Chemistry Research Journal, 2024, 9(4):1-14
Available online www.chemrj.org

Research Article

ISSN: 2455-8990
CODEN(USA): CRJHA5

Comparative Effect of Intrinsic and Extrinsic Motivation on Secondary School Students' Achievement and Retention in Chemistry in Ogidi Education Zone of Anambra State

Udegbunam Chiemeka Anastasia

Department of Chemistry, Nwafor Orizu College of Education, Nsugbe
E-mail: udegbunamchiemeka@gmail.com; 08037644064

Abstract
This study examined the comparative effect of intrinsic and extrinsic motivation on secondary school students' achievement and retention in Chemistry in Anambra State. It was quasi-experimental, non-randomized control group design. The study was guided by two research questions and two null hypotheses. The population of the study consisted of 2,154 (1,141 females and 1,013 males) Senior Secondary (SS) 1 Chemistry students in 26 state owned co-educational secondary school in Ogidi Education Zone of Anambra State. Simple random sampling technique (balloting without replacement) was used to select two out of the three local government areas in Ogidi Education Zone. The sample of the study consists of one hundred and fifty-eight (158) (76 males and 82 females) Chemistry students. A Simple random sampling technique (balloting without replacement) was used also to select 4 schools while a flip of a coin was used to assign two of the schools to intrinsic group and the other two to the extrinsic group. Chemistry Achievement Test (CAT) developed by the researcher was used as the instrument for data collection. The instrument was duly validated by three expects and the reliability index of .81 was obtained using Pearson Product-Moment Correlation Coefficient (PPMCC). Mean and Standard Deviation was used to answer the research questions while t-test was used to test the null hypotheses at .05 level of significance. The findings of the study showed that the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy was higher than those taught applying extrinsic motivational strategy. The result also showed that the mean retention scores of students taught Chemistry applying intrinsic motivational strategy was higher than those taught applying extrinsic motivational strategy. There were significant difference between the mean achievement and mean retention scores of students of both type of motivation in favour of intrinsic motivation group. Based on the findings, it was recommended that secondary school Chemistry teachers should be encouraged to adopt intrinsic motivational strategy in the teaching of Chemistry. Based on the findings also, conclusion and recommendations were made.

Keywords: Intrinsic and Extrinsic Motivation, Achievement, Retention and Chemistry

Introduction

Chemistry is one of the science subjects taught in senior secondary schools. Chemistry is a branch of pure and basic science which deals with the study of nature, composition, properties (physical and chemical) and uses of matter, and the changes matter undergo under different conditions. Chemistry in its entirety has a central role to play in

promoting sustainable development through basic research skills, chemical innovations and technology (Nnoli, & Ikokwu, 2018).

The universe is subject to the laws of Chemistry, while human beings depend on the orderly progress of chemical reactions within their bodies. Described as the central science, Chemistry connects physical sciences with the life sciences and applied sciences. Chemistry has applications in food, medicine, industry, the environment, and other areas. Learning Chemistry allows students to learn about the scientific method and gain skills in critical thinking, deductive reasoning, problem-solving and communication. Teaching Chemistry to students at a young age can increase student's interest in science-based careers. Chemistry also provides students with many transferrable skills that can be applied to any career.

Chemistry has been identified as a very important school subject and its importance in scientific and technological development of any nation has been widely reported (Fakeye, 2017 and Adesoji, 2018). The study of Chemistry is essential for the nation's scientific and technological developments. For instance, the knowledge of Chemistry is brought to play in the areas of manufacturing and processing industries, medicine, food production and pharmaceutical among others. It aids in textile industry, shelter, provision of ammunition for the military, medicine, transportation and others (Ufondu, 2019). Chemistry also enhances the country's economic empowerment. Without sound knowledge and wholesome attitude towards Chemistry, the much-needed technological breakthrough may not be achieved. The inclusion of Chemistry as a core science subject in secondary schools in Nigeria and requirement for many science-based carriers call for the need to teach it effectively. This is because effective science teaching leads to the attainment of scientific and technological greatness (Hussain, 2011). In spite of the relevance of Chemistry in the life of the society, the study of Chemistry in our secondary schools is challenged with poor achievement and lack of interest on the part of students, (Uchegbu, Anozieh, Mbadiugha, Ibe & Njoku, 2015).

In Nigeria, students' achievement in Chemistry has not been encouraging in the senior secondary school certificate examinations. There has been a decline in the performance of students in public examinations conducted by the West African examination council (WAEC) and National Examination Council (NECO) in Chemistry across the country over the years (Uchegbu, et al., 2015). This is evidently shown in Table 1 below. The table shows performance of students in WAEC for eleven consecutive years. Using the statistics in Table 1 as a case study of performance of students in Chemistry examination in secondary schools in Nigeria, it is very clear that general performance of students have not been excellent. It was only in the year 2013 that the percentage performance was above 70% that is 72%. A good percentage of students failed Chemistry and this is tantamount to drop in science related professions.

Table 1: Statistics of Students' Academic Performance in WAEC Chemistry (2008-2018).

Year	Total Sat	Credit	Passed (A1-	C6)	% Pass	Below Pass (D7-F9)	% Below Pass
2008	456980		202762		44.47	254218	55.53
2009	456980		203365		44.49	253615	55.51
2010	465643		263059		50.70	202584	49.3
2011	565692		280250		49.54	285442	50.46
2012	627302		270570		43.13	356732	56.87
2013	639296		462517		72.34	176779	27.66
2014	639268		397649		62.49	241619	37.51
2015	680357		412323		60.60	268034	39.4
2016	706873		408122		57.74	298751	42.26
2017	704494		441576		62.68	262918	37.32
2018	728998		451614		61.95	277384	38.05

Source: Statistics Section, WAEC Office, Yaba Lagos (2018)

Furthermore, WAEC Chief Examiners' report (2018) pointed out that Chemistry students have poor knowledge of acids, bases and acid-base reactions and are unable to report results of acid-base titration experiments, unable to make calculations on molar and mass concentration. These topics are fundamental and basic concepts in Chemistry. Judging from the percentage analysis of those who passed Chemistry at credit level over the years, there has not been consistent increase in the percentage of students who enrolled and passed at credit level. From 2008-2012, the percentage of those who passed at credit level was below 50% except in 2011. From 2013 to 2018, although, the percentage of those who passed at credit level was above 50%, still a good number of the registered student failed it resulting to dropout in science careers.

Chemistry teaching and learning can only be result-oriented when students are willing and teachers are favourably disposed using the appropriate strategies. Some factors have been identified as the cause of students' under-achievement in the science subjects including Chemistry. These factors include poor teaching method and strategies, poor motivation of students, poor teachers and students' attitude to science and students' lack of interest among others (Onunkwo, 2019 & Unegbu, 2016). Consequently, students coming into senior secondary school develop phobia for Chemistry. There is need to fight against this noted under-achievement of students in Chemistry for the growth of the country technologies. One of the means to reverse the phobia in Chemistry may be by teaching students in secondary schools with strategies that will ignite their motivational emotions which can provoke their interest and motivate them to learn Chemistry.

The series of conferences that were organized by Science Teachers Association of Nigeria (STAN) among others are in most cases geared towards acquainting serving teachers and educationist with the current curricula innovations in the area of instructional strategies. Little or no attention was paid on student's motivation. Without motivation on the part of students, teacher's effort to make students learn will be in vain. An area of concern which needs utmost attention is students' motivation to learn (Nnoli, 2014). Steinmayr, Weidinger, Schwinger and Spinath (2019) reported that students' motivation energizes and directs their behavior toward achievement which made it an important determinant of academic success. Motivation is described as a state that energizes, directs and sustains behavior. Motivation involves goals and requires activity. Goals provide the impetus for and the direction of action, while action entails effort: persistence in order to sustain an activity for a long period of time (Harandi, 2015).

Motivation is referred to as complex forces, drives, eagerness, desire, needs, tension states or other mechanism that starts and maintains activity towards the achievement of personal goals. According to Luthans (2012), motivation is a process which starts with physiological or psychological deficiency or need that activates a behaviour or drive which is aimed at a goal or incentives. Motivation is a central concept in human acquisition of skill, performance and competencies (Kempa, 2019). It is central to success of school learning. Motivation is the reason why somebody does something or behaves in a particular way. Motivation is considered as one of the fundamental factors that determine students' academic accomplishment (Mauludin, 2021). Motivation is an internal process that endow students with the drive and direction needed to engage with academic activities in an adaptive, open-ended, and problem-solving sort of way (Aboyinga & Nyaaba, 2020). Motivation is the word derived from the word 'motive' which means needs, desires, wants or drives within the individuals. It is the process of stimulating people to actions to accomplish goals (Wijnia, 2020).

Motivation determines the specific academic goals towards which students strive; thus, it affects the choices students make. Motivation also leads to increased effort and energy. Srisawasdi and Panjaburee (2019) noted that motivation determines whether a student will pursue a task (even a difficult one) with enthusiasm or a lacklustre attitude. Motivation increases the initiation and persistence of school activities (Salta & Koulougliotis, 2020). Motivation is important in getting students to engage in academic activities. It is also important in determining how much learners will learn from the activities they perform and the information to which they will be exposed to. Learners who are motivated to learn something use higher cognitive processes in retaining the concepts learnt. Motivation to do something can come about in many ways. It can be a personality characteristic or a stable long-lasting interest in doing something. It is pertinent to note that achieving high level of motivation in the classroom leads to higher levels of understanding and retention (Nakata, Nitta & Tsuda, 2020), creativity (Gibbens, 2019), and achievement (Anwar, Asari, Husniah & Asmara, 2021). Students' motivation is not a single construct but rather

subsumes a variety of different constructs like motivational beliefs, task values, goals, and achievement motives (Wigfield & Cambria, 2010; Wigfield, Tonks, & Klauda, 2016).

Motivation is not only important in its own right; it is also an important predictor of learning and achievement. Students who are more motivated to learn persist longer, produce higher quality effort, learn more deeply, and perform better in classes and on standardized tests. Students' motivation towards science learning has contributed a considerable impact on students' achievement and retention in science concept (Ibrahem & Alamro, 2021). The academic achievement and success of the students is important because it is strongly linked to the positive outcomes we value the most in students. Researches show that academically successful students will have more employment opportunities than those with less education. Academically successful students are more stable in their employment; more likely to have health insurance; less dependent on public assistance; less likely to engage in criminal activity; more active as citizens and charitable volunteers and healthy (Somers & Llinares, 2021). Moreover, academically successful students may also be able to contribute to the country's human capital growth which is in line with the national vision and mission. Finding ways to increase student's motivation is crucial because it allows the teacher to change behavior, develop competencies, be creative, set goals, grow interests, make plans, develop talents, and boost engagement (Eya, Attah, Ijeoma & Ugwuanyi, 2020).

There are two types of motivation: intrinsic and extrinsic motivation.

Intrinsic motivation is a force or drive in a person when one finds a task interesting and enjoyable. When one is intrinsically motivated, the rewards are internal. Intrinsic motivation refers to engagement in behaviour that is inherently satisfying or enjoyable (Legault, 2016). The force or drive behind such action is driven by an interest or enjoyment in the task itself. It exists within the individual rather than relying on any external pressure (Benabou & Tirole in Legault, 2016). When one is intrinsically motivated, one's behavior is motivated by internal desire to do something for its own sake. For example, one's personal enjoyment of an activity, or desire to learn a skill because you're eager to learn. Examples of intrinsic motivation could include reading a book because it is enjoyable, exercising to relieve stress and cleaning the home because it helps feel organized.

In a traditional classroom, teachers need to encourage students with intrinsic motivation (Sanacore, 2018). Intrinsic motivation stems from factors such as interest or curiosity (Woolfolk-Hoy & Hoy, 2019). In order to motivate, teachers must encourage and challenge their students (Sanacore, 2018). Students presented with too easy or too difficult material will eventually become bored and unmotivated. In a traditional classroom, teachers must differentiate activities in order to place some power into the hands of the students. Great motivators in traditional classroom should encourage students to love learning and help students maintain high self-efficacy beliefs (Linnenbrink & Pintrich, 2013). This often proves to be the most difficult task for some teachers. To motivate students, teachers must rely on students' interest and what they already know and with which they are successful. Instead of memorizing facts for a test, teachers want their students to retain the information longer than a week. Teachers find it difficult to teach more and more curriculum (Wolfe, 2011). Just covering the expanse curriculum does not build strong connections in student's memory. Teachers must bring in motivation initiative in teaching to help students retain the necessary knowledge.

Extrinsic motivation is a desire or drive to perform a task or engage in anything in order to get prizes or money among others. Extrinsic motivation focuses on rewards or incentives. Extrinsic motivation refers to performance that is fundamentally contingent upon the attainment of an outcome that is separable from the action itself (Legault, 2016). It refers to the performance of an activity in order to attain an outcome, which then contradicts intrinsic motivation (Reiss in Legault, 2016). When students are extrinsically motivated, their actions are motivated by an external factor pushing them to do something in hopes of earning a reward or avoiding a less-than-positive outcome. Examples of extrinsic motivation could include reading a book to prepare for a test, exercising to lose weight and cleaning the home to prepare for visitors coming over. Obviously, because human memory is imperfect, there is a constant need for educators to find effective and creative extrinsic motivational strategies to support the long-term preservation of knowledge in their students (Alexander, Wyatt-Smith & Du-Plessis, 2020). This is because students may choose to retain a given knowledge not because they enjoy them or find them satisfying, but in order to get something in return or avoid an adverse outcome.

Intrinsic and extrinsic motivation can be used very effectively in a variety of classroom activities to create and enhance drive to learn. According to Ogoma (2016), academic achievement and knowledge retention is not just dependent on individual abilities and inspiration but also on motivation. Because knowledge retention is the process by which new information is transferred from the short-term to long-term memory, motivation can enhance or diminish the force that leads to retention (Oktay & Çakir, 2013). In fact, it can sometimes be extremely beneficial, particularly in situations where students need to complete a task that they find unpleasant. In the classroom, just as in real life, there are many things we have to do that, if given the choice, we would not. Sometimes the right incentive serves as the hook that gets students invested in learning. Motivation is particularly important for achievement and retention in science and lack of motivation is a primary reason for students dropping out (Khalil & Ebner, 2014). Yuan and Powell (2013) argued that there might be different factors that influence students' motivation level, including "future economic benefits, development of personal or professional identify, challenge and achievement, enjoyment and fun".

There has been instances where punishments have not had the desired effect, in fact, it can make children to be rebellious at times. However, it is better to focus on the positives and encourage them in a useful way to ensure good behaviour and achievement. According to Dohim (2015) and Chima (2013), motivational strategies are more effective than punishment strategies in increasing and shaping drive in any learning environment. Motivation in certain ways has been observed to be more effective than punishment (Dennis, 2019). Using motivational strategies in the classroom helps to improve students' strength to the fullest, improve classroom behaviour and increase interest and achievement, cause students to believe that he or she is capable of learning where he or she may not have believed in the past, diagnose any specific difficulties inhibiting students' learning, arouse students' interest and curiosity (Chapman, 2017).

Furthermore, in accord with existing literature that finds out that motivation impacts on students' engagement and outcomes, Martin and Dowson (2019) observed that motivation predicts students' course engagement; and student engagement predicts their achievement and retention in the course. Therefore, it is obvious that motivation encourage hands on learning and also it is vital for students' high achievement in Chemistry. Despite all the important of motivation, it is still observed that senior secondary school teachers don't apply motivational strategy during their teaching. That is why the researcher choose to carry out this research work in order to motivate them to always do so. This study aims at determining the comparative effect of intrinsic and extrinsic motivation on students' achievement and retention in Chemistry.

Academic achievement is one of the variables in this study, academic achievement is a measure of learner's level of knowledge, skills or performance. Achievement is the result, the successfulness, the extent or ability, the progress in learning educational experiences that the individuals indicate in relation with his/her educational learning (Engida,2012). It is the extent of accomplishment or failure of goal in a particular content that the student has earlier been exposed to (Oviawe, 2021). Achievement according to Spinath (2012) represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Achievement is the ability of somebody to gain or reach a set goal through effort, skill or courage. It implies the art or process of finishing something successfully. Achievement is generally used to determine how well an individual is able to assimilate, retain, recall and communicate knowledge of what has been learnt (Nwalo & Eze, 2021). Achievement is usually measured using test and/or examinations. The poor achievement in Chemistry basically may largely be attributed to the inadequate or total absence of motivational strategies and teacher's attitude towards motivation of students as seen in several types of research on achievement (Omoniyi & Torru, 2019). The use of motivational strategies in teaching and learning Chemistry improves academic achievement. However, poor learning environmental conditions without motivational strategies contributes a lot to forgetfulness which invariably leads to poor achievement as well as retention in Chemistry. Knowledge gained can become worthless if it is not retained so as to be useful in future. This study aims to investigate the effect of intrinsic and extrinsic motivation on students' achievement and retention in Chemistry.

Retention is the ability to recall or recognize what has been learned or experienced or memory of something retained. Retention is an individual's ability to remember and recall information, materials and experiences learned over time. It is also the ability to store what has been learnt and recall what has been stored in the memory. Eze,

Obidile and Okotubu, (2020) reiterated that retention of learned material is simply the ability to remember what has been learnt. Eze, Ezenwafor, and Molokwu (2015) reaffirmed that retention is the ability to retain the knowledge of what is learnt and to be able to recall it when it is required. Knowledge retention is the capability to absorb what has been studied and recall what has been understood and kept in the memory for utilization when the need arises. According to Bichi in Ibe (2021), retention is the ability to retain and later remember the information or knowledge gained after learning into memory. The nature of the resources to be coded contributes to the level of retention (Ibrahim, 2012). Retention is, therefore, the ability to recall learning experiences after about three weeks of learning and beyond. Lack of motivation in the process of teaching and learning Chemistry can lead to poor retention of learned concept. Attah (2014) noted that retention is high when the degree of original information is high. In other words, teaching anchored in motivation leads to effective learning that results to high academic achievement and retention. Motivation is an ingredients to the quality and level of retention because using motivation in the learner's learning process makes students to become more active in the teaching/learning process. This is because applying motivational strategies make students to become more active in the teaching/learning process and retain what is taught. This study wish to determine the effect of motivational strategies (intrinsic and extrinsic) on secondary school students' achievement and retention in Chemistry.

Maslow's (1954) need-based theory of motivation is the most widely recognized theory of motivation and perhaps the most referenced of the content theories. According to this theory, a person has five fundamental needs: physiological, security, affiliation, esteem, and self-actualization. Maslow describes a pyramid comprising a series of layers from the base with the most fundamental physiological needs such as food, water, shelter and sex, rising to the apex where self-actualization needs which includes morality and creativity. Maslow saw these levels of needs being fulfilled one at time in sequence from the bottom to the top. Achievement and the rewards it brings are classified under safety needs level while the classroom which contributes to the sense of belonging and recognition are classified as the need for self-esteem level.

The physiological needs are food, shelter and clothing, good and comfortable work conditions etc. These are basic human needs necessary for existence and survival. The security needs are the need for safety, fair treatment, protection against threats, job security etc. Affiliation needs include the needs of being loved, accepted, part of a group while esteem needs include the need for recognition, respect, achievement, autonomy, independence. Finally, self-actualization needs, which are the highest in the level of Maslow's need theory, include realizing one's full potential or self-development. It is called the pinnacle of one's calling. According to Maslow, once a need is satisfied, it is no longer a need. It ceases to motivate one's behaviour, instead lead to motivation of the next level up in the hierarchy. All these needs gear towards human development and survival and have implication in the education of oneself.

Maslow's theory emphasizes that motivation to work is rooted in the fulfilment of various categories of needs which range from philological to self-actualization. The importance of Maslow's theory for education is the relationship between deficiency needs and growth needs. A hungry child is weak, irritable, rustlers, uninterested in what is going on around him. Inattentive students who are very hungry or in physical danger will not be interested in learning. If the basic needs of students are not met, learning will suffer. But when students is motivated well with food by the parent, their achievement and retention tends to improve well.

A learner that has been denied of good ventilation soon falls asleep because of lack of oxygen in the brain. It is very obvious that learners that are deprived any of these needs cannot learn effectively. Parents and school principals must ensure that these physiological needs are provided for children. Malnutrition retard growth and general development of children so parents should be encouraged to provide proper meals for lunch while in school. Activity and rest are essential for healthy growth and activities build muscles, foster physical endurance and provide an opportunity to practice the physical, skill of balance, timing and co-ordination. Activity offers opportunities for social skills, cooperation, team spirit, conversation, mutual respect, friendliness, courtesy, healthy competition, all of which give personal satisfaction to the learner. Sex drives are biologically based, so sex education is essential to help student understand and to express sex drive properly in accordance with societal and religion norms. When students are motivated with good ventilation, the atmosphere will be conducive for them to learn.

The leaner also craves for social recognition, attention and high esteem from teachers, parents, peers and seniors. The learner wants some assurance that he will pass the examination and attain the deserved goals. Constant denigration and threats of failure from the teacher can devastate the leaner and threaten their sense of security. Teachers need to give children a sense of hope rather than give them the impression that they will fail and drop out of school. Teachers should show students love and affection. Rejection puts students off and kills pride and a sense of self-worth. Love should be shown to all students and a teacher should not demonstrate clear love for some students while he shows definite hatred for others. When these needs are met, students will move to the need to know and understand, hence, their achievement and retention will be improved. In school, most of these needs are not met resulting to poor achievement and low retention among students. In view of the above, this study wish to determine how intrinsic and extrinsic motivation are able to improve secondary school students' achievement and retention in Chemistry.

Uzezi and Jonah (2017) examined the effect of Brain-Based Learning strategy on students' academic achievement, attitude, motivation and knowledge retention in ElectroChemistry Potiskum Educational Zone, Yobe state. The study used a pre-test-post-test quasi-experimental design. Three research questions and hypotheses guided the study. 87 sampled SS 2 Chemistry students (40 for experimental group and 47 for control group) were used for the study. The instrument of 25 items with reliability value of 0.78, which was established using Kuder-Richardson formula 20 (KR-20) was used for the study. Data were collected through achievement test, attitude and motivation scales. The data collected were analyzed with means, independent t-test, and Analysis of Covariate which were used to compare the groups' scores. The findings of the study reve¬aled that the Brain-Based Learning approach used in the experimental group was more effective in incre¬asing student achievement, attitude and motivation of students towards Chemistry than the Lecture-Based approach used in the control group. It was identified that the difference between retention test scores were also statistically significant in favour of experimental group. Hence, this study is related to the present study, but this present study focused on motivational strategy instead of Brain-Based Learning strategy. The area of the study and population size are also different from the present study.

Statement of the Problem

Motivation is a state that energizes, directs and sustains behaviour. Motivation is an indispensable tool to learning situations. However it is most times forgotten by teachers, instead teachers are more at ease to use punishment. Lack of motivational strategies in the teaching and learning process may have been responsible for the poor achievement and low retention of knowledge among students. An efficient and effective teacher can lift up the moral of the students using motivational strategy in their process of teaching. Chemistry is verse and abstract in nature as well as activity oriented. It needs motivational strategy that can create the desire to learn them and meet the needs of the students. The use of motivation (intrinsic or extrinsic) may be a solution to the problems of poor achievement and low retention in learning Chemistry. Motivation takes care of the needs of students which could lead to self-actualisation. Motivation enhances the ability to retain learned ideas because it energizes students actively during the learning process. Thus, the problem of the study if put into question is: What is the comparative effect of intrinsic and extrinsic motivation on students' achievement and retention in Chemistry?

Purpose of the Study

The purpose of the study is to ascertain the comparative effect of intrinsic and extrinsic motivation on secondary school students' achievement and retention in Chemistry in Ogidi Education zone. Specifically, the study seeks to:

i. Compare the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

ii. Compare the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy?
2. What are the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy?

Hypotheses

The following hypotheses guided the study at .05 level of significance:

1. There is no significant difference between the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.
2. There is no significant difference between the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

Method

The study adopted quasi experimental research design. This is in support of Nworgu (2015) which stated that quasi-experimental design is where random assignment of subjects to experimental or control groups is not possible rather intact classes are used. It is quasi-experimental because treatment groups was used. The population of the study comprised all the 2,154 (1,141 females and 1,013 males) SS 1 Chemistry students in public secondary schools in Ogidi Education Zone of Anambra State. A total of 158 (76 males and 82 females) SS1 Chemistry students were selected by simple random sampling technique. The instrument for data collection was Chemistry Achievement Test (CAT) which consisted of 25 multiple choice items. CAT was divided into two sections; Section A was designed to get bio data of the students and Section B contained the objective questions. CAT was used for achievement and retention tests. The instrument was validated by three experts drawn from department of Chemistry and Education Foundation of Nwafor Orizu College of Education, Nsugbe. Pearson Product Moment Correlation was used to establish the reliability of the instrument with an overall reliability coefficient of .81 which was considered adequate for the study. The experimental procedure was conducted in two phases. The first phase was training of the research assistants who were the regular Chemistry teachers of the sampled students. The second phase involved teaching of the students and administration of the instrument (CAT) by the class teachers. Research assistants were guided by the researcher who organised three days training for them on how to use the lesson plan prepared by the researcher. Research assistants gave both group of student the instrument to serve as their pre-test before teaching. Research assistants used the same lesson plan but different method, taught for 2 weeks after which the instrument was rearranged and served as post-test. After 2 weeks, it was rearranged again which was given to the same groups to serve as the retention test. Data collected were analyzed using mean, standard deviation and t-test. Mean and standard deviation was used to answer research questions while t-test was used to test the null hypothesis at .05 level of significance.

Result

Research Question 1

What are the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy?

Table 2: Pre-test and Post-test Mean and Standard Deviation Scores of the Achievement scores of Students Taught Chemistry Applying Intrinsic Motivational Strategy and those Taught Applying Extrinsic Motivational Strategy.

Motivational Strategies	Pre-test			Post-test			Mean Gain Score
	N	Mean $\bar{X}$	SD	N	Mean $\bar{X}$	SD	$\bar{X}$
Intrinsic	81	22.32	15.24	81	72.20	13.23	49.88

Extrinsic	77	21.97	12.54	77	67.45	12.09	45.48
Total	158			158			

The results in table Table 2 showed that the pre-test and post-test mean achievement scores of students taught Chemistry applying intrinsic motivational strategy were 22.32 and 72.20 respectively while the standard deviation scores were 15.24 and 13.23 respectively. On the other hand, pre-test and post-test mean achievement scores of those taught Chemistry applying extrinsic motivational strategy were 21.97 and 67.45; and the standard deviations were 12.54 and 12.09. The standard deviation scores for the pre-test for both strategies were higher than the standard deviations for the post-test. This suggests more variability in the pre-test scores of the students than the post test scores.

The mean gain score for students taught Chemistry applying intrinsic motivational strategy was 49.88 while that of their counterpart was 45.48. This represents a mean difference of 4.75 in favour of students taught Chemistry applying intrinsic motivational strategy which implies that students taught Chemistry applying intrinsic motivational strategy achieved better than those taught Chemistry applying extrinsic motivational strategy.

Research Question 2

What are the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy?

Table 3: Mean and Standard Deviation Scores of the Retention Score of Students Taught Chemistry Applying Intrinsic Motivational Strategy and those Taught Applying Extrinsic Motivational Strategy.

Motivational *Strategies*	**N**	**Mean** $\overline{\mathbf{X}}$	**SD**	**Mean Difference** $\overline{\mathbf{X}}$
Intrinsic	81	63.21	9.26	
				6.38
Extrinsic	77	56.83	8.49	
Total	158			

Table 3 shows that the mean retention scores of students taught Chemistry applying intrinsic and extrinsic motivational strategies were 63.21 and 56.83 respectively. The standard deviation scores for the two strategies were 9.26 and 8.49, indicating that students taught Chemistry applying intrinsic motivational strategy had slightly more variability in their retention scores. The difference in mean retention score of 6.38 implies that students taught Chemistry applying intrinsic motivational strategy had better retention in Chemistry than their counterparts taught applying extrinsic motivational strategy.

Hypotheses Testing

Hypothesis 1

There is no significant difference between the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

Table 4: t-test Comparison of the Mean Achievement Scores of Students Taught Chemistry Applying Intrinsic Motivational Strategy and those Taught Applying Extrinsic Motivational Strategy.

Motivational Strategies	**N**	**Mean**	**SD**	**df**	***t*-cal**	***P*-va**	**Decision**
Intrinsic	81	72.20	13.23	156	2.35	.020	Significant
Extrinsic	77	67.45	12.09				

The results presented in Table 4 show there was a significant difference in the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy, t (df,156)= 2.35, p-value = .020. Since the p-value was less than .05 level of significance stipulated, the null

hypothesis was rejected. This implies that the mean achievement scores of students taught Chemistry applying intrinsic motivational strategy (Mean = 72.20) was significantly greater than the mean achievement scores of those taught applying extrinsic motivational strategy (Mean = 67.45).

Hypothesis 2

There is no significant difference between the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

Table 5: t-test comparison of Mean Retention Scores of Students Taught Chemistry Applying Intrinsic Motivational Strategy and those Taught Applying Extrinsic Motivational Strategy.

Motivational Strategies	N	Mean	SD	df	*t*-cal	*P*-va	Decision
Intrinsic	81	63.21	9.26	156	4.51	.000	Significant
Extrinsic	77	56.83	8.49				

Table 5 shows there was a significant difference in the mean retention scores of students taught Chemistry applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy, t (df,156)= 4.51, p-value = .000. The null hypothesis was therefore rejected since the p-value was less than .05 level of significance stipulated. This indicates that the mean retention scores of students taught Chemistry applying intrinsic motivational strategy (Mean = 63.21) was significantly greater than the mean retention scores of those taught applying extrinsic motivational strategy (Mean = 56.83).

Discussion

The discussion of findings is organized under the following:

1. Students taught Chemistry applying intrinsic motivational strategy achieved more than those taught Chemistry applying extrinsic motivational strategy. The difference in the achievement was found to be significant in favour of students taught Chemistry applying intrinsic motivational strategy. Thus, applying intrinsic motivation enhanced students' achievement.
2. Students taught Chemistry applying intrinsic motivational strategy had higher retention score than those taught Chemistry applying extrinsic motivational strategy. The difference in retention was found to be significant in favour of students taught Chemistry applying intrinsic motivational strategy.

Students taught Chemistry applying intrinsic motivational strategy achieved more than those taught Chemistry applying extrinsic motivational strategy. The difference in the achievement was found to be significant in favour of students taught Chemistry applying intrinsic motivational strategy.

The findings of the study showed that students taught Chemistry applying intrinsic motivational strategy scored higher in achievement than those taught Chemistry applying extrinsic motivational strategy. Also the teaching of Chemistry applying intrinsic motivational strategy showed significant difference on students' achievement in Chemistry than those taught applying extrinsic motivational strategy. The finding was in conformity with the findings of Afzal, Ali, Khan & Hamid (2010) who observed that students taught applying intrinsic motivational strategy performed better than students taught applying extrinsic motivational strategy. Also, the findings of the study were in line with the studies of Wang, Hwang, Yin and Ma (2020), who reported that there was a significant effect in students' achievement when they are taught applying intrinsic motivational strategy than those taught applying extrinsic motivational strategy.

The finding of this study was in contrary to the work done by Ibrahim (2012) who reported that there was no significant effect on students' achievement in Physics between students taught applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy. Intrinsically motivated students performed better academically, and achievement remained consistent while extrinsically motivated students performed well for a short period (to achieve the reward) with inconsistent achievement overall. Students participated fully in the

classroom because they enjoy studying Chemistry. Therefore, application of intrinsic motivational strategy encourages students' participation and brings learning home which improves and enhances students' achievement.

Students taught Chemistry applying intrinsic motivational strategy had higher retention score than those taught Chemistry applying extrinsic motivational strategy. The difference in retention was found to be significant in favour of students taught Chemistry applying intrinsic motivational strategy.

The findings of the study showed that students taught Chemistry applying intrinsic motivational strategy showed higher retention than their counterparts taught applying extrinsic motivational strategy. The result showed a statistically significant difference in retention between the two groups in favour of the intrinsic group. This result is in conformity with the findings of Emeka and Okeke (2020), who reported that students taught applying intrinsic motivational strategy perform excellently well and retain what they had been taught than students taught applying extrinsic motivational strategy. The result is also in support of Wang, Hwang, Yin and Ma (2020) who revealed that there was significant difference in the mean retention of students taught science subjects applying intrinsic motivational strategy and those taught applying extrinsic motivational strategy.

Chemistry is an experimental science. When Chemistry is taught when students are motivated through the use of motivational strategies, especially applying intrinsic motivational strategy, students tend to remember what was taught.

Conclusion

Whatever, the constraint involved in the teachers' attempt to efficiently motivate students' responses for effective learning, we have to accept that motivation is an important concept in psychology whose relevance to teaching and learning is underscored every day in every classroom. Its knowledge is worthwhile for a professional teacher. Thus, based on the findings of this study, the following conclusions were drawn: Applying intrinsic motivational strategy while teaching Chemistry is effective for meaningful learning to occur. The Chemistry students taught applying intrinsic motivational strategy achieved higher than those taught applying extrinsic motivational strategy.

Secondly, the application of intrinsic motivation enhances students' retention of Chemistry. Thus, based on this study, the application of intrinsic motivation is very effective in learning. It helps to improve students' achievement and retention in Chemistry. By employing motivational strategies in teaching and learning process, the students will be able to make science great visionaries.

Recommendations

The following recommendations were made in the light of the findings of the study:

1. Chemistry teachers should apply intrinsic motivational strategy in the teaching and learning of Chemistry.
2. It is important that teachers should provide as many opportunities as possible for catching children doing good things in the classroom and making positive comments to motivate the behavior exhibited.
3. It is also important to sensitize teachers that adequate use of motivation could serve as a basis for improving students' achievement and retention.
4. Ministry of education (federal and state) should organize seminars and workshops to keep teachers abreast of the applications of motivational strategies for instruction delivery.
5. School administrators should also provide financial support for the acquisition of the educational materials that their teachers can make use of.

References

[1]. Aboyinga, J., & Nyaaba, M. (2020). Factors that ensure motivation in virtual learning among college of education students in Ghana: the emergency remote teaching during covid'19 pandemic. European Journal of Research and Reflection in Educational Sciences, 8(9) 34-67.

[2]. Adesoji, J. (2018). Student, teacher and school environmental factors as determinants of achievement in senior secondary school Chemistry in Oyo State, Nigeria. Journal of International Social Sciences 1(2), 9-11.

[3]. Afzal, H., Ali, I., Khan, M., & Hamid, K. (2010). A study of university students' motivation and its relationship with academic performance. International Journal of Business and Management, 5(4): 80-88.
[4]. Alexander, C., Wyatt-Smith, C., & Du Plessis, A. (2020). The role of motivations and perceptions on the retention of in-service teachers. Teaching and Teacher Education, 96: 103186.
[5]. Anwar, K., Asari, S., Husniah, R., & Asmara, C. H. (2021). Students' perceptions of collaborative team teaching and student achievement motivation. International Journal of Instruction, 14(1), 325-344.
[6]. Chang, E. (2013). A social psychological model of women's gender-typed occupational mobility. Career Development International, 8:27-39.
[7]. Chapman, S.O. (2017). Positive reinforcement in the classroom. Retrieved from www.buzzle.com.
[8]. Chima, P. (2013). Learning behavior 5th Edition Australia: Wadworth publishing.
[9]. Dennis, M. (2019). Rewards and punishment in intermediate schools. Journal of English Education 1(5): 45-61.
[10]. Dohim, L. (2015). Gifted students' intrinsic and extrinsic motivations and parental influence on their motivation: From the self-determination theory perspective. Journal of Research in Special Educational Needs, 16(1): 13-23.
[11]. Emeka, S.O. & Okeke, C.G. (2020). Comparative effect of extrinsic and intrinsic motivation on students' interest and retention in Chemistry. Unpublished B.Sc. Project, University of Nigeria, Nsukka.
[12]. Engida, T. (2012). Development of low-cost educational materials for Chemistry. Africa Journal of Chemistry Education. 2(1): 51-53.
[13]. Eya, N. M., Attah, F. O., Ijeoma, H. N. & Ugwuanyi, C. S. (2020). Socio-Psychological factors as correlates of students' performance in Chemistry: implication for science and engineering education. International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), 10: 239-248.
[14]. Fakeye, D.O. (2017). Teacher questioning behavior and classroom interaction patterns. Journal of Humanities and Social Science, 2(1): 127-131.
[15]. Gibbens, B. (2019). Measuring students' motivation in an introductory Biology class. The American Biology Teacher, 81(1):20–26.
[16]. Harandi, S. R. (2015). Effects of e-learning on students' motivation. Procedia-Social and Behavioral Sciences, 181: 423-430.
[17]. Hussain, L. (2011). The effects of classroom interaction on students' achievement at secondary school level. Mediterranean Journal of Social Sciences 2 (3): 115-145.
[18]. Ibe, F. (2021). Effect of improvised instructional materials on students' achievement and retention in Chemistry in secondary schools. Unpublished M.Ed. Thesis, Chukwuemeka Odumegwu Ojukwu University, Uli.
[19]. Ibrahem, U. M., & Alamro, A. R. (2021). Effects of infographics on developing computer knowledge, skills and achievement motivation among Hail university students. International Journal of Instruction, 14(1): 907-926.
[20]. Ibrahim, A. (2012). The role of the laboratory in the teaching of Chemistry in Nigeria. Poster Paper Presented at Kano State Polytechnic, 3 (2): 61-63.
[21]. Kempa, C. (2019). What is reinforcement? Retrieved 9th March, 2013 from Advanced Psychology Org.
[22]. Khalil, H. & Ebner, M. (2014). MOOCs completion rates and possible methods to improve retention - A literature review. In EdMedia, 1305–1313. Tampere, Finland.
[23]. Legault, L. (2016). Intrinsic and extrinsic motivation, Clarkson University, Potsdam, NY, USA https://www.researchgate.net/publication/311692691_Intrinsic_and_Extrinsic_Motivation
[24]. Luthans, F. (2012). Organizational behavior (7th Ed.). McGraw-Hill, Inc. New York, USA; 141- 165.
[25]. Martin, A. J. & Dowson, M. (2019). Interpersonal relationships, motivation, engagement, and achievement: Yields for theory, current issues, and educational practice. Review of Educational Research, 79(1): 327–365.

[26]. Maslow, A. H. (1954). A theory of human motivation psychological review. Australia: Wade worth Publishers.
[27]. Mauludin, L. A. (2021). Students' perceptions of the most and the least motivating teaching strategies in ESP classes. Iranian Journal of Language Teaching Research, 9(1): 139-157.
[28]. Nakata, Y., Nitta, R. & Tsuda, A. (2020). Understanding motivation and classroom modes of regulation in collaborative learning: An exploratory study. Innovation in Language Learning and Teaching, 1-15.
[29]. Nnoli, J. N. & Ikokwo, I. P. (2018). Construction in science; implication for skill acquisition in meeting the vision of NEEDS and MDES. Journal of Science Education 1(2):121 – 127.
[30]. Nnoli, J.N. (2014). Teaching Chemistry for creativity. The effect of the use of improvised organic reagents on students' achievement in Chemistry. In Z.C. Njoku (Ed), 55th Annual Conference Proceedings of STAN (265-270). Ibadan: Hern, Publisher Plc
[31]. Nwalo, C. N. & Eze, T. I. (2021). Effects of project and demonstration teaching methods on male and female students' achievement and retention in basic electricity in technical colleges. Advances in Research, 50-62.
[32]. Nworgu, B. G. (2015). Educational research: Basic issues and methodology. Nsukka, University Trust Publishers.
[33]. Ogoma, M. P. (2016). Reinforcement in education. Retrieved from vitucepogol e g mail.com.
[34]. Okebukola, P. A. O. (2008). Education reform: Imperative for achieving vision 20-20. Education Reforms for 20-20. Senate Committee on Education Summit.
[35]. Oktay, S. & Çakir, R. (2013). The effect of technology supported brain based learning on students' academic achievement, retention level and metacognitive awareness. Journal of Turkish Science Education, 10(3).
[36]. Omoniyi, A. O. & Torru, T. E. (2019). Effectiveness of process oriented guided inquiry teaching strategy on students' performance in Chemistry in secondary schools in Ondo State, Nigeria. American International Journal of Education and Linguistics Research, 2(1): 34-38.
[37]. Onunkwo, G. N. (2019). Verbal praise and secondary school adolescents' cognitive achievement. Journal of Counseling and Communication, 1(2): 182-185.
[38]. Oviawe, M. J. I. (2021). Enhancing academic performance and retention of general woodwork students using adaptive instructional strategy in technical colleges in Edo State, Nigeria.
[39]. Salta, K., & Koulougliotis, D. (2020). Domain specificity of motivation: Chemistry and Physics learning among undergraduate students of three academic majors. International Journal of Science Education, 42(2): 253-270.
[40]. Sanacore, J. (2018). Turning reluctant learners into inspired learners. A Journal of Educational Strategies, Issues and Ideas, 82(1): 40-44.
[41]. Somers, T. & Llinares, A. (2021). Students' motivation for content and language integrated learning and the role of programme intensity. International Journal of Bilingual Education and Bilingualism, 24(6): 839-854.
[42]. Spinath, B. (2012). Achievement. In encyclopedia of human behaviour (2nd ed.). San Diego, CA: Academic Press.
[43]. Srisawasdi, N. & Panjaburee, P. (2019). Implementation of game transformed inquiry-based learning to promote the understanding of and motivation to learn Chemistry. Journal of Science Education and Technology, 28(2): 152-164.
[44]. Steinmayr, R., Weidinger, A. F., Schwinger, M. & Spinath, B. (2019). The importance of students' motivation for their academic achievement–replicating and extending previous findings. Frontiers in psychology, 10: 1730.
[45]. Uchegbu, R. I., Anozieh, M. C., Mbadiugha, C. N. Ibe, C. O. & Njoku, P. C. (2015). Teachers' perception of the impediments to Chemistry teaching in secondary schools in Imo State Nigeria. Open Science Journal of Education, 3(5): 6-31.

[46]. Ufondu, N. U. (2019). The role of the laboratory on the academic achievement of students in Chemistry in Abakaliki education zone. Unpublished work, Abakaliki, Ebonyi State University.
[47]. Unegbu, C. (2016). Psychology of learning: theory and practice. Owerri: Reuben press Ltd.
[48]. Uzezi, J. G., & Jonah, K. J. (2017). Effectiveness of brain-based learning strategy on students' academic achievement, attitude, motivation and knowledge retention in electroChemistry. Journal of Education, Society and Behavioural Science, 1-13.
[49]. WAEC (2018). Chief Examiner's Report, 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2018 Retrieved from www.waec.online.org.Ng/E-learning/Biology/Domain.
[50]. Wang, Z., Hwang, G. J., Yin, Z. & Ma, Y. (2020). A contribution-oriented self-directed mobile learning ecology approach to improving EFL students' vocabulary retention and second language motivation. Journal of Educational Technology & Society, 23(1): 16-29.
[51]. Wigfield, A. & Cambria, J. (2010). Students' achievement values, goal orientations, and interest: definitions, development, and relations to achievement outcomes. Dev.Rev. 30: 1–35. doi: 10.1016/j.dr.2009.12.001
[52]. Wigfield, A., Tonks, S. & Klauda, S. L. (2016). "Expectancy-value theory," in handbook of motivation in school. 2nd Edn. eds K. R. Wentzel and D. B. Mielecpesnm. New York, NY: Routledge, 55–74.
[53]. Wijnia, L. (2020). Students' motivation in secondary and post-secondary education. Educational psychology. An International Journal of Experimental Educational Psychology, 40(8) 2020.
[54]. Wolfe, P. (2011). Brain matters: Translating research into classroom practice. Alexandria, VA: Association for Supervision and Curriculum Development.
[55]. Woolfolk-Hoy, A. & Hoy, W. K. (2019). Instructional leadership: A research-based guide to learning in schools. (3rd ed.) Boston: Pearson.
[56]. Yuan, L. & Powell, S. (2013). MOOCs and open education: Implications for higher education. Bolton: CETIS. Retrieved from http://publications.cetis.ac.uk/2013/667