect of academic success is the self-regulation skills in students. There is considerable evidence that students' academic performance is associated with their level of self-regulation (Kitsantas, Winsler & Huie, 2008). Self-Regulation is defined as the ability of students to actively participate in their own learning process motivationally, behaviorally and meta-cognitively (Zimmerman, 2008). Self-control, the main aspect of self-regulation, is an important determinant of academic success.

Studies show that there is a positive relationship between students' self-control and their academic success. (Honken & Ralston, 2013) The difference in the academic performance of students with and without learning disabilities is also due to the difference in their self-regulation skills. Research evidence suggests that students must develop self-regulation skills in order to succeed academically. The development of self-regulation in students has a beneficial effect on their grade point average (GPA). Therefore the development of these skills must be emphasized upon (Ruban, McCoach, McGuire & Reis, 2003). On the other hand, there is also substantial amount of research that suggests the benefits of early childhood schooling. According to a report published by Missouri Department of Elementary and Secondary Education, good quality early childhood schooling results in above average test scores, higher graduation rates and positive attitudes towards learning (Missouri Department of Elementary and Secondary Education.). Few empirical researches also suggest that children, who receive early childhood (pre- school) education, develop a higher level of vocabulary, mathematics skills and executive functioning and these help them to develop a strong base for future academic success and performance secondary school. Early math and reading skills were found to be linked to future

academic performance in later years. (Duncan, Claessens, Huston, Pagani, Engel & Dowsett, 2007; Weiland& Yoshikawa, 2013).

### **2.1.2. Age as a Factor in Student Academic Success**

In an overview of the historical data regarding school enrollment age and school success, Gray (2012) stated “findings on the importance of chronological age are mixed” Gray (2012) also noted “historical data do not establish a clear, rational „right age“ for school entry”. Many researchers have studied the possible relationship between school entry age and academic success. Nearly fifty years ago, Green and Simmons (2007) studied student age as a contributing factor to school success, comparing “early entrants to years of achievement”. Green and Simmons (2007) questioned the wisdom of enrolling students at an earlier age and summarized, “despite the extra year of schooling, the early entrant is only three months superior in achievement to the regular entrant at a particular age”. Hedges (2013) also studied student age and academic success, “No matter what the entrance age limit may be, the children who enter [earliest] have more problems and achieve less than those of equal IQ who enter [later]”. Hedges (2013) concluded, “earlier is not always better”. While these researchers studied the possible benefits and drawbacks of enrolling students into school earlier than their peers, other researchers studied students enrolled as the oldest of their peer groups. Crosser (2011) found that academic benefits for students who entered school a year older than their peers persisted through ninth grade for both males and females. Langer, Kalk, and Searls (2011), DeMeis and Stearns (2010), Gullo and Burton (2010), Trapp (2011) and Parks (2011) found a positive link between delayed age of school entry and improved academic performance. When compared to younger, yet still age appropriate peers, a meta-analysis by La Paro and Planta (2000) and a research study by Stipek and Byler (2001) concluded that older children in school classrooms performed better

academically than their younger peers. However, it must be noted that some researchers who agreed on the “short term academic and behavioral benefits” of delayed school entry could not agree on the long-term benefits (Oshima & Domaleski, 2006).

In contrast to studies which found a positive connection between student age and academic performance, Wood, Powell, and Knight (2009) stated, “chronological age of children entering kindergarten within the range of 4 to 6 years, is unrelated to eventual success or failure”

(p. 8). Dietz and Wilson (2012), and DeMeis and Stearns (2010) agreed, finding no significant relationship between a student’s age and academic achievement. In the first of two studies about school entrance age and education policies, Meisels (2007) argued against the practice of purposeful school delay, which can make an age appropriate student seem young and immature by comparison. In his second study, Meisels (2007) again examined students whose parents purposefully delayed their entry into school, making them the oldest children among their classmates, and again failed to find improved academic performance levels. May, Kundert and Brent (2011), Quinlan (2012), and Morrison (2010) agreed with earlier findings showing no link between student age and academic success. In two rare studies extending beyond the elementary years, Langer, Kalk, and Searls (2011) followed by Lincove and Painter (2006) studied student achievement into the middle and high school years. Langer, Kalk, and Searls (2011) used data from the 1979 National Assessment of Educational Progress study to determine a possible relationship between student age and achievement scores for students in the fourth, eighth, and eleventh grades. This study found that the oldest students had “significantly higher achievement” than the younger students in fourth grade (at age nine), but these differences had “disappeared by age 17”. Lincove and Painter (2006) studied student entrance age in kindergarten and subsequent eighth grade , tenth grade, and twelfth grade achievement scores, and found that “young and

older students had similar eighth-grade achievement” . Additionally, they found that the younger students outperformed the older students on tests in both the 10th and 12th grades (Lincove& Painter, 2006).

Research studies that examined the link between a student’s age and academic performance most often refer to the student’s chronological age, not maturational age. However, Gray (2012) noted, “Among children of the same chronological age, developmental and mental age can vary considerably” . Braymen (2007) questioned “whether chronological age is an efficient criterion to determine readiness for schooling” . The author raised the question of defining school success, pointing out that some schools use criterion-referenced approaches which suggests that “once a child can satisfactorily perform the tasks required at the kindergarten level, the child should be permitted to enroll in kindergarten”. Braymen (2007) also discussed parents and educators who “challenged the idea of minimum task performance and compared children with their age-related classmates”. Regardless of the definition of school success, Braymen (2007) stated “the issue surrounding optimal age for school entrance has become not merely maturation but rather relative age within a classroom. There will always be a youngest child in any group or grade”. Ogletree (2012) encouraged the use of “maturity age rather than chronological age” when considering school entrance, due to the “importance of maturity as a key predictor of school readiness”. He urged that traditional approaches “must be replaced with a developmental approach that examines the needs of the child and the process of the child’s development” (Ogletree, 2012). Crnic and Lamberty (2010) also made the distinction between students’ chronological age and their maturational age, stating that chronological age is related to school readiness, while maturational age is related to learning readiness (Crnic & Lamberty, 2010). Shepard (2010) agreed that emotionally mature children may do better in school compared to

younger, less mature children, but stated there are “no valid instruments” to identify these children. Jenkins (2003) agreed, referring to chronological age as “a student’s actual age from birth” while maturational age was referred to as “readiness to achieve at a set task”. Jenkins (2003) linked the idea of maturational age to maturational readiness, and stated, “Children should be expected to achieve a specified standard prior to school entry”. These researchers (Braymen, 2007; Crnic & Lamberty, 2010; Jenkins, 2003; Ogletree, 2012; Shepard, 2010) agreed that maturational age could differ from chronological age, and that a child’s maturity was often a better predictor of a student’s school readiness. Morrison’s (2010) research on groups of younger and older first graders found no academic differences between the two age groups, and suggested readiness screenings for children entering school, which would take into account the child’s maturity. However, possible solutions for testing a child’s maturity readiness which could be done on a large scale and with valid results (Shepard, 2010) were sorely lacking.

Currently, research findings in the educational literature regarding age and academic performance are inconclusive. While most agree that early entry into school is not advised outside of special cases, there is no agreement on the value of delayed school enrollment.

### **2.1.3. Gender and Academic Performance**

Contemporary researcher reflects scholars maturing view of the complexity of causation of differences between males and females in chemistry education. As fennema (2000) rightly points out, from around 1970, sex differences index was used to imply that any differences found were biologically and thus genetically determined immutable and not changeable. During the 70s and 80s sex-related differences criterion was used to indicate that while the behavior of concerned was clearly related to the sex of the subjects, it was not necessarily genetically determined. fennema (2000) concluded that while many studies had been poorly analyzed and/or included

sexist interpretations, there was evidence to support the existence of difference between girls and boys learning chemistry, particularly in activities that required complex reasoning, that the differences increased at about the onset of adolescence and were recognized by many leading chemistry educators.

In a 2008 study paid for by the Nation science foundation in the United States, researchers found that girls perform as well as boys on standardized chemistry tests. Although 20 years ago, high school boys performed better than girls in chemistry, the researchers found that is no longer the case. The reason, they said is simple , girls used to take fewer advanced math courses than boys, but now they are taking just as many.(Hyde, Linderg, Lin, Ellis & William 2008). However study indicated that, while an average boys and girls performed similarly, boys were over represented among the very best performers as well as among the very worst (Wistein& Keith,2008) . (Stoet& Geary,2013), analyzed one decade of data collected by the programme for international student Assessment (PISA), including the chemistry and reading performance of nearly 1.5 million , 15 years old in 75 countries. Across nations boys scored higher than girls in chemistry, but lower than girls in reading. The sex difference in reading was three times as large as in chemistry. There are countries without a sex difference in chemistry performance, and in some countries girls scored higher than boys. Boys scored lower in reading in all nations in all four PISA assessment (2000, 2003, 2006 & 2009). Literature about gender and academic performance in chemistry exist with different views and findings. Studies conducted in countries of the North have shown that boys performed better than girls in chemistry (Fennema, 2000, Muthukrishna, 2010).

Ogunleye & Babajide (2011) observed that science subjects such as chemistry are given masculine outlook by many educationists which imply that women and girls grapple with a lot of

difficulties (Okeke, 2007). The females' non-involvement in scientific studies has created males dominance in technological advancement in Nigeria. Agomuoh, (2010) and Ukozor, (2011) reported that males students performs better than females in chemistry, physics and biology generally while Olom, (2010) and Aniodoh & Egbo, (2013) revealed significant differences in favor of females. However, Udosoro, (2011) showed that gender has no significant effects on science performance. Although boys and girls differ in their physical, emotional and intellectual development, efforts to link gender difference to intellectual capabilities have however proved untenable (Inyang and Hannal, 2000; Orimogunje, 2006). Ezeudu (2014) stated that gender was not a significant factor on student's performance in organic chemistry. The male and female students showed the same level of performance. In their study, Udo and Udofia (2014) reported that gender has a significant influence on students performance in the area of symbols, formulae and equations in chemistry, with the male outperforming there female counterpart. Although, research has generally supported the conclusion that there are no biological, neurological or genetic factors at work in creation of scientific gender disparity. Thus, research findings in chemistry education have been inconclusive as to who achieve higher whether male or female? The use of improvised periodic table in the teaching and learning of chemistry is supported by Vygotsky theory. Vygotsky zone of proximal development talks about a point in the learning process where a special type of intervention is provided for the learning to help a student build knowledge or make sense of his/her world. The assistance used by the learner needs to be intentionally provided by the teacher. Vygotsky (2012) emphasized on social interaction as the best way of learning. To him a child learns better in collaborative activities than when he/she learns alone. According to Iroegbu, Nkwocha and Onyemerekyia (2002), one of the educational

implication of Vygotsky theory is for teachers to provide learners with motivations and clues on how to solve their problem.

In his article, Arthur E. Porpat (2010) reports a meta-analysis of personality-academic performance relationship, based on the five-factor model (FFM), with cumulative sample size ranging to over 70,000. Most analyzed studies came from the tertiary level of education, but there were similar aggregate samples from secondary and tertiary education. Academic performance was found to significantly correlate with Agreeableness, conscientiousness and Openness to Experience. Where tested, correlations between conscientiousness and academic performance were largely independent of intelligence. When secondary academic performance was controlled for conscientiousness added as much to the prediction of tertiary academic performance as did intelligence. Strong evidence was found for moderators of correlations. Academic level (Secondary), average age of participant, and the interaction between academic level and age significantly moderated correlations with academic performance.

#### **2.1.4 School Type and Academic Performance**

A student's educational outcome and academic success is greatly influenced by the type of school that they attend. School factors include school structure, school composition, and school climate. The school one attends is the institutional environment that sets the parameters of a pupils' learning experience. Depending on the environment a school can either open or close the doors that lead to academic achievement (Crosnoe, Johnson, & Elder, 2004b). Crosnoe, Johnson, and Elder (2004b) suggested that school sector (public or private) and class size are two important structural components of schools. Private schools tend to have both better funding and smaller class sizes than public schools (Crosnoe et al, 2004b). The additional funding of private schools leads to better academic performance and more access to resources such as computers,

which have been shown to enhance academic achievement (Crosnoe et al, 2004b; Eamon, 2005). Smaller class sizes create more intimate settings and therefore can increase teacher-student bonding which has also been shown to have a positive effect on student success (Crosnoe et al, 2004b). The relative social class of a student body also affects academic achievement (Eamon, 2005). Pupils from low socio-economic backgrounds who attend poorly funded schools do not perform as well as pupils from higher social classes (Eamon, 2005). School composition or the general makeup of a school is another important factor regarding academic achievement (Bali & Alvarez, 2004). The racial make-up of a schools' student body has been shown to influence test scores and pupils' attachment to their school (Crosnoe et al 2004, Bali & Alvarez, 2004). Student test scores and 16 school attachment increase when a pupils' own race matches the most common race of their schools' student body (Crosnoe et al, 2004, Bali & Alvarez, 2004). Crosnoe et al defines school climate as "the general atmosphere of a school" (2004). School climate is closely related to the interpersonal relations between pupils and teachers. Trust between pupils and teachers increases if a school encourages teamwork. Research shows that pupils who trust their teachers are more motivated and as a result perform better in school (Crosnoe et al, 2004; Eamon 2005). School policies and programs often dictate school climate. Therefore, pupils benefit more from school policies if the administrators and teachers, who help create the policies, are representative of minorities (Bali & Alvarez 2004). Pupils can focus more clearly when a school is able to create an environment where pupils feel safe. If a school is able to accomplish a feeling of safety pupils can have success despite their family or neighborhood backgrounds (Crosnoe et al, 2004).

### **2.1.5 Influence of School Physical Facilities on Academic Performance**

School facilities have been observed as a potent factor to quantitative education. The importance to teaching and learning of the provision of adequate instructional facilities for education cannot be over-emphasized. The dictum that “teaching is inseparable from learning but learning is not separable from teaching” is that teachers do the teaching to make the students learn, but students can learn without the teachers. According to Akande (2012), learning can occur through one’s interaction with one’s environment. Environment here refers to facilities that are available to facilitate students learning outcome. It includes books, audio-visual, software and hardware of educational technology; so also, size of classroom, sitting position and arrangement, availability of tables, chairs, chalkboards, shelves on which instruments for practical’s are Arranged (Farrant, 2011 and Farombi, 2010). Writing on the role of facilities in teaching, Balogun (2002) submitted that no effective science education programme can exist without equipment for teaching. This is because facilities enable the learner to develop problem-solving skills and scientific attitudes. In their contribution, Ajayi and Ogunyemi (2011) reiterated that when facilities are provided to meet relative needs of a school system, students will not only have access to the reference materials mentioned by the teacher, but individual students will also learn at their own paces. The net effect of this is increased overall academic performance of the entire students. Commenting on why high academic attainment is not in vogue in Nigeria primary schools, Adesina (2010) identified poor and inadequate physical facilities, obsolete teaching techniques, overcrowded classrooms among others, as factors. Throwing more light on school facilities and moral guiding provision, Fabunmi (2010) asserted that school facilities when provided will aid teaching learning programme and consequently improve academic achievement of students while the models guiding their provision to schools could take any form as rational bureaucratic and or political model.

According to Hallak (2010), facilities form one of the potent factors that contribute to academic achievement of students in the school system. They include the school buildings, classroom, accommodation, libraries, laboratories, furniture, recreational equipment, apparatus and other instructional materials. He went further to say that their availability, relevance and adequacy contribute to academic achievement of students. He however, quickly added that unattractive school buildings and overcrowded classrooms among others contribute to poor academic achievement of the students in primary and other levels of education.

### **2.1.6 Influence of Student Intelligence on academic performance**

Educational studies propose many factors in addition to age and gender which may contribute to student success, including, but not limited to: student intelligence, student diligence, preschool experiences, and socioeconomic status.

It is little surprise to many that student intelligence and academic success often go hand in hand. The positive relationship between a student's intelligence, based on intelligence tests such as the *Stanford-Binet Intelligence Scale* (Thorndike, Hagen, & Sattler, 1986) or the *Slosson Intelligence Test-Revised* (Nicholson & Hibpshman, 1991), and academic success has been well documented (Beattie, 1970; Hoge & Coladarci, 1989; Mayfield, 1979; Naglieri, 1996; Naglieri & Bornstein, 2003). However, in a meta-analysis conducted by Clarke (1984), which investigated the possible link between childhood cognitive development and early childhood experiences, many young children with seemingly low intelligence increased their cognitive functioning (as evidenced through intelligence test scores and observed academic performance) through rich and stimulating environments. A child's biologically acquired cognitive skills (nature) may certain

help them succeed academically, but one should not discount the importance of environment (nurture) as well.

### **2.1.7 Influence of Student's Diligence on Academic Performance**

Some have identified student diligence as another factor which may contribute to student academic success. On occasion, a child demonstrates the intellectual ability to achieve yet does not perform well on achievement measures due to lack of effort, or diligence (Mayfield, 2011).

Bernard, Drake, Paces, and Raynor (2010) defined student diligence as “effort expended toward holistic educational development”. These authors studied the relationship between student diligence and support from teachers and parents, based on the underlying idea that student diligence can affect student academic competence (Knapp & Michael 2009). Bernard, Drake, Paces, and Raynor (2010) found a significant level of correlation between student ability and performance (grade point average) as well as a difference in the level of student diligence among the grade levels. The highest level of student diligence was shown by third graders, followed by fourth, fifth, and then sixth graders. Additionally, the authors found no difference in levels of student diligence between genders at these elementary grade levels, yet found a significant difference between genders at the high school level. Arthur (2002) also studied student diligence and found that hard work was a positive contributing factor in academic success when the author studied “the relationships between student diligence, student support systems, and other related factors, and student academic performance” (p. 11). Therefore, student diligence is another factor which may contribute to student success.

### **2.1.8 Influence of Preschool Experience on Academic Performance.**

Preschool experience might also be a contributing factor in student academic success.

Preschool is available to more children now than in previous years, in part due to a strong professional belief that preschool experiences can help children succeed in school (Brown & Wright, 2011; Crnic & Lamberty, 2010; Gullo & Burton, 2010; Valenti, 2009). Students' preschool experiences were examined by Henry, Gordon, Henderson, and Ponder (2003) to determine "how differences in children's pre-kindergarten experiences and their experiences during primary school influenced their success in school". The results of this study showed that third grade standardized test scores were not significantly affected for children enrolled in the pre-kindergarten program versus children not enrolled in the pre-kindergarten program. However, Magnuson, Meyers, Ruhm, and Waldfogel (2004) studied the math and reading scores of kindergarten and first grade students who had attended preschool compared to the scores of children who had not attended preschool, and found that children who had attended preschool scored higher in both math and reading, and were retained less than children who had not attended preschool. Valenti (2009) also found a significant positive relationship between full day preschool attendance and first grade reading scores.

### **2.1.9 Influence of Student Socioeconomic Status on Academic Performance**

The socioeconomic status of students may also be considered a contributing factor in student academic success. Cosden, Zimmer, and Tuss (2009) studied the impact of ethnicity, age, and

sex combined with socioeconomic status (SES) on student achievement scores in kindergarten and first grade, finding that overall district SES was closely tied to student scores.

Poor language acquisition skills, in particular the lack of a rich and varied vocabulary, can be directly tied to lower socioeconomic status (Hart & Risley, 2008; Hoff, 2003) and can affect children throughout childhood, including the school years (Hart & Risley, 2010). Tajalli and Opheim (2005) and Lincove and Painter (2006) also studied the significance of student socioeconomic status (SES) on academic achievement, concluding that student achievement scores were positively associated with higher socioeconomic status. Socioeconomic status can also affect when a child enters school, with economically disadvantaged parents relying on preschools and kindergartens as a safe and inexpensive place for their children to stay throughout the day while the parents work (Planta, Barnett, Burchinal, & Thornburg, 2009). While many economically disadvantaged parents might like to keep their children at home an extra year, some may need to send their children to school as soon as possible to reduce the costs of childcare.

#### **2.1.10 Parental Response to Research.**

Parents who believe that younger children do not perform as well academically as their older peers may choose to purposefully delay school entry. This has been termed “academic redshirting” (Katz, 2000, p. 2). Originally a college sports term, redshirting refers to “Postponing an athlete’s career” to give him another year to “physically grow and improve his skills” for use in upcoming sports seasons (Katz, 2000, p. 2). According to Katz (2000), academic redshirting refers to “postponing entrance into kindergarten of age-eligible children in order to allow extra time for socio-emotional, intellectual, or physical growth” (p. 2).

Before the current term redshirting was coined, however, Uphoff and Gilmore (2010) recommended delayed school entry as a way to combat a more demanding curriculum which young students may find too difficult. Cosden, Zimmer, and Tuss (2012) also studied young students in the school setting and stated, “more retained students had birth dates in the first two quartiles than in the last two” and “children who were retained were younger than those who were not retained”. Brent, May, and Kundert (2010) studied students whose parents had purposely delayed school entry and reported that the majority of these students had autumn birthdays. This might be explained by an earlier research finding (Katz, 2000): “redshirting is most often practiced in the case of children whose birthdays are so close to the cut-off dates that they are very likely to be among the youngest in their kindergarten class”.

Researchers are divided on the possible effects of academic redshirting, and whether incidences of redshirting are on the rise. A California study found “a significant decline in the frequency of holding out for boys and girls” (Bellissimo, Sacks, & Mergendoller, 2007).

However, a twelve-year study in a suburban school showed a “significant increase in the number of children who had delayed school entry” (Brent, May, & Kundert, 2010). Both of these studies found that boys were held out more often than girls. The National Center for Education Statistics (NCES) reported that redshirting occurred in approximately 9% of all cases of children eligible to enter kindergarten (West, Meek, & Hurst, 2000).

#### **2.1.11 Trends in School Accountability.**

The No Child Left behind Act of 2001 (NCLB, 2003) emphasizes the importance of school accountability on student academic achievement measures. “Accountability in education means holding schools responsible for what students learn” (Johnson, Dupuis, Musial, Hall, & Gollnick, 2010). The goal of these assessments is to eliminate gaps in test scores among students of

differing cultural, language, racial, and socioeconomic backgrounds (Dworkin, 2005; Ravitch, 2010) and ensure that students remain on track for academic success, including high school graduation (U.S. Department of Education, 2010). Under NCLB (2003) regulations, accountability for student academic testing begins in third grade, which can put an increased level of pressure on kindergarten, first, and second grade students to meet academic expectations (Cosden, Zimmer, & Tuss, 2011; Crosser 2010; Dworkin, 2005; Graue & DiPerna, 2000; Meisels, 2010; Shepard, 2011; Tuerk, 2005).

According to the *Georgia Promotion and Retention Guide for 2010*, a third grade regular Education student's promotion, placement, or retention status is primarily determined by his or her scores on the reading portion of the Georgia CRCT (Georgia Department of Education, 2010f). Similarly, the promotion, placement, or retention of fifth grade regular education students in Georgia is primarily determined by their scores on both the reading and mathematics portions of the Georgia CRCT (Georgia Department of Education, 2010f). In addition to grade level advancement decisions in the upper elementary grades, some school systems use standardized test scores in grades as early as kindergarten to determine student placement into pre-first grade transitional classrooms and extra year programs (Graue&DiPerna, 2000; Tuerk, 2005; Wodtke, Harper, Schommer, & Brunelli, 2009).

Elementary school children are not the only ones affected by yearly testing. "NCLB's high-stakes accountability system rewards or punishes school districts, schools, and teachers for the academic performance of their students" (Dworkin, 2005,). Results from state mandated standardized testing can affect fund allocation for schools as well as evaluation of school personnel (Dworkin, 2005; Johnson, Dupuis, Musial, Hall, &Gollnick, 1999; Ravitch, 2010; Tuerk, 2005; Wodtke, Harper, Schommer, &Brunelli, 2000). Some teachers may be so anxious

by testing expectations that they act outside the parameters of standardized testing procedures. Wodtke, Harper, Schommer, and Brunelli (2009) studied kindergarten testing procedures carried out in small group settings with an average of 11 students per group. In several instances, teacher testing practices were so non-standardized the validity of test results could be called into question. Two classroom teachers in a low-performing school district exhibited nonstandard testing practices and procedures that were suggestive of tester effects (Wodtke, Harper, Schommer, & Brunelli, 2009). In 2011, over 170 school teachers and administrators in Atlanta, Georgia, were fired after the state of Georgia discovered suspicious erasures on state mandated assessments (Osunsami & Forer, 2011). Eighty-two teachers confessed to correcting student answer sheets, and each of the educators named in the report were subsequently fired, including then-Superintendent Hall, the National Superintendent of the Year in 2009. Teachers interviewed after the fiasco blamed their actions on the stress of high stakes testing, threats of job loss, and an atmosphere where cheating was encouraged. One teacher stated, “We were told to get these scores by any means necessary...We were told our jobs were on the line” (Osunsami & Forer, 2011).

Issues surrounding school accountability will continue as long as school successes and failures are made public and are tied to the financing of education (Johnson, Dupuis, Musial, Hall, & Gollnick, 2010). The current educational environment of increased testing and school accountability can make teaching and learning a stressful event. The result of these trends in school accountability is an increased and unprecedented level of academic rigor required from elementary age children (Cosden, Zimmer, & Tuss, 2000; Crosser, 2011; Graue & DiPerna, 2000), and increased stress and worry for educators (Dworkin, 2005; Graue & DiPerna, 2000; Osunsami & Forer, 2011; Ravitch, 2010; Tuerk, 2005).

### **2.1.12 Professional qualification of Chemistry Teachers**

Akinsolu. (2010) carried out a research study entitled Teachers and Students' Academic Performance in Nigerian Secondary Schools. This study examined the number of qualified teachers and their relationship to students' academic performance in public secondary schools in a sample of Local Government Areas (LGA) of Osun State. The Senior School Certificate Examination results from 2010/2011 to 20/2005 were used to analyze students' academic performance and reflected some concerns in the school system. Findings of this study showed teachers' qualifications, experience and teacher- student ratio were significantly related to students' academic performance. These findings can be used to guide planners about the need for qualified teachers to facilitate effective teaching and learning in secondary schools in Nigeria. It is in this perspective that this studies to tries to determine whether the same applies to situation in Kenya more especially in Kajiado North Distinct.

Ongubiyi (2004) in his study, “New challenges in the methodologies of teaching in Nigeria”, stated that problems facing science teaching today is how current the teaching professional is as at present. He observed that majority of the teachers had been employed in the past decades and they have been doing the same thing, the same way all along. They have no knowledge of the current ideas and innovations that have taken place in the field in the past recent. He emphasized on the importance of the teachers attending training workshop in their areas of specialties. This study confirms that teacher qualification and development is an important factor in determining student academic achievement. But having been done in a different country there is was need to find out whether the same influences performance of Chemistry in public secondary schools in Kenya.

Grangeat and Gray (2012) investigated factors influencing teachers' professional competence development. This study aimed to increase understanding and knowledge concerning teachers' competence enhancement. The results of the study highlighted the effects of the organization of the collective work situations: spurring exchanges amongst teachers and school partners appears to be a main factor for improving teachers' conceptions about teaching. Some ideas are outlined for constructing new continuing professional development programs and studying their effects.

Sifuna (2009) in his study on Certificate of Primary Education Examination revealed that teacher expertise, facility condition, and instructional materials affect Kenyan primary school quality. This indication was by student performance in the Certificate of Primary Education (CPE). He further stated that higher score are only attainable whenever there are more qualified teachers and suitable facilities. This study mainly concentrated on primary school level. The study at hand tries to find out whether teachers' expertise influences performance of Chemistry in public secondary schools.

Mugambi (2006) carried out a study on factors that influence student's performance in the KCSE examination in South Meru district. Based on her enumerated findings she noted that academic qualification of teachers was significant in influencing performance in secondary schools and the MoE should organize in-service courses for teachers periodically to give them more professional experience. It is therefore in this lime light that this study investigates whether professional qualifications of Chemistry teachers in public secondary, influences performance of students achievement Chemistry.

### **2.1.13 The Teaching and Learning Methods used in teaching of Chemistry Subject**

According to Wachanga and Mwangi (2004), successful teaching and learning of Chemistry depends partly on methods whose activities target most learning senses. This may imply that there is need for teachers to vary the teaching technique in their day to day teaching activity.

Apart from the most commonly applied lecture method approach there is need to employ other teaching methodology such as class demonstrations, practical's and field excursions which are more students involving. The participation of students in the lecture method is less involving. The teaching approach that a teacher adopts is one factor that may affect students' performance, (Mills 1991).

Adesaju and Olantunbosun (2008) carried out a study on student, teacher and school environment factors as determinants of achievement in senior secondary school Chemistry in Oyo state. Nigeria. In this study they observed that Chemistry teaching can only be result-oriented when students are willing and teachers are well disposed using the appropriate methods. They further stated that there is much more demand and emphasis should be laid on the teacher, the learner, the curriculum and the environment in the whole process of teaching and learning of science.

Danili and Reid (2004) studied difficulties facing the majority of Greek pupils in understanding Chemistry concepts, and therefore performing well in the National Examinations. The aim was to explore the problems and to suggest ways in which the situation might be improved. They suggested that approaches to learning must take into account cognitive factors in the learners in the context of information processing and understandings. If this is done, learning is much more effective. Danili and Reid study was mainly on the students' difficulties in learning and understanding Chemistry concepts and their alternative conceptions in Chemistry.

Elks and Byers (2009) carried out a study on the need for innovative teaching and learning Chemistry in higher education amongst European Union countries. The paper starts by identifying and justifying the need for innovation in the methods used to teach Chemistry in higher education to deal with challenges arising from the rapidly changing nature of higher

education. They observed that innovation is considered to offer opportunities for enhancing the student learning experience in higher level Chemistry education. The importance of improved training in pedagogy and pedagogical content knowledge for new lecturers is also stressed.

This study by Eilks and Byers engaged more of teaching and learning in higher education in Europe. The researchers mainly concentrated on innovative teaching and learning of Chemistry at higher education. The study at hand aims at looking at the teaching and learning methodologies that suit the teaching of Chemistry in secondary school. It intends to find out whether these methodologies have any impact on performance of Chemistry in public secondary schools.

According to Eshiwani (2010) in his study entitled Research into methods of Teaching Mathematics, he noted that performance of mathematics in many countries in Africa has been on a down ward trend. He further observed that this is due to inappropriate teaching methods and a high turnover of mathematics teachers in the schools. Thus there is need to find out how teaching methods influence performance of Chemistry in public secondary schools. Ndambuki (2006) observed that lack of facilities or improvisation of learning resources makes chemistry an abstract subject.

#### **2.1.14 The Teaching and Learning Resources available for Teaching Chemistry**

Resources include print and non print materials such as related text books, syllabuses, charts, laboratory and equipment's among others. Relevant resources that are provided to teachers enable them to teach better. This also enhances learning among student thus improving in their performance in examinations (Omao 2007).

Pan, Rudo, Schneider and Smith-Hansen (2003) carried out a study on the relationship between resources availability and student performance. The study examined district- level patterns of resource allocation, district and school resource practices implemented to improve student performance, and barriers and challenges to efficient resource allocation faced by schools. The findings from the research demonstrated that availability resources, enhances students' academic success. The study indicated that allocating resources within selected areas and for certain practices might make a significant impact on student. The study further observed that both the level of resources and their explicit allocation seemed to affect educational outcomes.

Ndirangu, Kathuri and Mungai (2001) examined improvisation as a strategy for providing science teaching resources. The researchers observed that in Kenya, performance in science subjects has often been very dismal. They further explained that poor performance is partly blamed on the increasing school enrolment, without corresponding increase in teaching resources. The study observes that cost sharing in secondary schools has limited the government's role to paying teachers' salaries only.

They further observed that capital development and purchase of teaching materials has been left to parents. Parents have been unable to carry out this role effectively because of increasing poverty level in the country. The focus of this study was on how improvised science resources may be used in teaching and learning of science. However the study did not reveal how resources influence the performance.

Omao (2007) investigated the Effectiveness of the implementation of secondary school Kiswahili. The researcher revealed that one of the challenges facing implementation of the Kiswahili curriculum in secondary schools was inadequate teaching and learning resources

among others. This study recommended that the parents should supplement materials for the learners apart from the course books and set books. It was further recommended that planners need to plan on different scenarios for each institution as regards resources, number of teachers and even climatic conditions. Choice and use of resources affect the teaching and learning process. The subject being taught determines the choice of the resources and material needed for effective learning process. The current study seeks to explore on factors influencing performance of Chemistry in public secondary schools in Kajiado North District.

Wachanga and Mwangi (2004) looked into Effects of the Cooperative Class Experiment Method on Secondary School Students' Chemistry' Achievement in Kenya's Nakuru District. This study sought to examine how the co-operative class experiment (CCE) teaching methods affect students' achievement. The study found that CCE method facilitated students' chemistry learning more than regular methods. Gender did not affect achievement. Neither did school type significantly affect girls' achievement when CCE method was used but it significantly affected boys' achievement with boys in boys' schools attaining higher scores. Since CCE method benefited students irrespective of school type, education authorities should encourage chemistry teachers to use it and teacher educators to make it part of the teacher-training curriculum.

Wanjohi (2006) studied factors affecting teaching of mathematics in secondary schools in Kamwangi Division, Thika District. The researcher recommended the provision of text books and other aids to make the teaching of mathematics more effective. This study concentrated more on factors affecting teaching of Mathematics in secondary schools and not on factors influencing performance of Chemistry in public secondary schools in Kajiado North District.

Mwai (2007) carried out a study on factors that influences performance in English, in Kirinyaga District. On resources the study mainly looked at the library and class size. The study suggested

that a properly stocked library will, in addition provide adequate reference books for teachers and students. However this study did not look into other related resources necessary to influence performance of student. Neither did it reveal how the availability of other resources may affect students' achievement. Moreover the study was mainly targeting performance in English.

Karue (2008) examined factors affecting performance in Kenya Secondary Education in day secondary schools in Embu District. The researcher used stratified random sampling covering each division. Data was analyzed using descriptive statistics, multiple correlation and regression analysis. He observed that lack of reading and inadequate instructional materials, laboratory equipment and physical facilities are some of the factors that affect performance of students in day secondary schools. The study mainly is based on day secondary schools thus it is not fully inclusive as it does not consider the boarding schools. This being taken into consideration, it implies that most of the provincial schools were not catered for in this study as majority of the day schools are categorized as district school.

### **2.1.15 Concept Chemistry**

Chemistry is one of the science subjects taught at the senior secondary school level of Nigeria's educational system. After the Junior Secondary School three (JSSIII) examinations, all students found suitable to study science in the SSS class are enrolled to study chemistry at least during the first and second year of the three years duration. The National Policy on Education (FRN, 2004) stated that chemistry can be taken as one of the "cores" among science subjects (i.e. Biology, chemistry, physics or health science) with other one vocational elective and two non-vocational elective subjects. Ihuahi, (2007) viewed chemistry as the study of the properties, composition and structure of matter, the changes in structure and composition which matter undergoes, and

the accompanying energy changes under different conditions. According to Njoku (2009), chemistry is the study of matter, its structure transformations, interactions and the energy consequences of the interactions and transformations. For any nation to attain self-reliance, science must be an important component of the knowledge to be given to her citizens irrespective of tribe/ethnicity, creed or gender (Ezenwa, 2011). Chemistry is the most basic science which deals with the study of matter. Understanding science begins with understanding Chemistry. With every passing day, Chemistry has brought to us deeper levels of understanding of nature. Everything we know about physical world and about the principles that govern its behaviour has been learned through observations of the phenomena of nature. Chemistry is one of the science subjects taught at the senior secondary school level of the Nigeria educational system. The study and application of Chemistry is essential to the scientific, industrial, technological and social advancement of societies or nations.

Chemistry is a basic science whose concerns are

- i. The structure and behavior of atoms
- ii. The composition and properties of compounds.
- iii. The reactions between substances with their accompanying energy changes.
- iv. The laws that unite these phenomena into a comprehensive system.

Chemistry deals extensively with energy changes which occur in chemical processes, elucidation of the structure of materials and identification of constituents of substances. Today, more than ever before, the study and application of chemistry is essential to the scientific, industrial, technological and social advancement of societies or nations.

The secondary school chemistry curriculum developed by the Federal Ministry of Education (FME) in conjunction with Comparative Education Study and Adoption Centre (CESAC) in 2009, has the following objectives:

- i. To facilitate a transition in the use of scientific concepts and techniques acquired in integrated science with chemistry.
- ii. To provide the students with basic knowledge in chemical concepts and principles through efficient selection of content and sequencing.
- iii. To show chemistry in its interrelationship with other subjects.
- iv. To show chemistry and its link with industry, everyday life benefits and hazards.
- v. To provide a course which is complete for students not proceeding to higher education while it is at the same time a reasonably adequate foundation for a post-secondary chemistry course.

According to Hordson, 2013, the main goals of chemistry education are to engage students in scientific knowledge of chemistry, the nature of chemistry and how to do chemistry that is scientific inquiry in chemistry. The nature of chemical knowledge, how knowledge growth occurs in chemistry and how this knowledge is structured and explained, that is chemical epistemology, are as a central part of chemistry education (Erduran, 2001; Erduran and Scerri, 2002). Chemistry has various unique features (Scerri and McIntyre, 2012), but also shares many features with other sciences. The philosophy of chemistry describes the nature of chemistry for example, how different classification schemes help explain qualitative aspects of matter, how different class concepts for example acid, salt and element, are used as a means of representation, how some concepts play very specific roles in chemistry explanations, such as chemical

compositions molecular structure and bonding and how electrons in particular orbital are employed in “level specific explanations (Erduran and Scerri, 2002).

Chemistry teaching in Nigerian schools has not been encouraging because of the poor performance of students in Chemistry relative to their counterparts in other countries. Research indicates that many students found Chemistry to be difficult, boring and not interesting (Salau, 2006). This is also evident in a recent report by the Shelter Right Initiative (Olubusuyi, 2003) where it was stated that for eight consecutive years, between 2002 and 2009, Nigerian candidates trailed behind their counterparts from other countries in the West African region based on performance in science subjects (Chemistry) conducted by the West African Examinations Council (WAEC). A number of factors have been identified to be responsible for these poor performances and lack of interest in Chemistry from the various studies conducted in Nigeria. These include the lack of motivation for most teachers, poor infrastructural facilities, inadequate textual materials, attitude of students to learning, lack and inappropriate teaching method to meet the demand of the society in which we live and the yelling of the changing world ,among others (Braithmoh & Okedeyi, 2001; Folaranmi, 2002; Okebukola, 2007; Olaleye, 2002; Olanrewaju, 2004).

#### **2.1.16 Attitude of Students towards Chemistry**

A number of studies have been carried out on attitude of students towards various subjects in different parts of the world. Attitude of students towards different subjects differ from one country to another even from one community to another. In Nigeria this is very prevalent in many subjects. Some of the research that has been done in this area includes, Wong, Young and

Fraser (2012) who investigated relationships between students' attitudes toward chemistry and their perceived laboratory environments in Singapore high schools.

This study concluded that there is a positive association between the nature of the laboratory classroom environment and students' attitude. The on-going study does not look at relationship between the nature of the laboratory classroom environment and students' attitude, but aims at determining factors that influence performance of chemistry at secondary school level.

Cousins (2007) carried out a study on gender inclusivity in secondary school Chemistry on male and female participation in the secondary schools in Australia. The study analysed the participations' rates in Chemistry by developing the "story" behind national trends and subject selection patterns within an independent school located in a large Australian city. It supplemented the documented quantitative data by presenting a case- study of 30 chemistry students who were interviewed about what motivated them to enroll in secondary school Chemistry. The students' comments indicated that, despite the quantitative transformations that demonstrate increasing female success over the past few decades, Chemistry is not totally gender inclusive.

Cousin further observed that secondary school Chemistry has not yet reached total gender inclusion due to the common gender differences that still occur in the students' motivation to select Chemistry and the influence that gender stereotypes still have on students' subject selection. Nevertheless, this study did not address the attitude issues and how attitude of students towards Chemistry as a subject in secondary schools in Nigeria, specifically in Minna Metropolis. In fact, this study by Cousins was engaged more on the gender perspective than on attitude. It was even carried out in Australia which is actually different in terms of context from

this intended study. Moreover Cousins study used a case study methodological approach while in this study a quantitative approach that mainly involves a survey design approach has been used. Further. Cousins findings do not seem to be relevant in terms of addressing the student attitude towards performance of Chemistry in the district under focus. Information in this area is wanting and scanty which raises concern. This study therefore is an attempt to close this knowledge gap.

Okebukola (2012) examined factors affecting attitudes toward laboratory Chemistry. The study involved a sample population of 1638 of grade II Chemistry students in 78 schools in rural, suburb, and urban area of Oyo State, Nigeria.

In another study Okebukola (2012) examined the influence of selected factors on secondary students' performance in practical Chemistry for a sample of students and teachers from 39 Nigerian schools. This study identified that participation in laboratory activities and students attitudes to Chemistry are the most important factors affecting performance in Chemistry. However relevant this study may be, its finding may not directly be generalized to Nigeria more especially Bosso L.G.A of Niger state as they are under different environment.

In another study carried out by Kamau (2006) on investigation of factors leading to poor performance in Chemistry in Kenya. The study involved three secondary schools in Naivasha Division. Kamau argued that one of major Millennium Goals of the Republic of Kenya is to be industrialized by year 2020. This can only be achieved by promoting science subjects in our schools. The three major science subjects taught in our secondary schools are Chemistry, Physics and Biology. The new move of science and technology has drawn a lot of attention to the performance of learners in the academic institutions especially on the performance of science. Unfortunately in Kenya the science subjects have not been performed well for a long time. This

means that there is a need to look at the reasons or factors that lead to these poor performances in Kenyan schools.

This survey study looked at the factors that lead to poor Chemistry performance in schools and hence tried to suggest the possible solution that can be used to benefit the students, parent and Kenyan society at large. This was done by using the survey method where by three secondary schools were randomly sampled. In each school 6/20 of the form three students were sampled using the stratified random sampling technique from each school. The random sampling was then done to get the individual student respondents. The questionnaires were used and dispatched to these students, two teachers from each school and the head teachers were interviewed. In the study the questionnaires contained questions which were answered by each of the groups of respondents to generate and extract more knowledge about the problems encountered in the subject.

However, this study by Kamau (2006) focused its attention on factors leading to poor performance in Chemistry as opposed to the factors influencing performance of Chemistry in secondary schools of Kajiado North District. This study engaged only three schools which is a relatively small sample size which is increasingly unrepresentative of the country's secondary schools and therefore cannot be generalized. This study focused on factors influencing performance of Chemistry in public secondary schools in order to fill the knowledge gap where information remained elusive.

#### **2.1.17 Students' Interest in the Study of Chemistry**

Interest is a persisting tendency to pay attention and enjoy some activities. Interest has been viewed as emotionally oriented behavioral tract which determines a student's vim and vigor in tackling educational programs or other activities Chukwu (2002). 21

Ogwo and Oranu (2006), emphasized that unless the teacher stimulates students' interest in learning students' achievement will be minimal. Hence it is essential chemistry teachers use teaching method which ensures students active involvement in learning, and stimulate interest of student in chemistry.

### **2.1.18 Concept of Academic Achievement**

Academic achievement is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are most important. According to Annie, Howard, Stoker and Mildred (2010) academic achievement is the outcome federal the extent to which a student, teacher or institution has achieve their educational goals. Bossaert, Doumen, Buyse and Verschueren (2011) defines academic achievement as student's success in meeting short or long term goals in education in the big picture according to the authors, academic achievement means completing high school or earning a college degree. Lassiter (2009) looks at students' academic achievement as referring to a students' strong performance in a given academic area. A student who earns good grades or awards in science has achieved in the academic field of science. He further stated that education associations and schools monitor the overall level of student academic achievement to decide what, if any challenges, need to be made in the educational system. Good (2009:56) defines academic achievement as "the knowledge obtained or skills developed in the school subjects usually designed by test scores or marks assigned by the teacher". Mehta (2009) defines academic achievement as "academic performance includes both curricular and co-curricular performance

of the students it indicates the learning outcomes of the students. In classrooms students perform their potentials efficiently, as a result of it, learning takes place: the learning outcomes changes the behavior pattern of the student through different subjects.

## **2.2. Theoretical Framework**

### **2.2.1. Piaget Cognitive Development Theory**

According to Learning Theories (2017), Jean Piaget (1896-1980) was a Swiss biologist and Psychologist who has tremendously contributed to the psychology, education, sociology, medicine and many disciplines. One of the greatest performance accorded this great psychologist, educationist, biologist and philosopher was the postulation of cognitive development theory. This is a theory that explains how mind process information as it comes to it. The theory portrays the significance of age in learning, as it is based on this analysis that learning materials were possible to be categorized in to nursery, primary, secondary and tertiary education in the contemporary society. The stages according to the theory are as follows:-

- i. Sensory motor Stage: - At this stage an infant develops understanding of self and reality via interaction with the environment. Assimilation is one of the major routes of learning, which is organizing information and absorbing it in to schema. Second rout is accommodation, which occurs when an object is not assimilated, and schemata are modified to include it.
- ii. Preoperational Stage (2-4 years):- this is the second stage in the theory. The major event here is the fact the objects are classified in simple ways by important feature. This is because the child needs concrete physical situations as he cannot think abstractly.

- iii. concrete Operations Stage (7-11 years):- This is the third stage, in which accommodation is increased due to physical experience. A child begins to conceptualize, create logical structures and be able to explain his or her physical experiences. This is full primary school age which the policy of education emphasized on as the regard the school age in primary school enrollment in Nigeria.
- iv. Formal operational stage (11-15):- this is the last stage of the theory, in which the cognitive development reaches the apex. At this stage, the child does not require concrete objects to make judgment; rather he or she can deduce and hypothesize just like an adult individual

From the theory, it can be deduced that age is very crucial to learning from the early stage of life to adulthood. Learning can only be effective if synchronized with age, for instance, as child's grows, more complex learning or information can be exposed to him or her. Also, by the time this theory is violated, there is every tendency to have learning difficulties and complications. Imagine a child of three years being exposed to information that are concrete, for instance class six learning, or secondary school level learning of course, effective learning will not be achievable. Therefore, this theory is crucial to this study as it was set to investigate the relationship or effect of age on student's performance in secondary school level.

### **2.3 Empirical Studies**

Abubakar and Oguguo (2011) examined the correlates between age and gender on academic performance (CGPA) of Mathematics and Science students. The study used three hundred and thirty-two (332) students; two hundred and twenty-three (223) females and one hundred and nine

(109) males . Scatter-plot, mean and Standard deviation were used for the descriptive statistics while univariate analysis of variance (ANOVA) and multiple regressions were used. Result revealed a linear relationship between, age-CGPA and gender–CGPA.A low positive correlation coefficients was obtained for ages and gender which significant. The predictor variables jointly accounted for 1.3% of the variance, gender was the better predictor.

Also, Momanyi, and Simiyu (2015) investigated the effect of students' age on academic motivation and academic performance among secondary school students attending day schools within Nakuru municipality. The objectives specific to this study were to investigate how students' age difference impact academic performance. The study adapted the ex-post facto research design. The target population comprised all Form two and Form four students in the sixteen secondary schools in Nakuru municipality from which seven day schools were sampled using the stratified random sampling technique. The sample was made up of 489 students. Data was collected using a students' questionnaire and the academic performance scores were obtained from the school records of the previous year. The major statistical methods used in this study were: Pearson's  $r$ , and analysis of variance (ANOVA). Descriptive statistics, means, frequencies, percentages and standard deviations were used for data presentation and to explain the variables in this study. The findings of this study indicated that there was a positive relationship between academic motivation and academic performance. It was also established that students' age had a significant effect on the student's academic performance and students' age had no significant effect on the academic motivation. These findings will assist teachers, parents, administrators and other stake holders to engage in interventions in school and at home, that can improve the quality of learning and hence boost the student's academic performance.

Furthermore, Amro, Mundy and Kupczynski (2015) investigated age and gender effects on students' performance in Algebra. The study utilized a quantitative approach with archival data. The factors of performance and demographics were compared for face-to-face and online students. Multiple regressions and ANCOVA were performed to analyze the data while controlling age and gender to reveal any significant differences between the two groups. The sample and population for this study were predominantly Hispanic students. Multiple regression findings indicated that age and gender were predictors of student performance in face-to-face college algebra courses at a college in south Texas. In the equivalent college algebra online courses, neither Age nor Gender impacted students' grade. ANCOVA showed that the average grade of face-to-face students was higher than that of online students.

In addition, Eze, Ezenwafor, Obi (2015) also studied effects of Age and gender on academic performance of students in Anambra state. Three research questions and one hypothesis tested at 0.05 level of significance guided the study. The survey design was adopted and the study was conducted in Anambra state. The population was 117 (44 males and 73 females) 2012/2013 graduates of the programme. Their computed degree results showing age, gender and final cumulative grade point average was collected from the Department and used for the study. Line AR regression, ANOVA and Chi Square were used for data analysis. Findings of the study revealed that a linear relationship does not exist between the two predictor variables and the university VTE students' academic performance and that their combined contribution is insignificant. However, the study revealed differences in the students' academic performance as a result of age and gender. Based on the findings, the researchers conclude that age and gender have effects on the academic performance of university VTE students which could be as a result

of the fact that the programme involves Mathematics, science and ICT as reported by earlier researchers.

Finally, Margaret Jennifer Voyles (2011) examined the possible relationship between student age and student gender on academic performance on a state mandated assessment for a cohort of North Georgia elementary school students in their first, second, and third grade years. Study results indicated that student age had a statistically significant impact on academic performance for students in their first and third grade years on the mathematics portion of the assessment. Older students within the cohort scored at higher academic levels of performance on the mathematics assessment than did younger students. Student age did not have an impact on scores for the reading portion of the assessment. Study results also indicated that student gender did not impact performance scores on either the mathematics or reading portion of the assessment.

### **2.3.1 Age, Gender and Performance**

Crosser (2011), Kinard & Reinherz (2011), and La Paro & Pianta (2000) presented evidence that older children fare better academically than their younger, age appropriate peers. On the other hand, Uphoff & Gilmore (2009) used research evidence about the relationship between age and achievement as well as other evidence to argue that the older and/or more mature students in a class fare better than younger classmates. In contrast DeMeis & Stearns (2011) and Dietz & Wilson (2011) found no significant relationship between age and achievement. Langer, Kalk, & Searls (2012) found significantly higher achievement of the oldest as compared to the youngest students at age nine but this difference disappeared by age seventeen.

Many studies have shown that girls perform better in school than boys in all major subjects (Epstein et al., 2009; Wong et al., 2002) and that they graduate from high school with higher

grade point averages (GPAs) than their male peers (Perkins, Kleiner, Roey, & Brown, 2004). Fergusson and Horwood (2008), Hillman and Rothman (2003) Praat (2009), Thiessen and Nickerson (1999) and Weaver-Hightower (2003) showed evidence of a growing gender gap in educational achievement in a number of developed countries. Educational statistics have indicated that females are outperforming males at all levels of the school system, attaining more school and post-school qualifications, and attending university in higher numbers (Alton-Lee & Praat 2001; Mullis et al. 2003).

One of the major issues that bothers students in Nigeria today is their academic performance (Ojukwu, 2009). Poor academic performance of students in internal and external examinations is a reflection of the problems and challenges facing the educational system in Nigeria today (Fehintola, 2009). Education helps individuals to adopt to a new environment. In Nigeria, education is seen as the only means of getting to the hierarchy in any endeavor. Thus, poor academic performance usually brings about sadness and frustration to the individual concerned and to his/her parents as well as other members of the family. As a matter of fact, it gives parent and students feeling of satisfaction and joy when children excel academically (Fehintola, 2009). To this end, the importance attached to good academic success or performance by the students as well as their parents and the difficulty experienced by these students have resulted in widespread failures, low grades, examination malpractices, cheating, and so on. These are the cases with the students taking the senior secondary certificate examination (SSCE) of the West African Examination Council (WAEC) and National Examination Council (NECO) (Ojukwu, 2009).

There has been wide cry each year when WAEC and NECO releases their annual results as a result of students poor performance especially in the science subjects (Salami, Mohammed, and

Ogunlade;2012). Candidates performance at the Senior school certificate examination (SSCE) conducted by WAEC and NECO has consistently remained poor with chemistry having one of the worst and poorest results over the years (Ibe& Madusnum,2001). For example, a look at the five-year SSCE results in chemistry from 2010 to 2014 shows that in 2010 out of 105,453 that sat for chemistry in all the secondary schools in Abia state only 26,680 credited chemistry.

Of all the science subjects, chemistry is vital for preparing scientist and technologists both at middle and upper manpower levels. Chemistry is one of the basic sciences which are essentially the pre-requisites for technological breakthrough. Hence, the need for effective chemistry education in Nigeria appears very crucial and therefore, demands considerable attention. For instance, chemical technologist and technical workers are needed in all those chemistry –related fields mentioned above. In the higher manpower requirement, 18 experts are needed in chemical engineering. These fields cannot be effectively studied without chemistry as it serves as pre-requisite to them. This implies that chemistry is an important science subject needed for higher education in virtually all the science related professions such as medicine, pharmacy, Agriculture, Engineering, Food and nutrition. So these aspects of the importance of chemistry explain why schools, governments, students' poor achievement in chemistry in senior school certificate examination. Chemistry is one of the most important disciplines in the school curriculum; its importance in the general education has world-wide recognition. It is worth to emphasize that the field of chemistry, Science and technology are related to the economic heart of every highly-developed, industrialized and technologically advance society (Burneister 2012).

Teaching and learning of science have significant roles towards technological development in a developing nation since chemistry is embedded, ecologic and societal influences (Hofstein 2011). In Pakistan, students' academic performance is measured by Grade Point Average (GPA)

(Galiner,2006). The performance is also measured through the result of a particular subject like chemistry (Hijazi&Naqvi,2006).

#### **2.4. Summary of Related Literature**

Studies on the performance, age, and gender of chemistry students were reviewed as relates to this study. From the review, it has been seen that age impacts students' performance in so many subjects. In view of the above, the researcher intends to investigate age difference on the academic performance among senior secondary school chemistry students in Bosso local Government area of Niger state.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1. Introduction**

The chapter explains in details the methodology of the study. It feature research design, population, sample and sampling techniques, research instruments, validity and reliability of the instruments, and concluded with method of data collection and data analysis.

#### **3.2 Research Design**

The research design adopted for this research is ex-post-facto design. According to Kothari (2008), ex-post facto design entails making inference about the relationship among variables without direct intervention of the independent and dependent variables. This implies that the researcher noted the dependent variables and retrospectively studied the independent variable for their possible effects on the dependent variable. The design enables the researcher to predict cause-and-effect among variables of interest. The student's previous performance record and bio-data were used to predict relationship of age and performance.

#### **3.4. Population of the Study**

The population of the study consists of all the senior secondary school chemistry students in Bosso local government Area of Niger state. But the target population was senior secondary school III students who have passed through senior secondary school I and II chemistry classes and are having two years academic performance for the study, comprises of 4096 students consisting of 2151 male and 1945 female students.

#### **3.5 Sample and Sampling Techniques**

The sample size used for the research study was 250 students which were drawn from five intact classes use for the study. Simple random sampling techniques was used in the selection of five schools from the population. Purposeful sampling was used in the selection of five intact classes from which,

S/N	Name of school	Population	Sample size
1.	Government Army Day Secondary School, Minna	560	95
2.	Federal Government College, Minna	268	46
3.	Day Secondary School, Chanchaga, B, Minna,	177	30
4.	Model Science College Tundu Fulani	116	20
5.	Government Science College, Chanchaga	346	59
Total	5	1467	250

Table 3.1: Sample size

### 3.6 Research Instruments

The instrument used for data generation in this study was duplicate academic performance report booklet of the students in the selected senior secondary schools. It covers all the academic performance report of each respondent. The total scores of each respondent were collected against his or her name, class, age and gender.

### **3.7. Validity of the Instrument**

All examinations were validated by the teachers before the administration according to the school's instructions. Usually papers are vetted before examination take place in schools as to ensure valid and reliable assessment.

### **3.9. Method of Data Collection**

At the beginning, introduction letter was obtained from the department and submitted to the respective schools in order to be able to gain access to schools' records needed for this study. Result booklets were collated from form (class) teachers of the given classes and were selected based on the sample technique used. Total scores, age and gender were retrieved from the records which are the concern of the study and recorded accordingly. The exercise lasted for a week across the selected schools using the class teachers and two of my colleagues as the research assistants. Finally all records were organized and subjected to data analysis.

### **3. 10. Method of Data Analysis**

The data collected were analyzed using percentage and mean to answer the research questions stated. The hypothesis will be tested using one-way Analysis of Variance (ANOVA).

## CHAPTER FOUR

### 4.0 PRESENTATION AND DISCUSSION OF RESULTS

#### 4.1 Introduction

This chapter presents the results of the data analysis for the study. The presentation and analysis were organized according to the research question and null hypothesis.

#### 4.2 Analysis of Data

**Research Question One:** What is the influence of age on the academic performance among Senior Secondary School Students of different age in Chemistry?

**Table 4.1: Mean score of age on the academic performance among students of different age.**

Age	N	Sum	% of Total Sum	Mean	Std. Deviation	Decision
14years	09	471	03.4%	52.33	8.047	Not Influenced
15years	69	3710	27.1%	53.77	9.294	Not Influenced
16years	98	5471	40.0%	55.83	9.904	Not Influenced
17years	61	3328	24.3%	54.56	8.761	Not Influenced
18years	11	661	04.8%	60.09	12.755	Not Influenced
19years	01	51	00.4%	51.00		Not Influenced

Influenced

**Total            249            13692            100.0%            54.99**

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Table 4.1 shows the average academic performance among Senior Secondary School Students of different age in Chemistry. The mean of 14-year-old students is 52.33, 15-year-old students is 53.77, 16-year-old students is 55.83, 17 years old students is 54.56, 18-year-old students is 60.09 and 19-year-old students is 51.00 which all shows a positive mean from the students' academic performance. The grand Mean ( $\bar{X}$ ) of the students' performance is 54.99. This indicated that age does not influence the academic performance of secondary school chemistry students.

**Research Question Two:** Is there any influence of age on the academic performance among Male and Female Senior Secondary Students in Chemistry?

**Table 4.2: Mean score of the influence of age on the academic performance of male and female chemistry students.**

<b>Gender</b>	<b>N</b>	<b>Sum</b>	<b>% of Total Sum</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Decision</b>
14years Male	04	211	01.5%	52.75	8.995	Not influenced
14years Female	05	260	01.9%	52.00	8.276	Not influenced
15years Male	37	1927	14.1%	52.08	8.849	Not influenced
15years	32	1783	13.0%	55.72	9.552	Not

Female						influenced
16years Male	47	2655	19.4%	56.49	11.120	Not influenced
16years Female	51	2816	20.6%	55.22	8.702	Not influenced
17years Male	39	2109	15.4%	54.08	8.302	Not influenced
17years Female	23	1283	09.4%	55.78	9.610	Not influenced
18years Male	06	348	02.5%	58.00	15.245	Not influenced
18years Female	04	249	01.8%	62.25	11.615	Not influenced
19years Male	01	51	00.4%	51.00		Not influenced
<b>Total</b>	<b>249</b>	<b>13692</b>	<b>100.0%</b>	<b>54.99</b>		

Table 4.2 shows the average academic performance of age on the academic performance among Male and Female Senior Secondary Students in Chemistry. The mean of 14-year-old Male students is 52.75 and 14-year-old Female students is 52.00, 15-year-old Male students is 52.08 and 15-year-old Female students is 55.72, 16-year-old Male students is 56.49 and 16-year-old Female students is 55.22 , 17 years old male students is 54.08 and 17 years old female is 55.78, 18-year-old male students is 58.00 and 18 years old female students is 60.25 and 19-year-old

male students is 51.00 which all shows a positive mean from the students' academic performance. The grand Mean ( $\bar{X}$ ) of the students' performance is 54.99. This indicated that there is no influence of age on the academic performance among male and female chemistry students.

### Hypothesis One (HO<sub>1</sub>)

There is no significant influence of age on the academic performance of Senior Secondary School Students of different age.

**Table 4.3 One-way Analysis of Variance (ANOVA) of age on the academic performance of Senior Secondary School Students of different age**

Source	Sum of Squares	<i>Df</i>	Mean Square	F	Sig.
Between Groups	548.665	5	109.733	1.204	0.308
Within Groups	22138.299	243	91.104		
Total	22686.964	248			

Table 4.3 shows that F-value = 1.204 while P-value = 0.308 at 0.05 significant level. Therefore,  $P > 0.05$ . This means that there was no significant influence of age on the academic performance of Senior Secondary School Students of different age. Hence the null hypothesis was retained.

### Hypothesis Two (HO<sub>2</sub>)

There is no significant gender difference of age in the academic performance of Senior Secondary School Students of Chemistry.

**Table 4.4. One-way Analysis of Variance (ANOVA) of gender difference of age in the academic performance of Senior Secondary School Students of Chemistry**

Source	Sum of Squares	<i>Df</i>	Mean Square	F	Sig.
Between Groups	73.372	1	73.372	0.801	0.372
Within Groups	22613.592	247	91.553		
Total	22686.964	248			

Table 4.4 shows that F-value (0.801) is equal to P-value (0.372) at 0.05 significant level. This shows that there was no gender difference of age in the academic performance of Senior Secondary School Students of Chemistry. Hence the null hypothesis is not rejected.

### 4.3 Discussion of Result

The study revealed that there was no influence of age on the academic performance among senior secondary school chemistry students in Bosso local government area of Niger state. It was also revealed based on the findings that there was no influence of age on the academic performance among male and female senior secondary chemistry students.

From the tested hypotheses it was revealed that there was no significant influence of age on the academic performance of senior secondary school chemistry students and this result is in line with that of Ebenuwa-Okoh (2017) and Amuda, Bulus and Joseph (2016). Also from the second tested hypotheses it was revealed that there was no significant influence of age on the academic performance among male and female senior secondary school chemistry students which is in

line with Bada (2011) and B.O. Abduraheem (2017) whose study revealed that there was no significant difference in academic performance based on age, gender, and financial status.

#### **4.4 Major findings of the study**

The following findings were found based on the data collected and analysed

1. The age difference of chemistry students does not affect their academic performance.
2. The age difference of both male and female is not a determining factor to their academic performance in chemistry.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATION**

#### **5.1 Introduction**

This chapter deals with the implication of this study, makes recommendation on how to improve the academic performance of chemistry students.

#### **5.2 Summery**

One of the goals of the study was to determine the impact of age difference on the academic performance of senior secondary school chemistry students and secondly to see the impact of age on the academic performance of male and female chemistry students in Bosso local government area of Niger state. The research methodology used was ex-post facto method. Simple random sampling of five schools in Bosso local government area and purposeful sampling was used to select the five classes from the five schools. Data of students were collected using academic performance report booklet and analysed using ANOVA.

#### **5.3 Conclusion**

The study revealed that age had no influence on the academic performance of senior secondary school chemistry students, it also revealed that age had no influence on the academic performance among male and female senior secondary school chemistry students.

Further conclusions drawn revealed that there was no significant influence of age on the academic performance of senior secondary school chemistry students of different age and that there was no significant influence of age on the academic performance among male and female senior secondary school chemistry students.

## **5.4 Recommendations**

In the light of this study the following recommendations were made;

1. Teachers, parents, administrators and stakeholders should involve in interventions in schools and at home that can improve the quality of learning and therefore boost the students' academic performance.
2. Counselling centres should open to handle varying problems confronting students irrespective of age or gender.
3. There should be effective monitoring of teaching and learning of chemistry to ensure that all students understand the content coverage and perform well.
4. Students in senior secondary school should be treated equally without bias irrespective of their age.
5. Male and female senior secondary school students of different age should be provided equal opportunity to learn chemistry.

## **5.5 Suggestion for further study**

Further research could be carried out in the following domain

1. Effect of type of school on the academic performance of students.
2. Impact of financial background on the academic performance of students.
3. Effect of student readiness on the academic performance of students.

## REFERENCES

- Abdu-Raheem BO 2010. Relative Effects of Problemsolving and Discussion Methods on Secondary Schools Students' Achievement in Social Studies. Ph.D. Thesis, Unpublished. Ado-Ekiti, Nigeria: University of Ado-Ekiti. [Google Scholar]
- Adesina, S. (2010). What is Educational Planning ; In Adesina, S. (Ed) Introduction to Educational Planning University of Ife Press Ltd 1-10
- Adesaju F, A & Olantunbosun, S. M. (2008). Student, Teacher and School Environment Factors as Determinants of Achievement in Senior Secondary school Chemistry in Oyo State, Nigeria. Uluslararası Sosyal Aratirmalar Dergisi. The Journal Of International Social Research Vol. 1/2. Winter.
- Ajayi, M. A and Ogunyemi, Y. (2011). Effect of learning environment on students' academic achievement Lagos State secondary schools in . Unpublished MED thesis University of Nigeria.
- Akande, O.M. (2012). Hints on teaching practice and general principles of education . Lagos, OSKO Associates.
- Akinsolu, A. O. (2010), Teachers and Students' Academic Performance in Nigerian Secondary Schools: Implications for Planning, Florida Journal of Educational Administration & Policy, Vol. 3 No. 2 pp 86-103 Sum 2010. 18 pp
- Annie Ward, Howard W. Stoker, Mildred MurrayWard (2010). " Achievement and Ability Tests the Domain", Educational Measurement Press of America, pp. 2Definition of 2 , University 5.
- Arthur E. Porpat. (2010). A meta-analysis of the five-factor model of personality and academic performance.
- Balogun, T.A. (2002). Improvisation of Science Teaching Equipment. Association of the science teachers, Journal 20 (2), 72 of 76. the Science Teachers
- Bossaert, G; S. Doumen; E. Buyse; K. Verschueren (2011). "Predicting Students' Academic Achievement after the Transition to First Grade: A TwoYear Longitudinal Study". Journal of Applied Developmental Psychology 32: 47-57.
- Braymen, R. (2007). The early entrance option academic and social. Psychology in Schools, 25, 179-189. Brent, D., May, D.C., & Kundert, D.K. (1996).
- Cousins, A. ( 2007). Gender Inclusivity in Secondary Chemistry: A Study of Male and Female Participation in Secondary School Chemistry. Intenational Journal of Science Education, Volume 29, 711 - 730.

- Crnic, K. & Lamberty, G. (2010). Reconsidering school readiness: Conceptual and applied perspectives. *Early Education and Development*, 5(2), 91-105.
- Crosser, S.L. (2011). Summer birth date children. *Journal of Educational Research*, 84(3), 140146.
- Danili, E & Reid, N. (2004). Some Strategies to Improve Performance in School Chemistry, Based on Two Cognitive Factors, *Research in Science and Technological Education*, Volume 22,203-226.
- DeMeis, J.L. & Stearns, E.S. (2010). Relationship of school entrance age to academic and social performance. *Journal of Educational Research*, 86(1), 20-27.
- Demmerk, G.W. (2001), Improving academic performance among native American students. A review of the research literature. Retrieved March 20, 2006 from <http://www.aor.com/pdf>
- Dietz, C. & Wilson, B.J. (2012). Beginning school age and academic achievement. *Psychology in the Schools*, 22(1), 93-94.
- Eilks, I., & Byers. B. (2009) *Innovative Methods of Teaching and Learning Chemistry in Higher Education*. Cambridge, UK: RSC Pub.
- Eshwani, G. (2013). Factors affecting performance among primary and secondary schools: A policy study. Nairobi (Kenya), Bureau of Educational Research.
- Farombi, J.G. (2010). Resource concentration, utilization and management as correlates of students' learning outcomes: a study in School Quality in Oyo State Unpublished Ph.D. Thesis, university of Ibadan.
- Farrant,J. S. (2011). . *Principles and practice of education* (Tenth Impression Singapore: Longman.
- Good, T. (2009). Teacher effectiveness in the elementary school: What do we know about it now? *Journal of Teacher Education* 30, 52 64.
- Grangeat M., Gray P. (2007). Factors influencing teachers' Professional Competence Development. *Journal of Vocational Education \$ Training*. Vol. 59 Issue 4, pp 485-501.
- Gray, R. (2012). Criteria to determine entry into school: A review of the research. Retrieved from the Illinois State Board of Education, Department of Planning, Research, and Evaluation:  
[http://vnweb.hwwilsonweb.com.proxy.lib.utc.edu/hww/results/external\\_link\\_maincontentframe.jhtml?\\_DARGS=/hww/results/results\\_common.jhtml.44](http://vnweb.hwwilsonweb.com.proxy.lib.utc.edu/hww/results/external_link_maincontentframe.jhtml?_DARGS=/hww/results/results_common.jhtml.44)
- Green, D.R. & Simmons, S.V. (2007). Chronological age and school entrance. *Elementary School Journal*, 63, 41-47.

- Gullo, D.F. & Burton, C.B. (2010). Age of entry, preschool experience, and sex as antecedents of academic readiness in kindergarten. *Early Childhood Research Quarterly*, 7(2), 175-186.
- Hallack, J. (2010). *Investing in the Future: Setting educational priorities in the developing world* TEP and Pe rgonion Press.
- Hedges, W. (2013). At what age should children enter first grade? A comprehensive review. Retrieved from ERIC database. (ED152406)
- Jenkins, D. (2003). Wisconsin school readiness indicator initiative: The status of school readiness indicators in Wisconsin. Retrieved from ERIC database. (ED480807)
- Kamau, N B (2006), "An investigation of Factors Leading to Poor Performance in Chemistry in Kenya: A study of three secondary schools in Naivasha Division" Unpublished master's dissertation. University of Nairobi.
- Karue Njagi (2008), "Factors affecting Performance in KCSE in Day Secondary School in Embu District." Unpublished master's Dissertation University of Nairobi.
- Langer, P., Kalk, J.M., & Searls, D.T. (2011). Age of admission and trends in achievement: A comparison of blacks and caucasians. *American Educational Research Journal*, 21(1), 61-78. doi: 10.3102/00028312021001061
- Lassiter, K. (2009). "The Relationship between Young Children's Academic Achievement and Measures of Intelligence". *Psychology in the Schools* 32 : 170177.
- Lincove, J. & Painter, G. (2006). Does the age that children start kindergarten matter? Evidence of long-term educational and social outcomes. *Educational Evaluation and Policy Analysis*, 28(2), 153-179. doi: 10.3102/01623737028002153
- Macmillan Publishers Ministry of Education. KNEC report, 2006 - 2009. Nairobi, Kenya: MOEST.
- May, D.C., Kundert, D.K., & Brent, D. (2011) Does delayed school entry reduce later grade retentions and use of special education services? *Remedial and Special Education*, 16(5), 288-294. doi: 10.1177/074193259501600505
- Mayfield, B. (2011). Teacher perception of creativity, intelligence, and achievement. *Gifted Child Quarterly*, 23(4), 812-817. doi: 10.1177/001698627902300413
- Meece, J.L. (2002). *Child and adolescent development for educators*. (2nd ed.). Boston, MA: McGraw-Hill Publishing.
- Mehta , R. . (2012). Managing international distribution channel partners: A crosscultural approach . *Journal of Marketing Channel* , 17 ( 2 ) , 89117.

- Meisels, S.J. (2007). Doing harm by doing good: Iatrogenic effects of early childhood enrollment and promotion policies. *Early Childhood Research Quarterly*, 7, 155-174.
- Meisels, S.J. (2010). Out of the readiness maze. *Momentum*, 26(2), 18-22.
- Mills, H. R. (2009). *Teaching and Training: A handbook for instructors* (3rd Ed). London:
- Morrison, F. (2010). Nature-nurture in the classroom: Entrance age, school readiness, and learning in children. *Developmental Psychology*, 33(2), 254-62. doi: 100121649.33.2.254
- Mwai, B. (2007). *Factors influencing Performance in English: A case Study of Gichugu Division, Kirinyaga*. Unpublished, Master's dissertation University of Nairobi
- Ndambuki P.M. (2006). *Factors Influencing the Performance of Chemistry in the Kenya Certificate of Secondary Education (K.C.S.E) in Secondary Schools in Mwala Division of Machakos*. Unpublished, master's dissertation University of Nairobi
- Ndirangu M., Kathuri N. J. & Mungai, C. (2002). *Improvisation as a Strategy for Providing Science Teaching Resources: an Experience from Kenya*," Egerton University, 2002.
- Nyambura B. M. (2007).
- No Child Left Behind (NCLB) Act of 2001, 20 U.S.C.A. § 6301 et seq. (West, 2003).
- Ogletree, E. (2012). The developmental approach to school readiness. Retrieved from ERIC database. (ED315156)
- Ogunbiyi, O. (2004). New challenges in the methodologies of Teaching, A case of in- service programme for school teachers In Elaturoti. F & Babarinde K (Eds) *Teachers' Mandate on Education and Social Development in Nigeria*.
- Okebukola, P. A. (2012). Students' Performance in Practical Chemistry: A Study of Some Related Factors. *Journal of Research in Science Teaching*. Vol. 24 No.2 pp 119-26.
- Omao. P. O. (2007). *Effectiveness of the Implementation of Secondary School Kiswahili Curriculum in Kajiado North District*. Unpublished, master's dissertation. CUEA
- Osunsami, S., & Forer, B. (2011). Atlanta cheating: 178 teachers and administrators changed answers to increase test scores. ABC News Internet Ventures. Retrieved from: <http://abcnews.go.com/US/atlanta-cheating-178-teachers-administrators-changedanswers-increase/story?id=14013113>
- Parks, L. (2011). What is the effect of school entrance age on the reading readiness achievement of kindergarten students? Retrieved from ERIC database. (ED400067)
- Piaget, J. (1970). *Science of education and the psychology of the child*. New York: Orion Press.

- Shepard, L.A. (2010). Children not ready to learn? The invalidity of school readiness testing. *Psychology in the Schools*, 34, 85-97. doi: 10.1002/(SICI)15206807(199704)34:2<85::AID-PITS2>3.0.CO;2-R
- Stipek, D. & Byler, P. (2001). Academic achievement and social behaviors associated with age of entry into kindergarten. *Journal of Applied Developmental Psychology*, 22, 175-189.
- Stipek, D. & Byler, P. (2001). Academic achievement and social behaviors associated with age of entry into kindergarten. *Journal of Applied Developmental Psychology*, 22, 175-189.
- Trapp, C.M. (2011). The effects of school entry age and gender on reading achievement scores of second grade students. Retrieved from ERIC database. (ED379633)
- Vygotsky, L. (2012). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wachanga & Mwangi, J. G. (2004). Effect of the cooperative Class Experiment Teaching Method on Secondary School Students' Chemistry Achievement in Kenya's Nakuru District, *International Education Journal*. Vol.5 No I pp26-36.
- Wanjohi, E. W. (2006). Factors affecting teaching of mathematics in secondary schools in Kamwangi Division - Thika. Unpublished master's dissertation Kenyatta University
- Wodtke, Harper, Schommer, & Brunelli. (2009). How standardized is school testing? An exploratory observational study of standardized group testing in kindergarten. *Educational Evaluation and Policy Analysis*, 11(3), 223-235. doi: 10.3102/01623737011003223
- Wong, A. F. L, Deidra J, & Fraser, B. J (2010). A multilevel analysis of learning environments and student attitudes: Education psychology. *International Journal of Experimental Education Psychology*, Vol. 17 pp. 449-68.
- Wood, C., Powell, S., & Knight, R. (2007). Predicting school readiness: The validity of developmental age. *Journal of Learning Disabilities*, 17(1), 8-11. doi: 10.1177/002221948401700104
- Young, J.W. and Fisler, J.L. (2000). Sex Differences on the SAT: An Analysis of Demographic and Educational Variables. *Research in Higher Education* 41(2): 401 - 416.
- Zaman, A. (2008). Gender sensitive teaching: A reflective approach for early childhood education teacher training programs. *Education*, 129(1), 110-118.

## APPENDIX

<b>GOVERNMENT SCIENCE COLLEGE CHANCHAGA, MINNA.</b>			
<b>S/N</b>	<b>GENDER</b>	<b>AGE</b>	<b>GRADE</b>
1	M	16	69
2	M	16	39
3	M	16	42
4	M	16	47
5	M	15	42
6	M	17	43
7	M	15	60
8	M	17	42
9	M	16	38
10	M	15	59
11	M	17	46
12	M	15	51
13	M	16	56
14	M	16	80
15	M	15	80
16	M	16	63
17	M	15	68
18	M	16	68
19	M	17	39
20	M	18	79
21	M	17	64
22	M	15	56
23	M	15	49
24	M	15	39
25	M	17	52
26	M	15	36
27	M	15	56
28	M	16	66
29	M	16	55
30	M	18	76
31	M	15	42
32	M	15	45
33	M	16	71
34	Ms	16	63
35	M	15	54
36	F	16	54
37	F	15	54
38	F	16	48
39	F	15	79
40	F	17	54
41	F	15	63
42	<sup>72</sup> F	15	73
43	F	15	70

44	F	18	76
45	F	17	57
46	F	14	51
47	F	15	61
48	F	17	30
49	F	15	51
50	F	15	59
51	F	16	47
52	F	16	39
53	F	16	41
54	F	16	55
55	F	16	57
56	F	17	78
57	F	16	43
58	F	17	61
59	F	16	50

<b>DAY SECONDARY SCHOOL MINNA.</b>			
<b>S/N</b>	<b>GRADE</b>	<b>AGE</b>	<b>GRADE</b>
1	M	17	50
2	M	15	50
3	M	15	44
4	M	16	54
5	M	16	40
6	M	15	55
7	M	15	57
8	M	17	53
9	M	17	53
10	M	16	45
11	M	18	50
12	M	17	53
13	M	14	58
14	M	16	42
15	M	16	52
16	M	15	37
17	M	16	37
18	M	16	53
19	M	16	45
20	F	16	56
21	F	16	55
22	F	16	40
23	F	15	48

24	F	16	34
25	F	16	60
26	F	15	36
27	F	16	60
28	F	17	55
29	F	16	58
30	F	16	50

<b>GOVERNMENT ARMY DAY SECONDARY SCHOOL MINNA</b>			
<b>S/N</b>	<b>GENDER</b>	<b>AGE</b>	<b>GRADE</b>
1	M	15	56
2	M	15	53
3	M	16	51
4	M	16	60
5	M	16	55
6	M	17	55
7	M	16	70
8	M	16	46
9	M	17	53
10	M	17	60
11	M	17	41
12	M	17	52
13	M	17	41
14	M	16	48
15	M	16	50
16	M	15	45
17	M	16	50
18	M	16	50
19	M	16	54
20	M	16	60
21	M	15	59
22	M	16	57
23	M	17	53
24	M	17	53
25	M	17	45
26	M	15	50
27	M	17	58

28	M	15	37
29	M	17	42
30	M	17	58
31	M	17	52
32	M	17	66
33	M	16	63
34	M	18	50
35	M	17	64
36	M	17	60
37	M	17	51
38	M	17	63
39	M	17	70
40	M	17	63
41	M	17	60
42	M	16	75
43	M	16	65
44	M	16	50
45	M	16	55
46	M	15	49
47	M	15	56
48	M	16	60
49	M	15	49
50	M	17	61
51	F	16	54
52	F	16	54
53	F	16	50
54	F	16	48
55	F	16	72
56	F	15	52
57	F	16	57
58	F	15	73
59	F	15	54
60	F	15	44
61	F	15	53
62	F	17	45
63	F	18	48
64	F	18	60
65	F	17	54
66	F	16	59
67	F	15	57

68	F	16	56
69	F	16	51
70	F	17	54
71	F	18	65
72	F	17	60
73	F	16	67
74	F	17	50
75	F	15	49
76	F	16	52
77	F	16	68
78	F	17	65
79	F	17	52
80	F	16	62
81	F	16	52
82	F	15	52
83	F	15	63
84	F	15	44
85	F	15	48
86	F	16	53
87	F	17	63
88	F	17	65
89	F	16	73
90	F	17	51
91	F	16	67
92	F	16	56
93	F	17	61
94	F	16	52
95	F	17	54

<b>MODEL SCIENCE COLLEGE, TUDUN FULANI, MINNA.</b>			
<b>S/N</b>	<b>GENDER</b>	<b>AGE</b>	<b>GRADE</b>
1	M	16	52
2	M	19	51
3	M	14	42
4	M	14	49
5	M	15	50
6	M	17	50
7	M	16	54
8	M	18	48
9	M	18	45
10	M	17	43
11	F	16	53
12	F	16	66
13	F	15	50
14	F	17	52
15	F	15	50
16	F	14	45
17	F	17	52
18	F	15	49
19	F	17	46
20	F	16	47

<b>FEDERAL GOVERNMENT COLLEGE, MINNA.</b>			
<b>S/N</b>	<b>GENDER</b>	<b>AGE</b>	<b>GRADE</b>
1	M	17	60
2	M	17	68
3	M	15	51
4	M	16	65
5	M	15	53
6	M	14	62
7	M	16	52
8	M	15	52
9	M	15	63
10	M	16	65
11	M	16	73
12	M	15	51
13	M	16	67
14	M	15	56
15	M	15	61
16	M	15	56
17	M	17	62
18	M	17	49
19	M	17	61
20	M	16	83
21	F	16	54
22	F	15	54
23	F	16	55
24	F	16	51
25	F	16	48

26	F	16	71
27	F	16	52
28	F	17	57
29	F	15	59
30	F	15	54
31	F	16	79
32	F	14	44
33	F	15	53
34	F	15	44
35	F	16	48
36	F	16	60
37	F	16	54
38	F	16	59
39	F	15	57
40	F	14	56
41	F	15	66
42	F	16	65
43	F	14	64
44	F	17	64
45	F	16	54
46	F	15	64