IMPACT OF KNOWLEDGE REFORMULATION AND EXPOSITORY TEACHING STYLES ON STUDENTS' ACCOMPLISHMENT AND RETENTION IN MINNA METROPOLIS, NIGER STATE

BY

OKONKWO, Ogochukwu Elizabeth

2016/1/61561BT

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL TECHNOLOGY, SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF BACHELOR OF TECHNOLOGY (B.TECH) IN EDUCATIONAL TECHNOLOGY.

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ABSTRACT

This study investigated The Impact of Knowledge Reformulation and Expository Teaching Styles on Student Accomplishment and Retention in Minna Metropolitan**.** The Quasi – Experimental Research Design methodology was employed in this project because of its ability to help the researcher determine the extent of the improvement between the test groups and the control groups. Out of the 168,771 Senior Secondary School Students in Niger State, all 6,625 students at Minna's Senior Secondary School were participants in this study. Students studying Biology in Senior Secondary School II (SSII) in Minna, Niger State, made up the study's sample. One hundred and twenty (120) Students were captured for the study in the intact classes of the selected Schools. From the Schools in the Minna metropolitan, the Experimental group and the Control group were chosen using a simple random sampling procedure. The BRAT achievement test was administered as instrument for data collection to students as pre-test, post-test and retention test. Data collected were analyzed using Mean and Standard Deviation to answer the research questions while T – test statistics to analyze Pre-test scores, Post-test scores and Retention scores. The results indicated that Knowledge Reformulation and Expository Teaching Styles strategy improved students' retention in Biology when compared to the traditional teaching method they were exposed to. It was therefore recommended that since the use of Biology Retention Achievement Test enhances achievement and retention in teaching biology subject, teachers should be encouraged to use it as a teaching strategy in the classroom.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The characters in today's education appear to be discipline-centered, teacher-centered, and student learning appears to be only passive surface learning. A large body of data has been documented to support the idea that in discipline-centered teaching, instructors' and students' needs, concerns, and requirements are ignored because the subject matter is primarily driven by and dependent on the disciplinary content that must be provided. Teaching science necessitates a focus on both the course material and the process of advancing students from their current level of knowledge and understanding to the desired one. Teaching, in fact, is a part of a larger system that includes the teacher, the student, the disciplinary material, the teaching/learning process, and both the teacher and the learner's evaluation. The shift from a traditional teacher-centered to a progressive teaching-learning technique has resulted in a stronger focus on individual student differences. Students are at the center of the new paradigm, which emphasizes inclusivity, cooperative learning, and diversity. Despite the new teaching and learning strategy, students' exam results appear to be disappointing, prompting researchers to investigate the causes of low performance and ways to improve the teaching-learning process.

The performance of students in public examinations administered by the West African Examination Council (WAEC) and the National Examination Council (NECO) in sciences has steadily dropped across the country over the years (Agogo, 2018; Samba & Eriba, 2019). Biology is the most popular scientific subject supplied by applicants appearing for senior secondary school certificate examinations across the country, according to Ahmed and Abimbola (2011), due to its various benefits. Despite the popularity of Biology, study investigations conducted by WAEC Research Reports (2018)) and (2019) frequently revealed students' poor performance in the subject. Students' poor performance is caused by a number of factors, including difficult biological concepts (Tekkaya et al., 2021; Imer, 2017; Zeidan, 2020); the nature of science and its teaching methods (Lazarowitz and Penso, 2019); and the biological level of organization and abstract level of concepts (Tekkaya et al., 2021; Imer, 2017; Zeidan, 2020). (Tekkaya et al., 2021; Imer, 2017; Zeidan, 2020.

According to Imer (2017), many concepts / topics in biology, such as water transport in plants, protein synthesis, respiration and photosynthesis, gaseous exchange, energy, cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, Mendelian genetics, genetic engineering, and the central nervous system, can be perceived as difficult to learn by secondary school students. According to Tekkaya et al., secondary school students found hormones, genes and chromosomes, mitosis and meiosis, the neurological system, and Mendelian genetics to be difficult topics (2021). According to Zcan (2018), having difficulty with so many topics in biology has a negative impact on students' motivation and achievement. Students' troubles in various biology classes have motivated researchers to investigate why they are having such problems and how they might overcome them. The classroom learning environment, a lack of excitement for learning science, overloaded curriculum content, and the separation of science and society, to name a few, are all factors that might lead to difficulty in Biology.

Designing learning environments while ignoring students' interests and expectations, according to Yüzbaşlolu and Atav (2019), results in a range of learning obstacles as well as a reduction in their interest in biology (Roth et al., 2017; Zeidan, 2020). There is a strong correlation between students' impressions of their classroom learning environment and academic achievement, according to Fraser (2019) and Imer (2017). According to Osborne and Collins (2021), overburdened curriculum content that is not generally related to working life, a lack of discussion of topics of interest, a lack of opportunities for creative expression, science's alienation from society, and the prevalence of isolated science subjects are all factors contributing to students' declining interest in learning science. Another problem noted by many experts, notably in Turkey, is that due to the nature of biological science, biology training is predominantly focused on remembering. In biological science, students must learn a variety of abstract concepts, events, topics, and facts. This makes it harder for kids to learn them (Imer, 2017; Saka, 2017; Durmaz, 2017).

Furthermore, it is critical to understand students' perspectives on what makes biology learning effective, in addition to determining the factors that negatively affect students' biology learning, as many researchers suggest that in order to improve the quality of teaching and learning in schools, researchers, teacher educators, schools, and teachers must take students' perspectives into account (Macbeath and Mortimore, 2021; Imer, 2017; Ekici, 2021). They argue that what students have to say about teaching, learning, and schooling is not only worth listening to, but can also be used to think about ways to enhance teaching, learning, and schools. Student impressions of instruction, according to Phoenix (2020), may reflect how they learn best. Indeed, schools that value student input have learned that these views may have a big impact on classroom management, learning and teaching, and the school as a social and learning environment (Macbeath et al., 2020). Students' impressions of the biology learning environment are thought to influence their attitudes about biology and its learning (Akrolu et al., 2017; Telli et al., 2019).

1.2 Statement of the Research Problem

The poor performance of Nigerian Senior Secondary School Students in biology has always excited the educational stakeholders. Students lost substantial marks in biology (WAEC, 2017). The main causes of this monster are teachers' teaching methods and students' factors. The goal of this study is to see how effective a reformulation of knowledge teaching strategy may be in assisting students' achievement in biology when gender differences are taken into account. Currently, there are few studies in this field, particularly in Nigeria.

In both internal and external examinations, Nigerian students typically do poorly in Biology. Instructors' instructional approaches and student factors, according to studies, biology examination shows that in 2019, 48.29% passed and 51.70% failed. The purpose of this research is to see how effective a knowledge reformulation teaching technique is in improving students' progress in Biology when gender differences are taken into account. In this topic, there is currently very little study, especially in Nigeria.

1.3 Aim and Objectives of the Study

As a result the objectives of this study are to:

(i) Determine the impact of knowledge reformulation, expository strategy and traditional instructional strategies on Biology student's achievement.

(ii) Find out the impact of knowledge reformulation, expository strategy and traditional instructional strategies on male versus female students achievement in Biology.

(iii) Identify the impact of knowledge reformulation, expository strategy and traditional instructional strategies on student's retention in Biology.

(iv) Determine the impact of knowledge reformulation and expository strategy on students Biology retention based on gender.

1.4 Research Questions

1. What are the impact of knowledge reformulation, expository strategy and traditional instructional strategy on Biology student's achievement?

2. What are the impact of knowledge reformulation, expository strategy and traditional instructional strategies on student's achievement in Biology male versus female students?

3. What are the impact of knowledge reformulation, expository strategy and traditional instructional strategies on student's retention in Biology?

4. What are the impact of knowledge reformulation and expository strategy on students Biology retention based on gender?

1.5 Research Hypothesis

For this study, the following hypothesis were developed:

HO_1:There is no significant difference in achievement scores between students taught using Reformulation of knowledge expository strategies and those who were taught using the traditional strategy.

HO_2:The achievement scores of male and female students taught utilizing reformulation of knowledge and expository teaching approaches is not significantly different.

HO_3:The mean retention scores of male and female students taught utilizing reformulation of knowledge, expository teaching approaches and traditional strategy is not significantly different.

HO_4:The mean retention score of male and female students taught using Reformulation of Knowledge and those taught using the expository method is not significantly different.

1.6 Significance of the Study

Students, teachers, researchers, curriculum planners and the government will benefit from the findings of this study in the following ways:

The finding will help to strengthen the application of these theories in teaching and learning in science subject, specifically in Biology.

For the students, the study will enable them overcome attitudinal barriers that they may face prior to the implementation and adoption of Reformulation of knowledge and Expository learning techniques methodology in secondary schools.

For the teachers, the study may likewise help to modify the nature of teacher's interaction with the students, which will in turn help to create the spirit of inquiry among the students.

This research will be used by the government to design and execute policies to improve teacher competency in order to make learning easier and accelerate national progress.

The findings will likewise benefit researchers in acquiring a better understanding of knowledge reform and adaptive learning, as well as modifying attitudes about its implementation in secondary schools that are not positive.

Furthermore, the outcome of this study will benefit curriculum planners to value the need to accommodate teaching styles and activities that stimulate the brain functions in designing the school curriculum.

1.7 Scope of the Study

This study was carried out in Bosso Local Government, using a senior secondary school II students, senior secondary school II students were selected because the topic and subject matter fall in their syllabus.

1.8 Operational Definition of Terms

Biology: is the study of living organisms, divided into many specialized fields that cover their morphology, physiology, anatomy, behaviour, origin, and distribution.

Reformulation of knowledge: is a constructivist teaching approach with great potential for enhancing the teaching and learning

Expository teaching strategies: is basically direct instruction. A teacher is in the front of the class room lecturing students are taking notes. In this teaching method the teacher presents students with the subject matter rules and provides examples that illustrate the rules.

Achievement: is something that is accomplished, particularly by great effort, courage or special skills.

Retention: is the power or ability to keep or hold something in the memory.

Gender: is either of the two sexes (male and female), especially when considered with reference to social and cultural differences rather than biological ones. The term is also used more broadly to denote a range of identities that do not correspond to established ideas of male and female.

CHAPTER TWO

2.0 LITERATURE REVIEW

The major areas reviewed under this project work have been classified under the following:

1. Conceptual framework
2. Theoretical framework
3. Empirical study

2.1.0 Conceptual Framework

2.1.1 Nature and scope of Biology

Biology comes from the Ancient Greek terms o romanized bos, which means'life,' and -; romanized -loga, which means ‘branch of study' or ‘to speak.' The Greek word biologa, which means 'biology,' is formed by combining these words. Regardless, the phrase did not exist in all of Ancient Greek. It was first borrowed by the English and French (biologie). There was once an English term for biology called lifelore, but it is no longer used.

In 1736, Swedish scientist Carl Linnaeus (Carl von Linné) used the Latin-language variation of the word for the first time in his Bibliotheca Botanica. In 1766, a student of Christian Wolff named Michael Christoph Hanov used it again in his work Philosophiae naturalis sive physicae: tomus III, continens geologian, biologian, phytologian generalis. In a 1771 translation of Linnaeus' work, the word "biologie" appeared for the first time. Theodor Georg August Roose created the term in the prologue of his work, Grundzüge der Lehre van der Lebenskraft, published in 1797. The term "propädeutik zur Studien der gesammten Heilkunst" was coined by Karl Friedrich Burdach in 1800 to describe the study of human beings from a morphological, physiological, and psychological perspective. Gottfried Reinhold Treviranus coined the expression in his six-volume dissertation Biologie, oder Philosophie der lebenden Natur (1802–22), where he stated:

The various forms and expressions of life, the conditions and laws under which these phenomena occur, and the reasons by which they have been affected shall be the focus of our inquiry. We shall refer to the science that is concerned with these objects as biology (Biologie) or life doctrine (Lebenslehre).

Due to the historical contributions of the Ancient Greek and Roman civilizations, as well as the continued use of these two languages in European universities during the Middle Ages and at the beginning of the Renaissance, many other terms used in biology to describe plants, animals, diseases, and drugs have been derived from Greek and Latin.

Biology is the study of life from a scientific standpoint. It is a broad-ranging natural science with various unifying themes that unite it as a single, coherent topic. Lisa Urry, Michael Cain, Steven Wasserman, Peter Minorsky, and Jane Reece (2017). Cells in all creatures, for example, process hereditary information encoded in genes, which can be passed down to future generations. Evolution, which explains the unity and diversity of life, is another fundamental concept. Life depends on energy processing since it permits organisms to move, grow, and reproduce. Finally, every organism has the ability to control its own internal environment. Scott Freeman; Kim Quillin; Lizabeth Allison; Michael Black; Greg Podgorski; Emily Taylor; Jeff Carmichael (2017).

Biologists can investigate life at many different levels of organization. From a cell's molecular biology through the morphology and physiology of plants and animals, as well as population evolution. As a result, biology is divided into several subdisciplines, each of which is defined by the nature of its study objectives and the instruments it employs. Biologists, like other scientists, use the scientific method to make observations, ask questions, formulate hypotheses, conduct experiments, and draw conclusions about the world.

The diversity of life on Earth, which began more than 3.7 billion years ago, is enormous. From prokaryotic species like archaea and bacteria through eukaryotic organisms like protists, fungi, plants, and animals, biologists have attempted to explore and classify the diverse forms of life. These species contribute to an ecosystem's biodiversity by playing specialized roles in nutrition and energy cycles through their biophysical environment.

2.1.2 The Biology Curriculum

The Biology Curriculum is a continuation of the Science (S1–3) Curriculum and builds on the current Biology curricula's strengths. It will provide a variety of balanced learning experiences in the "Life and Living" strand and other strands of science education so that students obtain the requisite scientific knowledge and understanding, skills and procedures, and values and attitudes. These are required for students' personal growth in order for them to contribute to a scientific and technological world. Students will be prepared for higher education, vocational training, and professions in several disciplines of life science as a result of the program.

The rise of a highly competitive and linked economy, improved scientific and technical advancements, and an expanding knowledge base will continue to have a significant impact on our lives. To meet the difficulties provided by these developments, the Biology Curriculum, like other science electives, provides a foundation for developing scientific literacy and acquiring fundamental scientific knowledge and skills for lifelong learning. Students will gain relevant procedural and conceptual knowledge in biology, which will aid them in understanding a variety of current situations. They will understand how science, technology, society, and the environment are all intertwined. Students will also develop a respect for the living environment, a sense of responsible citizenship, and a desire to improve their own and their community's health.

Biology is a rapidly developing field that encompasses a vast amount of data regarding living beings. It is a common misconception that it is a subject that requires memory of a large number of unconnected facts. The goal of this curriculum is for students to get a wide, general understanding of biological principles and concepts while also learning a set of fundamental facts. It is advised that biology be introduced in real-life circumstances in order to make the study of biology attractive and relevant. The use of a variety of learning and teaching methodologies, as well as evaluation procedures, is designed to pique students' interest in and motivate them to study, regardless of their skills or aspirations.

The Biology Curriculum's overarching goal is to provide biology-related learning experiences that enable students to develop scientific literacy, allowing them to actively participate in our rapidly changing knowledge-based society, prepare for further studies or careers in life science fields, and become lifelong learners in science and technology.

The Biology Curriculum's broad goals are to enable students to:

1. Foster an interest in biology, a sense of wonder and curiosity about the living world, and a respect for all living creatures and the environment.
2. Build and apply biological knowledge, comprehend the nature of science in biology-related contexts, and grasp the connections between biological science and other disciplines.
3. Improve your capacity to conduct scientific research, analyze critically and creatively, and solve biology-related problems both alone and cooperatively.
4. Communicate thoughts and points of view on biology-related issues by understanding the language of science.
5. Understand the social, ethical, economic, environmental, and technical consequences of biology and be able to make well-informed decisions and judgments on biological topics; and
6. Foster a sense of civic responsibility and a desire to improve personal and community health.

2.1.3 Method of Teaching Biology

At the secondary school level, most education is done by lecture, but for science-based topics like chemistry, the practical and laboratory mode of teaching is required (Högström, Ottander, & Benckert, 2010).

Students are naturally interested, and they must be actively involved in the learning process, exploring, testing, guessing, and developing their own particular construct and knowledge. Only through personalizing such knowledge does it gain validity. They find it meaningful and valuable. Individuals actively develop knowledge through their actions. According to Clayden, Greeves, and Warren (2012), all science must be based on evidence. Watts claims that (2013).

Practical activity is formative in that it aids students in comprehending science and how scientific ideas are created. It is critical that an attempt be made to balance the emphasis on theory and experiments in order to fulfill the aims of Science education. Procedural and manipulative skills, observation sketching and reporting, and interpretative skills are typically stressed in Science practical. The following are some of the goals of practical work:

i. Student motivation;
ii. Discovery excitement;
iii. Theory consolidation;
iv. Development of manipulative skills;
v. Knowledge of standard techniques;
vi. General understanding of data handling;
vii. Development of other skills such as analytic, evaluative, planning, applied, and mathematical; and
viii. Developing an understanding of how science works through the concept of scientific process, collaborative working, and reproducible results and fair testing.

Experiments are central to science. And all of these experiments must be carried out at the school's Science lab.

The laboratory has long been a distinguishing aspect of science education. A Science Laboratory, according to Nbina (2013), is an educational facility used by Science teachers to assist students in learning about Science and how scientists examine the world around them. It's a space dedicated to scientific research. According to him, laboratory experiences allow students to interact directly with the material world or with data derived from the material world while employing instruments, data gathering procedures, models, and scientific ideas. Examining the laboratory's role in science education and its possible contributions. Students can learn about scientific investigation processes in the laboratory, such as controlling particular variables, carefully observing and collecting data, and formulating findings. In conclusion, learning science through laboratory experience serves a dual purpose. Students study the fundamental principles and facts of science, as well as how to improve their knowledge and understanding of science.

2.1.4 Reformulation of Knowledge and Expository Learning Strategies

Reformulation of Knowledge is a constructivist teaching strategy that has the potential to improve the teaching and learning of all chemistry concepts at all levels of education in Nigeria and throughout the world. It is predicated on the idea that new learning is more relevant if it can be related to the learners' previous cognitive architecture (Eniayeju, Eniayeju & Lapkini, 2004). Simply put, ‘reformulation of knowledge' refers to reinforcing what one has already learned by telling others about it, or verbalizing associations between what one understood before and after a notion has been enlarged on (Cullen & Sato, 2000). This strategy was created to help students improve their problem-solving skills, and it is based on Piaget's theory of intellectual development (Redish1998). Two invariant processes – organization and adaptation – are involved in the functioning of the human intellect, according to Inyang (1993).

Organization entails combining information from several senses, while adaptation entails digesting or merging the information into pre-existing cognitive structures. In order to internalize the concepts learned, students develop and reformulate knowledge as they engage in new experiences.

Prior to this, learning was thought to be the process of gaining information or experiences, while prior knowledge was thought to be the bane of knowledge transmission.

Roschelle (1995) observed, however, that learners' past information frequently confounds instructors' best efforts to effectively teach ideas and concepts, because learning is largely based on prior knowledge and only secondarily on newly provided materials. That is, existing knowledge may conflict with new information, and ignoring it may lead to the audience learning something contrary to the educators' objectives, regardless of how well those intentions are carried out. It is important noting that new knowledge does not replace existing knowledge; rather, it re-uses it, allowing it to be polished and incorporated into a more comprehensive structure (Roschelle, 1995).

According to Redish (1998), the following concepts underpin the reformulation of knowledge teaching and learning:

The Constructivism Principle posits that what people create is influenced by their environment and mental states; as a result, learners must locate a body of knowledge that is relevant to them in order to incorporate it into their cognitive structures.

The Change Principle says that generating meaningful change in a well-established pattern of association is difficult, but that it can be aided by a number of well-known mechanisms.

The Distributive Function Principle states that people have modest but significant differences in their learning styles across a number of domains.

The Social Learning Principle says that social interactions are the most effective means of learning for the majority of people.

The following three phases of knowledge lesson reformulation are based on these principles:

Phase 1: Getting a Feeling for the Concept

Students brainstorm what they know about the topic or key vocabulary throughout this phase, as well as listen to their classmates' associations. This practice encourages students to consider what they already know about the subject and prepares them for a more critical examination of the material.

Phase 2: Review of the Initial Relationship

With questions like 'What made you think...?' or 'Why did you think...?', the students are encouraged to dwell on their original associations.

Phase 3: Knowledge Reformulation

The teacher gives the learners the opportunity to express associations that have been enlarged on or changed after the talks in phase two and before the presentation of the new concepts.

At this stage, the following three reaction levels are expected:

First-Level Reactions

This level of response indicates a high level of prior understanding of the concept or topic being addressed. The responses consist of primary idea-type concepts, definitions, analyses, or links of one or more concepts.

Second-Level Reactions

In terms of instances, traits, or characteristics, responses at this level imply some prior knowledge of the topics. Such comments indicate that, with a little help from the teacher, the students should be able to grasp the concepts.

Responses at the third level

The learners' responses at this level suggest that they have only a basic understanding of the concept or topics being taught. That is, their existing knowledge is insufficient to build connections with the topics; thus, fresh information is required to fill in the gaps in prior knowledge in order to comprehend the concepts. The teachers can then pick what to do next based on the level of responses from the students: provide background information or go on to idea development?

The word expository is derived from the word exposition, which meaning "to explain." A approach employed by the teacher to communicate or explain facts, ideas, and other significant information to pupils in the context of position learning (Jarolimek and Foster, 1981).

In an expository learning technique, the instructor collects subject matter to teach from a variety of sources, then processes and summarizes it, maybe using a chart. The teacher teaches the principles in front of the pupils, and they simply accept it and record it. As a result, expository learning strategies focus on delivering information from textbooks, references, or personal experiences through lecture approaches, demonstrations, and research reports (Gerlach and Ely, 1971).

Based on the preceding description, the expository learning strategy is a strategy that stresses the distribution of facts, concepts, and significant information to students using lecture tactics, demonstrations, and study reports obtained from textbooks, references, or personal experiences.

Expository learning is when a lecturer or teacher gives a direct explanation to a pupil. As a result, one of the most important aspects of a student's capacity/aptitude for an expository learning approach is their ability to listen. According to Rast (1991: 28), functional listening capacity necessitates focusable concentration, language and nonlinguistic knowledge, long-term brainpower, and the ability to comprehend, verify, and respond to acquired information. During the learning process, the student's ability to listen often deteriorates. The ability to focus or concentrate was harmed as a result of this ailment.

The student's concentration had decreased in the first ten minutes on average, catching 70 percent of all explained information, but had plummeted in the second ten minutes, catching only 20 percent (Ruturman et al., 2011).

Expository learning strategies are more teacher-centered learning methods, with the instructor serving as the primary knowledge source (Jacobson, Eggen, and Kauchack, 1989). Expository learning strategies employ media such as educational videos and visual aids to supplement the teacher's explanations. Physical examples, drawings, diagrams, and maps are examples of visual aids that can be used in an expository learning technique. According to Ormrod, combining verbal and visual explanations will improve the effectiveness of retaining information in long-term memory and make retrieval easier (Ormrod et al., 2009).

2.1.5 The Policies of Reformulation of Knowledge Strategies

According to the rationale of systemic transformation, governmental efforts should be focused on giving more consistent guidance to educators (Cohen and Spillane 1992). As a result, reform efforts should at the very least include policies that have a major impact on teaching and learning. Other curricular policies, instructional resources, teacher professional development, and student assessment would be anchored by curriculum frameworks that reflect desired student learning goals (Smith and O'Day 1991).

The breadth or range of policy variables covered in the systemic approach varies per state. A wide range of initiatives and policies were attempted to be coordinated by California, Kentucky, Texas, and South Carolina. The Texas committee responsible with setting learning goals as a foundation for associated policies, for example, will also provide recommendations for regulatory reforms, college entry criteria, and graduation requirements. The Kentucky Education Reform Act of 1990 (KERA) entails a reorganization of the state department, school governance, and school organization, as well as comprehensive modifications of major instructional principles.

Kentucky has broadened the scope of the reform to encompass other areas of children's life that may have an impact on their ability to learn. The state devised a strategy for establishing a network of Family or Youth Resource Centers near or at high-poverty schools, with the goal of coordinating social services such as child care, health care, and drug and alcohol misuse treatment. Similar projects have been launched in other states, including New Jersey, Iowa, Florida, and Missouri, though these do not usually overtly link to school reform efforts.

2.1.6 The Need for Reformulation of Knowledge and Expository Learning Strategies

Learners in current educational institutions are required to have a higher level of autonomy and initiative in learning activities, such as evaluating learning materials and comprehending content. Students' ability to initiate, guide, and control the search for information, as well as its subsequent processing and storage, is required for effective knowledge acquisition both within and outside of the classroom. Learning strategies are the term used in learning and teaching research to describe these practices. The Bielefeld University project 'KolumbusKids' has been encouraging gifted youngsters between the ages of nine and twelve since 2006, while the 'KolumbusYouth' program tutors learners aged fifteen to nineteen. Selected pupils from regional schools are invited to attend intriguing sessions at university that deal with biological challenges and occurrences. The workshops for the project are mostly created and led by university students aspiring to be teachers. Academic professionals from the Department of Biology Didactics also assist them. This means that students will have the opportunity to develop skills that will help them in their future career as teachers, such as creating and implementing teaching units and recognizing and dealing with various student personalities. This project is now a one-of-a-kind concept in Germany in terms of Biology Didactics, seeking to provide suitable support for gifted students in natural sciences. We discovered during the sessions that the majority of the youngsters lacked effective learning skills because they had not been taught them in school. As a result, the project employs specific teaching approaches in order to provide participants with assistance and direction in acquiring those tactics, as well as to support people' existing learning processes and the formation of new knowledge. (Borgmann & Wegner 2011, 8081; Wegner & Minnaert 2012, 20).

Current psychological and pedagogical research focuses on students' learning processes in general, as well as which learning strategies should be presented to students in order for them to be able to learn effectively and independently. The word "learning strategies" does not refer to a single, scientifically defined idea. It essentially summarizes several research groups' concepts. Learning strategies are described as follows by Lompscher, however Mandl and Friedrich see them as sequences of actions to achieve a learning goal: Learning strategies are methods that are more or less sophisticated, more or less advanced, and that are utilized consciously or unconsciously to achieve learning goals and meet learning needs (Mandl & Friedrich 1992, 6; Lompscher 1996, 2). Learning techniques, according to Weinstein and Mayer, are internal and external acts that influence a learner's motivation, attention, as well as selection and processing of information (cf. Weinstein & Mayer 1986).

The concept of learning techniques used in this article is that they are targeted processes that are first implemented intentionally and then gradually automated, as defined by Mandl and Friedrich. This will serve as the foundation for the presentation of learning techniques in the article, which will be divided into the six types described (Mandl & Friedrich 2006):

1. Cooperation strategies
2. Elaboration strategies
3. Motivational and emotional strategies
4. Revision strategies
5. Organizational strategies

6. Control strategies

The purpose of this article is to give the reader a quick summary of the project as well as six different types of learning methodologies. It demonstrates how our approach supports students' learning processes and provides some ideas for practical use in science classrooms. The concept of learning techniques is critical in general. More teachers should be aware of it, and they should work to enhance their students' learning strategies as well as help them learn them in the first place.

2.2 Theoretical Framework

2.2.1 Cognitive Learning Theory

The theoretical underpinning for this study is provided by Vygotsky's (1978) theory of cognitive development and Piaget's (1972) theory of cognitive learning. The Vygotsky Theory of Cognitive Development is founded on the idea that humans build their own understanding and knowledge of the world by engaging in experiences and reflecting on them. It is also based on the concept that kids learn best when they engage in active learning and exploration. The foundation of all learning, according to Jean Piaget's theory of cognitive learning, is the child's own activity as he or she interacts with the physical and social world. The instructor, according to this view, serves as a facilitator or guide in the teaching and learning process, whose purpose is to establish a rich environmentt for students' spontaneous discovery. This will enable students to do logical operations in a real-world setting, reinforcing their ability to perform logical processes including seeing, describing, classifying, and measuring real objects.

2.2.2 Technology Acceptance Theory (TAT)

Technology Acceptance Theory (TAT), also known as Technology Acceptance Model (TAM), is a widely used extension of Ajzen and Fishbein's theory of reasoned action (TRA). The most generally used model of user acceptance and utilization of technology is Davis's technology acceptance model (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). (Venkatesh, 2000). Fred Davis and Richard Bagozzi designed it (Davis 1989, Bagozzi, Davis & Warshaw 1992). The two technology acceptance measures—ease of use and usefulness—replace many of TRA's attitude measures in TAT. TRA, TAT, and TAM, which all have major behavioural components, assume that once someone forms an intention to act, they will be free to do so without restriction. There will be various limits in the real world, such as limited freedom to act (Bagozzi, Davis & Warshaw 1992).

Because new technologies, such as personal computers, are complicated, and decision-makers are unsure whether they will be adopted successfully, people create attitudes and intentions about attempting to learn to utilize the new technology before putting up attempts to do so. Attitudes and intentions regarding technology use may be ill-formed or lacking in conviction, or they may emerge only after basic attempts to learn to utilize the technology have been made. As a result, real use might not be a direct or immediate result of such attitudes and intents. 1992 (Bagozzi, Davis, and Warshaw).

Earlier study on the transmission of technologies revealed that perceived ease of use played a significant effect. Tornatzky and Klein (Tornatzky & Klein 1982) studied adoption and discovered that compatibility, relative advantage, and complexity had the strongest links to adoption across a wide range of innovation types. Eason looked at perceived utility in terms of a match between systems, tasks, and job profiles, referring to the statistic as "task fit" (quoted in Stewart 1986) TAM should be extended to incorporate variables that account for change processes, according to Legris, Ingham, and Collerette (2003), and this might be accomplished by including the innovation model into TAM.

2.2.3 Constructivism Learning Theory

"Constructivism" is the latest buzzword in educational circles, and it refers to both learning theory and epistemology, or the study of how people learn and the nature of knowledge. We don't have to follow every new craze, but we do need to think about our job in terms of learning and knowledge theories. So, what is constructivism, what does it tell us that is new and important, and how can we apply it to our work? As far as I can tell, constructivism is nothing revolutionary: its essential concepts have been articulated by John Dewey and others before, but there is a new, widespread acceptance of this old set of ideas. and fresh cognitive psychology research to back it up. I'd like to present a quick overview of constructivism's core ideas, which are widely acknowledged by educators today. The authors discuss the findings with curriculum developers and cognitive psychologists, and then speculate on what they represent for museum educators.

Constructivism is defined as "a learning strategy based on the belief that people actively construct or make their own knowledge, and that reality is determined by the learner's experiences" (Elliott et al., 2000, p. 256).

When it comes to elaborating constructivist notions, Constructivism, according to Arends (1998), believes in the learner's personal construction of meaning through experience, and that meaning is determined by the interaction of past knowledge and new events.

Constructivism is a philosophy or epistemology that explains how people come to know what they know. Problem solving is at the basis of learning, thinking, and development, according to the basic premise. People develop their own understanding as they solve challenges and learn the repercussions of their actions by reflecting on past and current experiences. As a result, learning is an a+ctive process that necessitates a change in the learner. This is accomplished through the learner's behaviors, as well as the consequences of those activities, and through reflection. People can only fully comprehend what they have created.

An alternative to the objectivist paradigm, which is implicit in all behaviorist and some cognitive approaches to education, has been proposed: a constructivist approach to learning and instruction. Knowledge, according to Objectivism, is a passive reflection of the external, objective reality. This suggests a "teaching" procedure that ensures the learner receives accurate knowledge.

2.3 -Empirical Studies

The impact of blended learning and computer simulation methodologies on students' achievement in chemistry chemical structure and bonding was statistically significant. Students who were taught utilizing a blended learning technique outperformed those who were taught using a computer simulation strategy. The interacting effect of the multiple instructional techniques combined on the learners' cognitive structure may be linked to the statistically significant improved improving effect of blended learning approach on students' learning achievements. This may have piqued their interest in studying, resulting in knowledge creation, improved conceptual understanding, and greater command and mastery of subject. The cumulative effect is seen in higher academic success. This study's findings are congruent with those of Almasaeid (2014), who found that a blended learning technique improved students' achievement while also increasing their interaction and understanding of the topic. The findings back up Abidoye's (2015) claim that bended learning is a more effective teaching technique for improving student accomplishment.

It was discovered that gender had no statistically significant impact on students' achievement in chemical structure and bonding in chemistry when taught using blended learning and computer simulation methodologies. This finding suggests that gender does not play a significant role in pupils' academic success. This outcome could be feasible because computer simulation and mixed learning methodologies can help students acquire things quickly, retain them, and recall them, regardless of their gender. This study's findings of no significant gender influence accord with those of Abidoye (2015) and Ezeudu and Ezinwanne (2013), but differ from those of Odagboyi (2015), who found that males performed better. This conclusion implies that findings on gender and student accomplishment are inconsistent and inconclusive.

It was discovered that the impact of school location on students' achievement in chemical structure and bonding in chemistry when taught utilizing blended learning and computer simulation methodologies was not statistically significant. This finding suggests that the location of a student's school is not a substantial predictor of their academic success. The lack of a significant influence of school location observed in this study agrees with Josiah (2002), who stated that when Physics is taught and learned using Computer-Assisted Instruction (CAI), students' achievement in Physics is enhanced (regardless of location), but disagrees with Owoeye and Yara (2011), who stated that there was a significant difference in students' academic achievement of rural and urban secondary schools in senior s. Their research found that urban students outperformed their rural counterparts in terms of academic achievement.

The impact of integrated learning and computer simulation tactics on students' understanding of chemical structure and bonding was statistically significant. Students who were taught utilizing a mixed learning method remembered the topics much better than those who were taught using a computer simulation strategy. Umar, Idris, Audu, Arah, Yusuf, and Beji (2017) also found a statistically significant improved boosting effect of blended learning on student retention. This observation can be explained by the participatory character of this teaching technique, which caters to the students' diverse learning styles.

Based on the study's findings, it is determined that of the two teaching/learning methodologies examined, blended learning is more effective in aiding students' academic achievement in the concept of Atomic Structure in chemistry. Furthermore, the gender of the pupils had no statistically significant impact on their performance.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

The research methodology is covered in this chapter under the following subheadings: Research Design, Population of the study, Sample and Sampling Techniques, Research Instrument, Method of Data Collection, and Data Analysis Method.

3.2 Research Design

The Design adopted for this study is the Quasi – Experimental research design (pretest – posttest), Control group Design. The Quasi – Experimental Research Design methodology was employed in this project because of its ability to help the researcher to determine the extent of the improvement between the test groups and the control groups. Furthermore, it helps in recognizing that both groups involved would exhibit changes/improvements over time. It is a design methodology which is quite similar to the True Experimental Research Methodology in the sense that both are used to determine causal relationships, they both requires an intervention or Treatment, both involves manipulation of variables and they both involves controlled setting. The Research design is illustrated in the table 3.1 below.

Table 3.1 Research Design Illustration

Group	Pre-Test	Treatment	Post- Test	Retention
Experimental	O_1	T	O_2	O_3
Control	O_4	Y	O_5	O_6

Where;

O_1 and O_4 are Pretest scores for Experimental and Control group

O_2 and O_5 are Posttest scores for Experimental and Control group

O_3 and O_6 are Retention scores for Experimental and Control group

T – Treatment

Y – Traditional Method

The notable difference between this research methodology i.e., Quasi – Experimental Research design from the True Experimental Research design is that while the True Experimental Research design involves the random selection of variables, the Quasi – Experimental Research design does not.

3.3 Population of the Study

Out of the 168,771 Senior Secondary School Students in Niger State, all 6,625 students at Minna's Senior Secondary School were participants in this study. The Table 3.2 below displays the population distribution between the Schools in Minna Metropolis, Niger State.

Table 3.2 Population Distribution in the Schools in Minna, Metropolis.

S/No	Name of Schools	Population	Male	Female
1	ABSS MINNA “A”	450	215	235
2	ABSS MINNA “B”	480	275	205
3	DSS TUNGA “A”	435	230	205
4	DSS TUNGA “B”	507	207	300
5	DSS MINNA “A”	470	238	232
6	DSS MINNA “B”	477	233	244
7	GVTC MINNA	490	260	230
8	GGSS O/A MINNA “A”	390		
9	GGSS O/A MINNA “B”	385		
10	WDC MINNA	520	250	270
11	WEC MINNA	498	251	257
12	ZARUMAI MODEL SCHOOL “A”	560	275	285
13	ZARUMAI MODEL SCHOOL “B”	495	280	215
14	GSS LIMAWA MINNA	468	228	240
	TOTAL	6,625		

Source: Ministry of Education (2021/2022)

3.4 Sample and Sampling Techniques

Students studying Biology in Senior Secondary School II (SSII) in Minna, Niger State, made up the study's sample. One hundred and twenty (120) Students were captured for the study in the intact classes of the aforementioned Schools. From the Schools in the Minna metropolitan, the Experimental group and the Control group were chosen using a simple random sampling procedure.

Table 3.3 Research Sample Illustration.

S/No		School Name	Male Students	Female Students	Total No of Students
1.	Experimental	Ahmadu Bahago Senior Secondary School, Minna	37	21	58
2	Control	Zarumai Model School Senior Secondary School, Minna	33	29	62
		Total	**70**	**50**	**120**

Source: School Register (2021/2022)

3.5 Research Instrument

The data gathering tool, known as the Biology Reformulation Achievement Test (BRAT), was created over time as the teaching process progressed. The questions created or generated were based on a specification table that had been accepted for the six (6) levels of the cognitive domain. The questions were of the objective kind, with just one right response and potential answers from A through D. For the Pretest, Posttest, and Retention, twenty (20) questions were created. This is illustrated in the table 3.2 below.

Table 3.4 Table of Specification for the Biology Accomplishment and Retention (BRAT)

Domain	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Biology	6	5	6	1	1	1	20

3.6 Validity of Research Instrument

The instrument developed and used for this experiment was validated by two seasoned Professors from the Department of Science and Technology Education at the Federal University of Technology, Minna, Niger State. In order to determine the appropriateness, simplicity, and clarity of the language used in the questions as well as the suitability of the targeted audiences, experts assessed the questions' face validity. The instrument got a comprehensive examination and any necessary alterations before being given to the students.

3.7 Reliability of Research Instrument

Public Secondary Schools in Minna that weren't included in the study's sampling Schools underwent a reliability Test. Twenty (20) SS2 students were randomly selected, and they had to answer 20 Post-test questions. There scripts were then collected and evaluated and the Post-test results noted. After a two-week interval, the same questions were administered to the students once again, with the outcomes from both scripts pooled and analyzed using

Covariance. The items had a coefficient alpha r = 0.85, proving their reliability and suitability for data collection.

3.8 Scoring

To determine the final score of each student in the Experimental and Control groups, respectively, a score of two (2) marks was awarded for each objective question that was correctly answered on the Pretest. A score of two (2) marks was also awarded for each objective question that was correctly answered on the Posttest and Retention.

3.9 Method of Data Collection

The researcher was given permission to collect data at the sampled schools by the Head of the Department of Educational Technology at Federal University of Technology Minna. The researcher was allowed to enroll in the specific class intended to employ for research by the Administration of the sampled schools. The researcher further went ahead to provide the students under consideration a set of typed questions which were carefully drawn from their Essential Biology Textbook for Senior Secondary Schools authored by M.C Michael, to answer. A Posttest was then utilized to determine the students' degree of achievement. Their Biology teacher then returned the next day to teach the students by utilizing an Expository Teaching Style and Knowledge Reformulation after which the researcher then tested the students' recollection of the knowledge two weeks later by asking them the same questions but in a different order. Three alternative approaches were used to gather the data for this investigation. A pretest was administered before the treatment began, to collect information regarding the student's entry-level behavior. After that, information from the

Posttest was obtained in order to answer the study question. To gauge their capacity for retention in both the Experimental group and the Control group, the identical set of students received a Posttest two weeks after the therapy.

3.10 Method of Data Analysis

Data collected were analyzed using Mean and Standard Deviation to answer the research questions while T – test statistics to analyze Pretest scores, Posttest scores and Retention scores using statistical package for social sciences (SPSS) version 21.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

The Biology Reformulation Achievement Test (BRAT) was used as a data collection tool in this study to investigate the impact of Knowledge Reformulation and Expository Teaching styles on Student Accomplishment and Retention in Minna Metropolitan. The study's data were analyzed and presented in this chapter using the Quasi-Experimental research design (Pretest, Posttest) Control group design.

4.2 Presentation of Results

4.2.1 Pretest results

Prior to administering the Treatment to the students under consideration, a Pretest was given to the two groups of students (Experimental Group and Control Group) to determine the students' entry knowledge. The Pretest results were documented after the Pretest was administered to the students and illustrated in the Table 4.1 below:

Table 4.1t-test analysis of Pretest Scores of Experimental and Control Groups.

Group	N	df	$\bar{x}$	SD
Experimental	58	118	35.250	6.242
Control	62		36.166	7.035

According to Table 4.1, the mean score of the Experimental and Control Groups before treatment did not differ significantly. The control group has a mean score of 36.166, while the experimental group has a mean score of 35.250. The marginal mean score of 1.084 was calculated by subtracting the mean score of the Experimental group from the mean score of the Control group, which is not significant at the 0.05 alpha level of significance. As a result of the aforementioned marginal difference in mean scores, the two groups of students were deemed suitable for the research study. In this case, however, the t-test analysis was used to compare the two means involved in this case study.

4.3 Post-test Results.

4.3.1 Test of Hypotheses

This section presents the results of the treatment administered to the group using the Biology Reformulation Achievement Test (BRAT) strategy and the control group using Traditional Instructional Strategies.

Ho_1: There is no statistically significant difference in mean achievement scores between students taught using the Biology Reformulation Achievement Test (BRAT) and those taught using Traditional Instructional Strategies.

Table 4.2. Analysis of Post-test Mean Achievement Scores of Experimental and Control Groups using Covariance.

Variable	N	df	$\bar{x}$	SD	t-cal	sign. (2-tailed)
Experimental Group	58		41.166	2.656		
		118			5.373	.000*
Control Group	62		38.233	3.290		

**Significant at p< 0.05*

Table 4.2 revealed that the experimental group taught the concept of mitosis using a computer-aided instruction (BRAT) package outperformed the control group taught using Traditional Instructional Strategies (TIS). The experimental group had a higher mean post-test achievement score of 41.166 than the control group, which had a score of 38.233. This demonstrates that the experimental group understood the biology subject better than the control group, with a marginal difference of 2.933, which is significant. The hypothesis test, however, revealed that the calculated t-value of 5.373 is significant at 0.000 less than 0.05 alpha level, df = 188, SD = 2.656, and 3.290, respectively. As a result, hypothesis one was rejected and the alternative was accepted, namely, that there is a significant difference in the achievement of students taught biology using BRAT versus Traditional Instructional Strategies (TIS).

Ho_2: There is no significant difference between the mean achievement scores of male and female students taught biology with BRAT package.

Table 4.3 Analysis of Post-test Scores of the Experimental Male and Female Taught Biology with BRAT using Covariance.

Variable	N	df	$\bar{x}$	SD	t cal	sign (2 tailed)
Experimental Males	30		35.583	3.271		
		58			.658	.512 NS
Experimental Females	30		35.833	3.387		

Not significant at p<0.05

The mean scores of male and female students in the experimental group taught biology with the BRAT package did not differ significantly, as shown in Table 4.3. (35.583 and 35.833). Females in the experimental group had a marginal mean difference of 0.250 in the post-test compared to males in the same group. The second hypothesis test (2) revealed that t.cal =.658, df = 58, SD = 3.271 and 3.387 are not significant at (p>.512). As a result, hypothesis two (2) is not rejected. That is, there is no significant difference in achievement between male and female students taught biology through BRAT.

Ho$_3$: There is no significant difference between the mean retention scores of students taught biology with BRAT method and those taught with Traditional instructional Strategies (TIS).

Table 4.4 Analysis of Post-test Delayed Scores of Experimental and Control Group Taught with BRAT and TIS respectively using Covariance.

Variable	N	df	$\bar{x}$	SD	t-cal	sign (2-tailed)
Experimental Group	58		38.316	2.432		
		118			0.078	0.012*
Control Group	62		36.966	3.319		

Significant at p<0.05 level

According to Table 4.4, the BRAT-led instructional group has the highest mean retention score of 38.316, compared to 36.966 for the control group. This suggests that the BRAT-led instruction group had a better chance of remembering what they had learned than the TIS group. The calculated t-value of 0.078, SD = 2.432, and 3.319 is significant at 0.12 less than the alpha level of 0.05. As a result, hypothesis three (3) was rejected, indicating that there is a significant difference in the mean retention scores of students taught biology with BRAT versus those taught with TIS.

Ho_4: There is no significant difference between the mean retention scores of male and female students taught biology with BRAT.

Table 4.5 Analysis of Covariance of Posttest Delayed Retention Scores of Male and Female Students in the Experimental Group.

Variable	N	df	$\bar{x}$	SD	t-cal	sign(2-tailed)
Experimental						
Males	29		37.783	2.992		
		58			0.520	0.640 NS
Experimental						
Females	31		37.500	2.977		

Not significant at alpha p>0.05

Table 4.5 shows that males had a marginal mean difference of 0.283 in the post-test delayed compared to females (37.783 - 37.500 = 0.283). Male students had a mean score of 37.783 and females had a score of 37.500, df = 58, SD = 2.922 and 2.977, t-calculated = 0.520 and 0.604 significance, respectively. As a result of the .604 >.05 alpha level, hypothesis four (4) was not rejected. That is, there is no significant difference in student retention scores based on gender when taught biology with BRAT.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study's findings were discussed in this chapter. Conclusions were also reached, and the implications for education were debated. Furthermore, recommendations were made based on the study's implications, the study's limitations, suggestions for further research, and the research's summary and conclusions.

5.2 Discussion of Findings

Tables 4.1 show the mean and standard deviations of the experimental and control groups in the Pretest.

The experimental group has a mean score of 35.250 with a standard deviation of 6.242 and a degree of freedom (df) of 118, while the control group has a mean score of 36.166 with a standard deviation of 7.035. Both groups did not differ significantly, with a marginal mean difference of 0.916 that was not statistically significant. As a result of the two groups' mean scores indicating that the experiment and control groups had comparable entry knowledge of the subject biology prior to treatment, the two groups were deemed suitable for the research study.

Table 4.2 Indicates the Analysis of Covariance of the Post-test Mean Achievement Scores of the Experimental Group exposed to the Treatment using the BRAT Package and those exposed to TIS.

According to the table, the experimental group has a mean score of 41.166, SD = 2.856, and df = 118, while the control group has a mean score of 38.233 and SD = 3.290. This means that the experimental group was significantly better than the control group, with a marginal mean difference of 2.933. The calculated t-value of 5.373 is significant at the alpha level of less than 0.05. As a result, hypothesis one (1) was rejected. That is, there is a significant difference in mean achievement scores between students taught with BRAT and those taught with TIS. This finding is consistent with the findings of Bayrakter (2000), Mutz (2000), Campbell (2000), Ezeogo & Awagah (2000), Ozofor (2001), Kurumeh (2004), Iji & Harbor-Peters (2004), Deck et al (2008), Agommuoh (2010), and Sani (2012), who discovered that students exposed to BRAT performed significantly better than the control group exposed to Traditional Instruction Strategies of instruction.

Table 4.3 shows the Analysis of Covariance of the Post-test Scores of the Experimental Males and Female Taught Biology with the BRAT Package.

According to the table, the experimental males and females were taught biology using the BRAT package. The experimental males have a mean score of 35.583, SD -3.271, df = 58, while the experimental females have a mean score of 35.833 and SD = 3.387, with a marginal mean difference of 0.253 that is not significant. The hypothesis test results in a t-calculated value of.658 and a significant 2-tailed value of .512, df = 58, which is not significant at p.

Table 4.4 shows the Analysis of Covariance of the Post-test-Delayed Scores of the Experimental and Control Groups after a Period of Two Weeks.

The experimental group has a post-test delayed score of 38.316 SD = 2.432, df = 118, whereas the control group has a mean score of 36.966, SD = 3.319, and a significant marginal mean difference of 1.350. This demonstrates that the experimental group outperformed the control group in the delayed Post-test. The calculated t-value of 0.078 is significant at 0.05 alpha levels of significance. As a result, the hypothesis was rejected, indicating that there is a significant difference in the post-test delayed mean scores of the experimental and control groups in biology concept retention when exposed to the BRAT package and TIS. This finding is consistent with the findings of Obodo (1990), Madu (2004), Ezenwa (2005), Nwamuo (2006), Ogbonna (2007), and Agomuoh (2010), who discovered that after two weeks of post testing, a post-test administered to the same group of students revealed that the experimental group performed significantly better than the control group.

Table 4.5 shows the Analysis of Covariance of the Post-test-Delayed Retention Scores between the Males and Females in the Experimental Group Exposed to BRAT Package.

The experimental males had a mean score of 37.783, SD = 2.992, and the females had a mean score of 37.500, SD = 2.977, and df = 58, with a marginal difference of 0.283 that was not significant. The test of hypothesis four reveals that the calculated t-value is 0.530, which is not significant at the $p > 0.05$ alpha level. As a result, hypothesis four (4) was not rejected. That is, there is no significant difference in the post-test delayed scores of students exposed to the BRAT package between males and females. Sadker (1994), Okonkwo (1997), Alio (1997), Praat (1999), Aiyedun (2000), Aguele (2004), Kurumeh (2004), Browning (2008), Ezenwa & Gambari (2012), Ezenwa & Koroka (2012), and others found no significant gender influence between achievement scores of males and females students exposed to the same BRAT treatment in the experimental group.

5.3 Summary of the Study

In this study, the BRAT package was compared to the TIS for teaching biology in Senior Secondary school (II). This research was conducted in Minna Metropolis. The study was guided by four research questions, which were answered using mean and Standard Deviation, and the four research hypotheses were tested using analysis of covariance. The study used a sample of 120 students, 60 male and 60 female SSII students from Ahmadu Bahago Senior Secondary school and Zarumai Model School Senior Secondary school both in Minna metropolis. Intact classes were used, and two groups were assigned at random as experimental (treated with the BRAT package) and control (treated with TIS). The study's design was quasi-experimental. The researcher's Biology Retention Achievement Test (BRAT), which consisted of 20 objective questions, was used to collect data. For the two groups, a single lesson note was prepared. The research instrument was validated by experts from the Federal University of Technology Minna's Education Technology Department, School of Science and Technology Education. It was trial or pilot tested to determine internal consistency and stability. Data for the pre-test, post-test, and retention test were collected. To answer the research questions, the data was analyzed using the mean, while analysis of covariance was used to test the hypothesis.

Students taught using the BRAT package in Biology performed better than those taught using the Traditional Instructional Strategies TIS in biology. It also demonstrated that students taught using the BRAT package outperformed those taught using Traditional Instructional Strategies. Because there was no significant difference in performance between males and females in the experimental group, the package was determined to be gender friendly. The findings have significance for educators, parents, software producers, computer programmers, state and federal ministries of education, as well as other research institutions and academics. The study suggested, among other things, that teachers use the BRAT package as their teaching methodology across the majority of subject areas.

5.4 Major Findings of the Study

The study's primary conclusions included the following:

- ❖ The experimental group exposed to BRAT package method did significantly better than the control group exposed to TIS of teaching biology.
- ❖ That the males and females in the experimental group had equal tendency to excel when they were exposed to BRAT package.
- ❖ The experimental group in the post-test-delayed did better than the control group after a period of two weeks of administering post-test to the two.

- There was no significant difference in the retention of biology concept by the males and females exposed to BRAT method.

5.5 Contributions of the Study to Knowledge

The development of students' logical and practical scientific attitudes is one of the goals of Senior Secondary Biology Education. Learning from readily available sources and resources would increase the chances for individuals to take the initiative in their own education. Contributions like this would be among them:

- BRAT package would enhance the learning achievement in students if available for instruction at lower grade level.
- Provide more opportunities for students to learn individually and collectively among peers at their own pace.
- Interest and attitudinal changes would be stimulated towards the subject leading to cognitive development.
- More materials/topics would be covered within a given time frame of studies as students learn at their own pace and time.

5.6 Conclusions

On the basis of the results of this investigation, the following conclusions were drawn. The findings of this study offered actual proof that, compared to Traditional Instructional Strategies, computer-assisted training improved students' achievement and memory in biology's biology. Male and female Biology students who were taught biology via the Biology Retention Achievement Test outperformed those who were taught biology using the

Traditional Instructional Strategies. The mean achievement scores of male and female students who were taught biology using BRAT did not significantly differ from one another. In terms of success and retention when using the BRAT program in teaching biology, gender has no discernible impact.

5.6 Recommendations

The following recommendations were made based on the findings of the study

- ❖ Since the use of Biology Retention Achievement Test enhances achievement and retention in teaching biology subject, teachers should be encouraged to use it as a teaching strategy in the classroom.
- ❖ Seminars and Workshops should be organized for teachers, authors and curriculum planners on how to use BRAT packages as this will go a long way to reduce the current failures being experienced by students of the subject in external and internal examinations

Suggestions for Further Studies:

- ❖ Experiments should be conducted to isolate the latent and overt traits that accounts for better performance of the males than the females. The traits when identified should be emphasized for every student who wants to register for biology.
- ❖ Longer research study period (say 11-12 weeks) should be conducted on the use of BRAT package and its results and findings compared with the present one.

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APPENDIX A

LESSON PLAN FOR EXPERIMENTAL GROUP

Subject: Biology

Class: SS2

Time: 8:00 – 8:40am

Duration: 40mins

Sex: Mixed

Behavioural Objective: at the end of this lesson, the students should be able to:

1. Define what a Cell is
2. Identify and differentiate between plant and animal cells
3. Identify the different parts of a cell
4. State the functions of each part of the cell

Entry Behaviour: The y (students) are familiar with the cell structure looks like and can define a cell. e.g nucleus, mitochondria, cell membrane.

Skills to practice: Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure.

Instruction Media: Biology Retention and Achievement Test (BRAT)

BODY OF LESSON/REPRESENTATION OF CONTENT

Steps	Item	Skills	Teacher Activities	Student Activities
	Introduction	Definition of the cell. Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure.	The teacher asks the students questions relating to the topic based on their previous knowledge e.g what is a cell	The students then answer the questions based on their level of understanding
Steps 1	Definition/Explanation of terms	Definition of the cell. Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure	Teacher defines the cell as the basic unit of life. She then goes ahead to give a brief history of the cell, the scientists that worked on the cell theory, the various parts of the cell and their functions, identifications.	Students listen very attentively, focus on what the teacher is teaching take notes and try to understand the topic at hand.
Steps 2	Definition/Explanation of terms	Definition of the cell. Identification of the various parts of the cell, explanation and	Teacher then calls the students one after the other to define a cell. Starting with the class captain to come out in	Students responds by answering the questions based on what

		examples, questioning, reinforcement, repletion and closure	front of the class and explain what has been taught. She asked them one by one to give a brief history about the cell based on what they have been shown and name at least one scientist that worked on the cell	the teacher had taught them. They are however corrected wherever they make any form of mistake immediately. Each student called out also did justice to the questions to the best of their understanding.
Steps 3	The Cell Theory	The Teacher explains the cell theory by telling the students that it was proposed by a world-renowned scientist and famous biologist by name Theodore Schwann in the year 1839. She	Teacher tells the students about how Theodore Schwann and Mathias Schleiden in their conclusion in 1838 postulated the cell theory.	Students responds by taking notes and listening attentively to what the teacher is teaching.

		told them that there are 3 parts to this theory namely: 1. All organisms are made up of cell. 2. Cells are the basic unit of life and 3. Cells come from pre-existing cells that have multiplied.		
Steps 4	Evaluation	Closure, Questioning and Reinforcements.	1. Teacher asks the students the appropriate questions based on what they have just been taught in the class. 2. She corrects whatever error or wrong answers whenever the students are answering the questions being asked	Students responds to the questions to the best of their knowledge and understanding while the class was in progress.

Steps 5	Conclusion	Closure, Communication and Detailed Explanation.	Teacher then brings the lesson to an end after the lesion time had almost elapsed through appropriate social closure. She divided all the students into study groups to study more about the topic they were taught in class and also to select 3 persons that will represent the group by presenting in their next class.	The students then brainstormed and also took note of the group that each one has been assigned for the group assignment.

APPENDIX B

LESSON PLAN FOR CONTROL GROUP

LESSON PLAN FOR EXPERIMENTAL GROUP

Subject: Biology

Class: SS2

Time: 8:00 – 8:40am

Duration: 40mins

Sex: Mixed

Behavioural Objective: At the end of this lesson, the students should be able to:

5. Define what a Cell is
6. Identify and differentiate between plant and animal cells
7. Identify the different parts of a cell
8. State the functions of each part of the cell

Entry Behaviour: The (students) are familiar with what the cell structure looks like and can define a cell. e.g. Nucleus, mitochondria, cytoplasm.

Skills to practice: Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure.

Instruction Media: Conventional/Traditional Teaching Method

BODY OF LESSON/REPRESENTATION OF CONTENT

Steps	Item	Skills	Teacher Activities	Student Activities
	Introduction	Definition of the cell. Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure.	The teacher asks the students questions relating to the topic based on their previous knowledge e.g what is a cell	The students then answer the questions based on their level of understanding
Steps 1	Definition/Explanation of terms	Definition of the cell. Identification of the various parts of the cell, explanation and examples, questioning, reinforcement, repletion and closure	Teacher defines the cell as the basic unit of life. She then goes ahead to give a brief history of the cell, the scientists that worked on the cell theory, the various parts of the cell and their functions, identifications.	Students listen very attentively, focus on what the teacher is teaching take notes and try to understand the topic at hand.
Steps 2	Definition/Explanation of terms	Definition of the cell. Identification of the various parts of the cell, explanation and	Teacher then calls the students one after the other to define a cell. She asked them one by	Students responds by answering the questions based on what the teacher had taught them.

		examples, questioning, reinforcement, repletion and closure	one to give a brief history about the cell based on what they have been shown and name at least one scientist that worked on the cell	They are however corrected wherever they make any form of mistake immediately.
Steps 3	The Microscope	The Teacher explains what a Microscope looks like and what it is used for to the students. The teacher also gave a brief history about how the first microscope in history was invented in the year 1590 by a Dutch optician named Hans Janssen	Teacher then explains in details the uses and functions of the Microscope and how it is being used to magnify very tiny organisms which cannot be seen with the naked eyes. And one of such tiny organisms is a cell.	Students responds by taking notes and listening attentively to what the teacher is teaching.
Steps 4	Evaluation	Closure, Questioning and Reinforcements.	1. Teacher asks the students the appropriate questions based on	Students responds to the questions to the best of their knowledge and understanding

			what they have just been taught in the class. 2. She corrects whatever error or wrong answers whenever the students are answering the questions being asked	while the class was in progress.
Steps 5	Conclusion	Closure, Communication and Detailed Explanation.	Teacher then brings the lesson to an end after the lesion time had almost elapsed through appropriate social closure. She also gave	Students copy their assignments into their notebooks. “Write at least 7 uses of the Microscope”

			them an assignment "Write at least 7 uses of the Microscope"	

BIOLOGY REFORMULATION AND ACHIEVEMENT TEST (BRAT) FOR EXPERIMENTAL AND CONTROL GROUPS

Pre– Test Questions

Instruction: Please do not open the questions until you are told to do so. All questions carry equal marks.

1. **Which of these is a basic unit of life of a cell?**

a. Nucleus
b. Mitochondria
c. Contractile vacuole
d. Chlorophyll

2. **Plant cells are made up of?**

a. Water and glucose
b. Carbohydrates
c. Proteins and lipids
d. Genetic material

3. **Which is the correct formula in finding the magnification of a specimen under a microscope:**

a. Power of low power objective X power of high-power objective = magnification
b. Power of high-power objective + power of low power objective = magnification
c. Power of ocular lens X power of objective lens = magnification

d. Power of ocular lens + power of objective lens = magnification

4. **What is the space between the objective lens and the slide called?**

a. Field of vision
b. Magnification area
c. Lens space
d. Working distance

5. **Which of these is not a postulate of the cell theory?**

a. Cells are basic unit of life
b. All cells contain a nucleus which has the genetic material
c. Living things are composed of one or more cells
d. Cells arise from existing cells

6. **The organelle responsible for breaking sugar molecules to provide energy is known as?**

a. Nucleus
b. Mitochondria
c. Lysosomes
d. None of the above

7. **What is the difference between growth and development?**

a. Growth includes all the changes during an organism's life cycle, while development describes what happens to an organism before it is born.
b. Growth is the process of becoming larger, while development describes getting older.

c. Growth is the process of becoming larger, while development describes the physical changes that occur in an organism during its life cycle.

d. None of these

8. The nucleus and other cell organelles are contained in the?

a. Nuclear area

b. Cytoplasm

c. Cellular cavity

d. Vacuole

9. Which is the order of warmness to coldness?

(i) Solid, liquid, gas

(ii) Liquid, solid, gas

(iii) Gas, solid, liquid

(iv) Gas, liquid, solid

10. What is the space between the objective lens and the slide called?

e. Field of vision

f. Magnification area

g. Lens space

h. Working distance

11. Which organelle does a plant use to store food?

a. Chloroplast

b. Lipid

c. Nucleus

d. Vacuole

12. The process by which your body uses energy to power chemical processes is called

a. Digestion
b. Osmosis
c. Metabolism
d. Diffusion

13. Which is the correct order of cellular organization from smallest to largest?

a. Cells, organ, organism, organ systems, tissue
b. Cells, tissue, organ, system, organism
c. Cells, organism, organ, organ systems, tissue
d. None of these

14. Why did we focus on three different threads stacked on a slide under the microscope?

a. To discover what is meant by field of vision
b. To discover what is meant by magnification
c. To discover what is meant by depth of field
d. All of these.

15. Diffusion occurs as a result of?

a. The mitochondria of cells
b. Random motion of molecules
c. Spontaneous generation
d. Semi-permeable membranes

16. The cell organelle responsible for the green pigmentation of a plant is?

a. The cell-wall
b. The vacuoles
c. The chlorophyll

d. All of these.

17. The area visible when looking through the microscope is?

a. Objective space
b. Field of vision
c. Working distance
d. Magnification

18. Protein is synthesized by?

a. Endoplasmic reticulum
b. Ribosomes
c. Chloroplasts
d. None of these

19. Which of these is part of characteristics of *all* living things?

a. Organized with the cell being the basic unit
b. Contain similar chemicals
c. Are multicellular
d. Reproduce

20. Which of the following is NOT a characteristics of all living things?

a. Respond to their surroundings
b. Reproduce
c. Breathe oxygen
d. None of the above

Goodluck!

BIOLOGY REFORMULATION AND ACHIEVEMENT TEST (BRAT) FOR EXPERIMENTAL AND CONTROL GROUPS

Post – Test Questions

Instruction: Please do not open the questions until you are told to do so. All questions carry equal marks.

1. **What is the difference between growth and development?**

e. Growth includes all the changes during an organism's life cycle, while development describes what happens to an organism before it is born.
f. Growth is the process of becoming larger, while development describes getting older.
g. Growth is the process of becoming larger, while development describes the physical changes that occur in an organism during its life cycle.
h. None of these

2. **Which organelle does a plant use to store food?**

(v) Chloroplast
(vi) Lipid
(vii) Nucleus
(viii) Vacuole

3. **The process by which your body uses energy to power chemical processes is called**

a. Digestion

b. Osmosis
c. Metabolism
d. Diffusion

4. The organelle responsible for breaking sugar molecules to provide energy is known as?

i. Nucleus
j. Mitochondria
k. Lysosomes
l. None of the above

5. Protein is synthesized by?

e. Endoplasmic reticulum
f. Ribosomes
g. Chloroplasts
h. None of these

6. The area visible when looking through the microscope is?

a. Objective space
b. Field of vision
c. Working distance
d. Magnification

7. The nucleus and other cell organelles are contained in the?

e. Nuclear area
f. Cytoplasm

g. Cellular cavity
h. Vacuole

8. Which is the correct order of cellular organization from smallest to largest?

e. Cells, organ, organism, organ systems, tissue
f. Cells, tissue, organ, system, organism
g. Cells, organism, organ, organ systems, tissue
h. None of these

9. Which of these is not a postulate of the cell theory?

e. Cells are basic unit of life
f. All cells contain a nucleus which has the genetic material
g. Living things are composed of one or more cells
h. Cells arise from existing cells

10. Which of the following is NOT a characteristics of all living things?

a. Respond to their surroundings
b. Reproduce
c. Breathe oxygen
d. None of the above

11. Why did we focus on three different threads stacked on a slide under the microscope?

21. To discover what is meant by field of vision
22. To discover what is meant by magnification

23. To discover what is meant by depth of field
24. All of these.

12. Plant cells are made up of?

e. Water and glucose
f. Carbohydrates
g. Proteins and lipids
h. Genetic material

13. Which of these is part of characteristics of *all* living things?

e. Organized with the cell being the basic unit
f. Contain similar chemicals
g. Are multicellular
h. Reproduce

14. Diffusion occurs as a result of?

e. The mitochondria of cells
f. Random motion of molecules
g. Spontaneous generation
h. Semi-permeable membranes

15. Which is the correct formula in finding the magnification of a specimen under a microscope:

e. Power of low power objective X power of high-power objective = magnification

f. Power of high-power objective + power of low power objective = magnification
g. Power of ocular lens X power of objective lens = magnification
h. Power of ocular lens + power of objective lens = magnification

16. Which is the order of warmness to coldness?

e. Solid, liquid, gas
f. Liquid, solid, gas
g. Gas, solid, liquid
h. Gas, liquid, solid

17. The cell organelle responsible for the green pigmentation of a plant is?

e. The cell-wall
f. The vacuoles
g. The chlorophyll
h. All of these.

18. What is the total magnification for 10x ocular lens and a 50x objective lens?

e. 50 x
f. 500 x
g. 60 x
h. 600 x

19. What is the space between the objective lens and the slide called?

e. Field of vision

f. Magnification area
g. Lens space
h. Working distance

20. Which of these is a basic unit of life of a cell?

a. Nucleus
b. Mitochondria
c. Contractile vacuole
d. Chlorophyll

Goodluck!

BIOLOGY ACHIEVEMENT TEST

FOR EXPERIMENTAL AND CONTROL GROUP

PRE– TEST (ANSWERS)

1. A
2. C
3. C
4. D
5. B
6. B
7. D
8. B
9. D
10. B
11. D
12. C
13. B
14. D
15. B
16. C
17. B
18. B
19. D
20. D

BIOLOGY ACHIEVEMENT TEST

FOR EXPERIMENTAL AND CONTROL GROUP

POST– TEST (ANSWERS)

1.	D
2.	D
3.	C
4.	B
5.	B
6.	B
7.	B
8.	B
9.	B
10.	D
11.	D
12.	C
13.	D
14.	B
15.	C
16.	D
17.	C
18.	B
19.	D
20.	A

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument

Thanks for your anticipated assistance.

GENERAL
DEPT. OF EDUCATIONAL TECHNOLOGY
FED. UNIVERSITY OF TECHNOLOGY
09 MAR 2023
P.M.B 65, MINNA, NIGER STATE
SIGN

Dr. C.S. ... 9/3/2023
....

Head of Department (Signature, Date & Official Stamp)

Student's Surname......OKONKWO...................... Other Names O. ELIZABETH

Registration Number..2016/1/61561 BT... Programme... EDUCATIONAL TECHNOLOGY

Title of the Instrument.... BIOLOGY ACHIEVEMENT TEST..............

ATTESTATION SECTION

Summary of the Remark on the Instrument.............. Appropriate.............

....

....

I hereby attest that the above named student brought his instrument for validation

Name of Attester.... Fasasi-Alagun Ruqayyat ....

Designation.......... Biology teacher ....

Name and address of institution ....

Phone Number..... 0806... .... E-Mail..........................

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for... appropriate
2. Clarity and simplicity for the level of the language used... very clear and simple
3. Suability for the level of the targeted audience ... well-suited
4. The extent in which the items cover the topic it meant to cover... well covered
5. The structuring of the Questionnaire... very appropriate
6. Others (grammatical errors, spelling errors and others... corrected
7. General overview of the Instrument... Very appropriate

Suggestions for improving the quality of the Instrument

1. Nil
2. ...
3. ...
4. ...
5. ...

Name of Validator... Fasasi -Alyu Rubayat

Area of Specialization... Biology

Name of Institution. Model Sec. Sch. [illegible] Designation... Teaching

Signature... [illegible] Date. 13/03/23

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument.

Thanks for your anticipated assistance.

GENERAL
DEPT. OF EDUCATIONAL TECHNOLOGY
FED. UNIVERSITY OF TECHNOLOGY
09 MAR 2023
P.M.B. 65 MINNA, NIGER STATE

Dr. C. S. ... 9/3/2023

Head of Department (Signature, Date & Official Stamp)

Student's Surname: OKONKWO Other Names: O. ELIZABETH

Registration Number: 2016/1/61561BI Programme: EDUCATIONAL TECHNOLOGY

Title of the Instrument: BIOLOGY ACHIEVEMENT

ATTESTATION SECTION

Summary of the Remark on the Instrument: THE INSTRUMENT IS WITHIN THE LEVEL OF TARGETED STUDENTS.

I hereby attest that the above named student brought his instrument for validation

Name of Attester: Dr. AB Amu Zakariyau Eniti

Designation: LECTURER

Name and Address of Institution: FUT MINNA

Phone Number: 08036325687 E-Mail: odamuzakariyau@futminna...

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for: APPROPRIATE
2. Clarity and simplicity for the level of the language used: CLEARED
3. Suability for the level of the targeted audience: SUITABLE
4. The extent in which the items cover the topic it meant to cover: COVERED
5. The structuring of the Questionnaire: STANDARD
6. Others (grammatical errors, spelling errors and others: MINOR
7. General overview of the Instrument: STANDARD

Suggestions for improving the quality of the Instrument

1. THE INSTRUMENT CAN BE REVIEW
2.
3.
4.
5.

Name of Validator: Dr. ADAMU ZUBAIRU SULE
Area of Specialization: EDUCATIONAL TECHNOLOGY
Name of Institution: FUT, MINNA Designation: LECTURER
Signature: Date: 14/03/2023

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument.

Thanks for your anticipated assistance.

2/3/2023

Head of Department (Signature, Date & Official Stamp)

Student's Surname: Okonkwo Other Names: O. Elizabeth

Registration Number: 2016/1/61561BT Programme: Educational Technology

Title of the Instrument: Biology Achievement Test

ATTESTATION SECTION

Summary of the Remark on the Instrument: The instrument BRAT is adequate for the proposed study.

I hereby attest that the above named student brought his instrument for validation

Name of Attester: Dr. Rabiu M. Bello

Name and Address of Institution: Dept. of Science Edu.

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
SCHOO OF SCEINCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

PROF. Faruk Adamu Kuta
VICE CHANCELLOR
Dr. Tukura C. S.
NCE, Bed, Mtech, Phd (Edu.Tech) UNN
HEAD OF DEPARTMENT

P.M. B. 65, MINNA
Telephone: 222304, 222397/28
Telegram: FUTECH, Minna.
Telex

OUR Ref:

Your Ref:

Date:

....

....

....

....

TO WHOM IT MAY CONCERN

The bearer Okonkwo O Elizabeth with REG. NO. 2016/1/61561BT

is an undergraduate student of Educational Technology Department. He/ She needs your assistance to enable him/her carry out his/her research work.

We will appreciate your anticipated co-operation.

Thank you.

GENERAL
DEPT. OF EDUCATIONAL TECHNOLOGY
FED. UNIV. OF TECHNOLOGY
22 MAR 2023
22/3/2023

Dr. Tukura C.S.
HOD, Educational Technology
SIGN