EFFECTS OF TECHNOLOGY- ENABLED ASSESSMENT FOR LEARNING PACKAGES ON JUNIOR SECONDARY SCHOOL STUDENTS' ATTITUDE TO AND ACHIEVEMENT IN BASIC SCIENCE IN IBADAN, NIGERIA

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CERTIFICATION

I certify that this work was carried out by **Hannah Bosede OGUNRINDE** in the Institute of Education, University of Ibadan, Nigeria.

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DEDICATION

This thesis is dedicated to the glory of the Almighty God, the benefactor of mankind, for His unfailing love, care, mercy and favour upon me. It is through His help I am able to achieve this current academic success, and also dedicated to my beloved children.

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ABSTRACT

The performance of students in Basic Science in junior secondary schools in Ibadan is poor due to inappropriate instructional strategies used by the teachers. Previous studies focused largely on effects of several teaching methodologies that are instructional based on students' Basic Science performance without considering the use of technology-enabled assessment approach that offers opportunities to the students to learn at their own paces. Therefore, this study was designed to investigate the effects of two Technology-Enabled Assessment for Learning Packages [Feedback, and Feedback and Remediation (FR) on students' attitude to and achievement in Basic Science in JSS in Ibadan. Moderating effects of gender and Social Economic Background (SEB) were also examined.

The study was anchored to constructivist (John Dewey) and behaviourist (Ivan Pavlov) learning theories. Pretest-posttest control quasi-experimental design using 3x2x3 factorial matrix was adopted. Three co-educational schools were randomly selected from each of the two existing educational zones in Ibadan city. Two schools were randomly assigned to each of the experiment (FR, feedback) and control groups. Twenty–five students were randomly selected in each of the six schools making 150 participants. Since intact classes were not used, remaining students were taught same topics by their teachers in the selected schools. Basic Science Attitudinal (r=0.73), Basic Science Achievement Test (r=0.79), and Social Economic Background Scales (r=0.75) were used as instruments. Data were analysed using Analysis of Covariance at $\alpha = 0.05$.

There was a significant main effect of treatment on students' attitude to Basic science (BS) $F_{(2, 131)} = 143.2$, $\eta^2 = 0.70$. The FR group had highest $\bar{x} = 56.67$, those in feedback group had$\bar{x} = 51.13$, while control had $\bar{x} = 25.66$ on attitude of students to BS. Also, there was a significant main effect of treatment on students' achievement in BS ($F_{(2,131)} = 294.4\eta^2 = 0.82$). The FR group had highest $\bar{x} = 82.30$, followed by those in feedback group ($\bar{x} = 63.04$), while control had $\bar{x} = 32.10$ on achievement of students in BS.Gender and SEB had no significant main effect on students' attitude to BS. Meanwhile, males had a higher $\bar{x} = 45.70$, while females had ($\bar{x} = 43.30$ on attitude to BS. Students from high SEB had highest$\bar{x} = 45.20$, moderate SEB had $\bar{x} = 44.70$ while low SEB had $\bar{x} = 43.60$. Gender and SEB also, had no significant main effect on student's achievement in BS. However, males had higher mean score ($\bar{x} = 60.86$), while females had $\bar{x} = 57.43$ in BS achievement. Students from high SEB had highest $\bar{x} = 61.81$, low SEB had $\bar{x} = 58.49$, while moderate SEB had $\bar{x} = 57.13$. There was no significant interaction effect of any pair of independent and moderating variables on achievement and attitude.

The Technology-Enabled Assessment for Learning Package of feedback and remediation type enhanced attitude to and achievement in Basic Science among Junior Secondary School students in Ibadan. Basic Science teachers should make use of Technology-Enabled Assessment packages in teaching the subject.

Keywords: Technology-enabled assessment package, Feedback and remediation, Students' attitude to Basic Science, Social economic background, Students' achievement in Basic Science

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Problem

Science is a systematic and organized method of acquiring knowledge about the natural world through observation, experimentation, and analysis. It involves studying and understanding the various aspects of the universe, including its physical, biological, and social phenomena. Science relies on empirical evidence and follows a set of principles and methodologies to investigate the natural world and formulate explanations based on evidence. Primary goal of science is to develop a deeper understanding of how things work and to uncover the underlying laws and principles that govern the natural phenomena. It involves making observations, formulating hypotheses or explanations for those observations, designing experiments or studies to test those hypotheses, and analyzing the results to draw conclusions.

Science is characterized by its reliance on evidence-based reasoning and the continuous refinement of knowledge through the scientific method. It is an ongoing process of inquiry and discovery, with scientists building upon the work of previous researchers and continually challenging and revising existing theories and explanations. The scope of science is broad and encompasses various disciplines, including physics, chemistry, biology, astronomy, geology, psychology, sociology, and many others. Each discipline has its own specialized methods and techniques for investigating and understanding different aspects of the natural world. Overall, science plays a crucial role in expanding our knowledge, driving technological advancements, and improving our understanding of the universe, leading to practical applications and benefits for society. (Adewale, 2009).

In accordance with Urevbu (2016), science is the systematic study of the natural world through observation and experimentation. It involves three main aspects: empirical research, theoretical explanation, and technological application. Empirical research involves collecting data through observation and experimentation, theoretical explanation involves developing models and theories to explain the data, and technological application involves using scientific knowledge to develop new

technologies and solve practical problems. These can be summarized as content, attitude and process. There are two categories of content: physical life and earth science; that is, the understanding we gather about our environment. Attitude in science involves openness and objectiveness (Omoifo, 2012). Process has to do with the means through which scientists gather facts about the universe. Process, in the field of science, has to do with the skills which are mental tools. These include skills like observation, measurement, recording, classification, experimentation, hypothesis, inference, analysing, reasoning, prediction and generalization (Ajayi, 2017). All these mental tools of science were developed to enhance innovation and ensure good interactive environment (Eriba, 2004; Towolawi and Onuka, 2018).

Science has achieved numerous significant accomplishments throughout history, leading to transformative advancements in various fields and benefiting humanity in numerous ways. It has revolutionized the field of medicine, leading to the development of vaccines, antibiotics, surgical techniques, and diagnostic tools. These advancements have significantly reduced the impact of infectious diseases, increased life expectancy, and improved overall healthcare. It has driven remarkable technological innovation or advancements, such as the invention of electricity, computers, telecommunications, and the Internet. These innovations have transformed the way we live, work, communicate, and access information, greatly enhancing our quality of life. These accomplishments of science represent just a fraction of its overall contributions to society, it continues to push boundaries, uncover new knowledge, and address pressing challenges, driving progress and shaping our future. (Omoifo, 2018).The impact of science in the advanced world and its significance in such countless aspects of our lives necessitated its direction into the school system right from elementary classes, where it was known as integrated science. At present, it is referred to as Basic Science.

Okolo and Median, 2018(2018) asserts that all science courses and technological knowledge are built on the foundation of basic science at the senior high school level. Beginning in lower basic levels, fundamental science prepares students for the study of biology, chemistry, and physics in senior secondary school. It was known as fundamental science before it became Integrated Science. As the foundational or elementary science, a learner comes across this subject from lower basic classes to the upper Basic classes (Junior Secondary School), which is responsible for developing the principles of both natural science and humanitarian

disciplines. The influence of Basic Science has enhanced education in terms of restructuring of educational programmes, improvement of classroom facilities due to inclusion of practical sessions. This restructuring process has provided learners the knowledge they need for specific subject areas, promoted expressive learning, enhanced professional productivity with self-dependence (Nazimuddin, 2014).

One of the subjects that emanated from Basic Science is Biology and is concerned with life, its processes and the survival. Chemistry and Physics are also off-shoots of Basic science. The 21st century is characterized by advancement in science, therefore for Nigeria to realize accelerated development in her technology know how, she needs quality science education that is, Basic science in her schools especially at the Basic Educational Level (Glory, Godpower-Echie, Ihenko, 2017)). Despite all the aforementioned importance of science education in national development and everyday life, research reports show a decline in students' performance in Basic science (Okolo and Median, 2018). Basic Science is considered as one of the science-based subjects and one of the core science subjects for prospective students who wish to offer science subject, in senior secondary. However, Basic Education Certificate Examination (BECE) results for Oyo state students in Basic Science reveals that Basic Science students' performance has not been excellent as indicated in Table 1.1. Performance has been fluctuating yearly, and desirable achievement in the subject has not been achieved (Ojimba, 2012)

Table 1:1 Statistics for Student's Performance in Basic Science for BECE in Oyo State from 2006 to 2021

Years	Total Entry No of Candidates	No of Candidates who sat for the Exams	Percentage Passes of Candidates at credit level (A-C)	% of passes at passes(D)	% of failure level (F)
2006	278,112	240,163	31.52	10.32	58.16
2007	382,249	286,831	44.15	42.20	13.65
2008	253,487	245,553	24.69	19.65	55.66
2009	375,850	280,162	35.04	40.46	24.50
2010	559,854	490,522	48.60	23.13	28.27
2011	413,211	400,137	33.37	22.41	44.22
2012	427,644	392,910	33.94	41.00	25.06
2013	453,928	392,567	33.87	30.99	35.14
2014	427,644	381,381	33.90	25.12	40.98
2015	579,432	540,141	38.50	32.85	28.65
2016	649,156	609,827	38.82	32.40	28.78
2017	675,122	623,226	40.22	23.15	36.63
2018	764,234	752,112	40.22	27.64	32.14
2019	689,234	622,122	39.22	25.65	35.13
2020	789,234	642,111	34.45	25.12	40.43
2021	865,554	780,101	35.55	22.14	42.31

Source: Examinations Office, Ministry of Education, Ibadan, Oyo state (2021)

KEY: A- EXCELLENT and B - DISTINCTION, C- CREDIT, D- PASS, F- FAILED

From Table 1:1, it can be affirmed that the percentage performance of the students at the distinction, credit, pass and failure levels in Basic Science is fluctuating, therefore mastery in the subject has not been attained. This fluctuating performance in Basic Science might be as a result of the following challenges: teachers' workload, social economic background of students, and lack of computer usage (Olorundare, 2014).

Spirited intervention is needed for successful learning of Basic Science to give excellent performance. Before this can take place, activities of student are very important in facilitating teaching and learning (Ivowi, 2012). Adopting appropriate strategies of assessment and materials for teaching science can help in making the subject more interesting and engaging for students. One such strategy is the use of formative assessment, feedback, and remediation, as proposed by Anjorin (2008). Additionally, using instructional methods and aids specifically designed for teaching integrated science, as taught through the National Integrated Science Programme (NISP), can also be beneficial in promoting student engagement and understanding of integrated science, which is now known as Basic Science.

Filgona and Linus (2017) proposed an individual mastery learning strategy that included integrated science, now known as basic science in junior secondary schools. These strategies are: standard testing, remediation for students' problem, feedback to students before moving to next instruction. All these are principles of learning worked upon by these researchers to improve student's achievement in the subject but still yield no much improvement.

Yet, with these principles of learning, the ultimate goal has not been achieved in Basic science students' performances, which calls for more work to be done towards getting good a result in the subject. Extant studies have indicated that the Technology-Enabled Assessment for Learning package strategy is superior to the traditional method of teaching and end-of-term evaluation (Danjuma (2015). Therefore, the teaching of Basic science must be given the needed attention, by making use of technology to arouse the interest of students thereby making teaching and learning simpler and more interesting. The roles and responsibilities of teachers in various schools and institutions have undergone significant evolution since the beginning of the 21st century. Armed with a good knowledge of technology, the realm of 'too-much-to-know' and too-many sources-of-knowledge outside the classroom can easily be brought within the school walls by students themselves.

Computer based instruction within the school system is not only a way of implementing the existing curriculum, it has become a new part of the curriculum. It drills students on facts and figures that are new, or difficult to teach using the conventional method. It facilitates self–instruction, which in itself is a 21st century skill. This corroborates the idea of Toffler (2012) which says that, the ignorant or illiterate of 21st century will not be individual who cannot read and write, but the ones that cannot learn, unlearn and relearn. Teaching has gone beyond simply dispensing knowledge, in some ways, students can be involved in their learning, be guided on the computer screen, using simulations, pictures, and videos to explain concepts of some topics in basic science, and other subjects. Such simulations, as well as drill-and-practice tutorial, are available in schools through Computer Assisted Instruction (CAI) also known as Technology-Enabled Instruction (TEI)

Adewale (2009) describes Technology - Enabled Instruction (TEI) which is also known as Computer-Assisted Instruction (CAI) as a programmed instruction in which the computer stands as a teacher to give instruction or tutoring to learners through an interactive process. It is referred to as utilization of computers to train or pass instruction for acquiring skills, (Nazimuddin, 2014). TEI can be considered as a learner-centered and activity-oriented learning that is self-paced and self-directed, through exercising of various senses and the ability to represent content in a variety of media. It makes learning more effective by allowing students to skip through topics or concepts they are already familiar with. Because learning is self-directed, students can choose what they want to learn and how they want to study it. Technology- Enabled Instruction (TEI) combined with assessment is Technology- Enabled Assessment for Learning Package (TEALP), TEALP with Feedback, is TEALPF; andTEALP with Feedback and Remediation is TEALPFR.

Technology- Enabled Assessment for Learning Package will be for assessment with feedback, and also for assessment including feedback and remediation. To achieve better performance in Basic science, continuous learning, testing and assessing is necessary (Oludipe, 2012).Also, Technology- Enabled Assessment Learning Package (TEALP) could be introduced and used, buttressing the idea of Rao and Fapojuwo (2016) which says that “we cannot continue to teach as the Boomers of years back as we were taught, if we do, we can be considered obsolete, hence click delete and download current 21st century skills so that our students can function in the current and future economies”.

Also, in 2020 when the pandemic altered students' learning environment, educators quickly changed to online learning, especially virtual learning. Virtual learning became an essential tool during the coronavirus pandemic, it was good and enhanced healing and safety during pandemic but internet connection failure and affordance of data, limits many students and kids from accessing and benefit from virtual learning. Low-income families cannot afford internet connections which ultimately limits their children. To solve the problem of internet connection, and to give opportunity to all students of high, medium and low- income families, and moreover to give opportunity to all students to learn at their own pace during pandemic or not pandemic, TEALP was designed, it is offline mode of leaning, give opportunity of learning at one's pace and is ongoing. It was designed simple, sequential, easy to access anywhere and anytime. (Kumar, Sarka, Davis and Palemo, 2021).

Technology-Enabled Assessment for Learning Package (TEALP) is the use of computer in assessing students' progress or achievement in a particular concept. It is effective in assessing and encouraging learning, (Heinrich and Lawn, (2004). It is aligned to learning outcomes and it is student-centered. It is of benefit to students in ascertaining the extent of learning, the concept the teacher intends, giving timely feedback and instant remediation for reflective learning. Afuwape and Aanu, (2010) reports that changing the methods of teaching and keeping assessment unchanged, can bring failure in the area of learning. Pedagogical advantages of Technology-Enabled Assessment for Learning Package (TEALP) allow assessment of a topic in a wide range manner to be faster, eradicates double marking, saves time and resources, monitors students' progress in learning, and identifies students' problem quickly. Assessment can be used to monitor the progress of a learner, and the purpose of TEALP is not to determine grades alone, but to inform teachers and students about learning progress and areas of learning that needs improvement. Formative assessment is a process that monitors a student's understanding of a topic as it is being taught. It is a way for teachers to check for understanding and make adjustments to their teaching methods or materials as needed, in order to ensure that students are properly comprehending the material being presented. Formative assessment typically includes activities such as quizzes, class discussions, and individual or group projects, which provide teachers with ongoing feedback on student learning, so that they can make adjustments to instruction and help students to achieve their goals. It is a way by which continuous assessment (C.A) is giving to student, which is one of the educational

reforms in Nigeria. The outcome of assessment is given out as feedback to educational stakeholders, for instance parents, guidance, government at every level for proper re-taught and amendment.

Feedback using (TEALPF) can also be viewed as a way of giving out results of student's ability in a task. This stands as an important portion of active and effective learning that assists learners for proper understanding of a concept learnt in a subject and report to them and give specific instructions on how to enhance their learning. Instructional feedback is effectively linked to academic success or performance (Aldabbus, 2022).

Feedback is a signal that is looped back to control and guides the performance and achievement of a learner. Giving report to students as feedback, sometimes, helps to reduce the gap outcome between the present and proposed learning (Hattie and Timperley, 2007). Hattie, and Gan, (2011) explains that to make feedback useful in the area of learning, there are three major things to be put into consideration, the learner's need to be given reports, receiving report by the student as feedback, willingness and ability to use the feedback. Student who has difficulty with a specific topic or concept are provided with additional instruction and support in order to correct errors in their understanding or skills. It can take many forms, such as additional small group instruction, one-on-one tutoring, or targeted practice activities. The goal is to help student overcome difficulty in learning, and to provide them support they need to achieve success. This process is known as remediation.

Remediation is an important aspect of formative assessment as it allows teachers to address student's difficulties early on and to make adjustments to instruction as needed. By providing students with additional instruction and support, teachers can help students to catch up with their peers and to achieve the learning goals and objectives. Remediation utilizing TEALPFR is an approach of giving elaborate feedback to amend a wrong. Remediation assumes a significant part in learning that gives more explanation on concept of a topic (Thomson, De Bortoli, and Underwood, 2017). For instance, social theory explains that feedback appears as a brief reaction or quick response, which could be delegated as elaborate feedback (remediation) by the time assistance is given to learners. In constructivism, remediation normally includes clarifications of systems or techniques that work as instrument for development of information and abilities (Hattie, and Gan, 2011). For meta-cognitivism, remediation appears to be typically worried about ways students' study, rather than what the

student is study (Mulliner, and Tucker, 2015).

Therefore, Technology -Enabled Assessment for Learning Package which involves feedback with instruction through remediation, can be referred to as an effort to analyze learning complications in individual especially in J.S 2 students. It is used to detect strong point and feebleness in their performances for the essence of refining instruction as well as making for an improved instructive achievement (Ivowi, 2012.). Technology -Enabled Assessment for Learning Package (TEALP) has useful benefits over paper-and-pencil tests; the usefulness includes advanced effectiveness, cheap expenses and sophisticated test safety(Dennis, Falah-Hassani and Shiri, 2017)). All these benefits on the usage of computers, in giving assessments extensively to improve learning by remediating, making TEALP to be useful in learning, as assessment can be administered to a large group. Therefore, Computer Based Test (CBT) was developed and adopted to be useful in classes and higher education level (Peat and Franklin, 2002). However, if CBTs were constructed and implemented adequately for summative assessment, TEALP will also be useful in monitoring the ongoing learning process which is also formative in nature of assessing, as a pedagogical advantage (Danjuma, (2015).Whitelock and Raw, (2013) emphasised that assessment, utilizing TEALP is connected with the automated created timing and speed input and versatility of the assessment in item selection. Students can receive rapid feedback while taking assessments.

Also, immediate feedback can be provided to students while they are taking assessment to ensure higher learning outcomes. The outcome of assessment is given out as feedback to educational stakeholders who are government, parent and student, for proper and good remediation, Feedback in TEALP can effectively fill the gap between the students' ongoing position in the instructional system with the intended learning outcome (Cui, Kong, and Zhang, 2012). Also, this input can be given to each test taker, in the light of their specific reaction to a thing. Accordingly, it intends that, for science education to guarantee subjective training and qualitative education, learning should be appropriately figured out and how to offer students an equivalent chance to show their value, independent of their gender (Aitokhuehi and Ojogho, 2014).

Gender differences in science achievement remains a source of concern as scientists seek to address the low-representation of females at the highest levels of physical and earth sciences. (Asante, 2010).Gender is one of such factors that have

considerable effects on student's academic performances especially in science subjects. According to Glory, Godpower-Echie., and Ihenko (2017) the necessity of assessing performance in connection to gender is based on the socio-cultural differences between girls and boys. There are factors that might influence learning, particularly science education, through gender, they include insight, discernment, social influence, physiological variables (Owolabi and Etuk-Ire, 2014). Gender is a unique developed peculiarity that gives significance to how society attributes various roles, obligations, ways of behaving, and mannerism of males and females, Liu, and Yin, (2022). This perception and experience may influence external social factors relating to gender, and one of the social factors is the Social Economic Background (SEB). Lawson and Farah (2017) suggested that the use of home language for communication and expression in schools and homes, in relation to family economic background will assist in achieving quality education.

Social Economic Background (SEB) affects student achievement especially when it is low, access to educational resources will be limited Bhat et. al. (2016).SEB refers to a person's social and economic status, which is determined by factors such as their family's income, education level, occupation, and cultural and social values. It influences an individual's opportunities, experiences, and outcomes in life. Low SEB limits student's provision to access to educational resources, and thus causes them to experience more psychological stress and domestic disputes, which may negatively affect their learning attitude and impede their academic success (Towolawi and Onuka, 2018)

Learning outcomes has to do with descriptions of the specific knowledge, skills or understanding that the learner will get from a learning activity. It deals with measurable achievement that shows the positive effect of the learning activity, and learner's attitude to a particular concept of teaching after learning is complete. Tofler, (2012)posits that positive attitude allows a student to build up self-confidence in themselves, both at school and outside school, which in turn, motivates the pursuit of academic excellence. Students who have positive attitudes toward learning, have desire to add to knowledge, there helping in increasing in, global awareness, and more opportunities to do so, tend to do better academically than their counterparts who have a negative attitude. Achievement and a positive attitude toward learning are strongly correlated.

Academic achievement refers to the successful completion of educational goals and objectives, typically measured by grades, test scores, and other forms of assessment. It is an important indicator of a student's success in school and is often used to determine eligibility for college admission, scholarships, and other opportunities. Academic achievement can be influenced by a variety of factors, including the student's level of motivation, study attitude, family support, and access to resources. Effective teaching and a supportive learning environment can also play a critical role in promoting students' academic achievement and attitude (Ivowi, 2012).

Joe, Kpolovie, Osonwa and Iderima, (2014) explains attitude to learning as an individual's overall disposition or mindset towards the act of learning. This can include a person's beliefs, values, and perceptions about the importance and enjoyment of acquiring new knowledge and skills. A positive attitude to learning is characterised by enthusiasm, motivation, and a growth mindset. People with a positive attitude to learning embrace challenges and are open to new experiences and perspectives. On the other hand, a negative attitude to learning can be characterised by disinterest, boredom, and a fixed mindset (Afuwape and Aanu, 2010). People with a negative attitude to learning may avoid challenges and be resistant to change.

It is important to note that a person's attitude to learning can have a significant impact on their academic achievement. Research has shown that academic performance is generally greater, and persistence in studies is more likely better among students who have a positive attitude toward learning. On the other hand, students with a negative attitude to learning may struggle academically and be less likely to persist in their studies. Therefore, promoting a positive attitude to learning can play a critical role in supporting student success and achievement. Attitude to learning science refers to an individual's overall disposition or mindset towards the process of learning about science. This includes a person's beliefs, values, and perceptions about the importance and enjoyment of acquiring scientific knowledge and skills. A positive attitude to learning science is characterised by curiosity, interest, and a willingness to experiment and try new things. People with a positive attitude to science enjoy asking questions, making observations, and seeking answers to scientific questions. On the other hand, a negative attitude to learning science can be characterised by disinterest, boredom, and a lack of motivation. People with a negative attitude to science may view science as irrelevant to their lives or find it uninteresting.

It is important to note that a person's attitude to learning science can have a significant impact on their academic achievement in science and their overall understanding of scientific concepts. Research has shown that students with a positive attitude to learning science tend to perform better academically and are more likely to persist in their studies even when faced with difficulties. On the other hand, students with a negative attitude to learning science may struggle academically and be less likely to persist in their studies.

Therefore, promoting a positive attitude to learning science can play a critical role in supporting student success and achievement in the field of science. For the purpose of this study, for students to have positive attitude to Basic science, intervention was needed, for excellent learning outcomes. There are topics that are considered difficult to assimilate by the students, and teachers have also realized they are difficult to understand by the students; this discovery was made through the diagnostic questionnaire (DQBS) given to both teachers and students. These topics require extra strategies to ensure a student has a good grasp and solid foundation in science subjects in J.S. 2, such that their performance and attitude towards basic science are greatly improved. The topics are- Chemicals, Energy, Crude oil and petroleum. The mastery in these topics may likely improve academic achievement in, and attitude to Basic science using Technology - Enabled Assessment for Learning Package. These topics are in basic science curriculum and basic science textbooks.

Akinbode (2014) explains that textbooks are important to students. It is a primary source of information and instructional materials for students' personal studies. There are details in textbooks that cause student' change in behaviuor and improve their performance. The structure, the organisation, the presentation format which includes color, font type font sizes, the illustration, the content, the exercises and the task range are in order which brings about student change in behaviuor. All these textbook structure and presentations are good, but this study intends to reveal how learners' performance and attitude can be largely enhanced with the use of Technology-enabled Assessment for learning Package on Basic Science.

Having observed that science cannot be underestimated by its importance in building and developing the country technologically, there is a need to invent or suggest strategies that will help in achieving better understanding of science like Technology-Enabled assessment for learning packages which involves feedback and remediation (Azman-Saini, Baharumshah, and Law, 2010). Adewale and Anjorin,

(2012) asserts that assessment is used to detect strength and faintness in the students' performance for improving instruction, fill the gap between their learning as well as making an improved educational attainment.

Feedback is a way of giving out result of students' ability, Powell, and Kalina. (2009) state that educational feedback is more powerful in relation to academic achievement, than any other teaching behaviour. Hence, the researcher hopes to confirm the above assertion, and discovered difficult topics in Basic science which were used to develop a learning package called Technology-Enabled Assessment for Learning Package (TEALP). In conclusion, the value of teaching and learning basic science is likely to increase as a result of TEALP, besides, also to detect its ability, flaws, and strong points in the students' performance so as to improve their learning, and academic instruction in no small measure. Also, TEALP, can improve students' practical knowledge, skill acquisition in Basic science, which will untimely lead to self-reliance.

1.2 Statement of the Problem

Teaching, learning and assessment are intricately linked, they are significant variables for learning. Assessment in teaching helps to monitor the extent to which a learner comprehends a particular concept or topic in the teaching and learning processes. As important as Basic science is, it was perceived that performance of junior secondary school students in the subject was poor as revealed in the Basic Education Certificate examinations (BECE) results of the last few years in Oyo State.

A number of studies have been carried out on strategies for refining students' performance in the Basic Science, without much improvement. However, it seems there is dearth of empirical study on how Technology- Enabled Assessment for Learning Packages with feedback and remediation can be used to improve performance of students in Basic Science.

The gaps created by some of the previous studies need a closer re-examination. Therefore, this study determined the extent to which Technology- Enabled Assessment for Learning Packages (TEALP) with feedback, and remediation improve Basic Science learning outcomes in Ibadan city. Investigations were also done into how gender and social economic background affected outcomes.

1.3 Objectives of the study

The objectives of the study are to;

1. determine the impact of Technology-Enabled Assessment for Learning Package (TEALP),gender and social economic background on students' attitude to and their achievement in Basic science.
2. examine the interaction impact of TEALP and gender on students' attitude and achievement in Basic science.
3. determine the interaction impact of TEALP and social economic background on students' attitude and achievement in Basic science.
4. determine the interaction impact of social economic background and gender on students' attitude and achievement in Basic science.
5. investigate the interaction impact of TEALP, gender and social economic background on students' attitude and achievement in Basic science.

1.4 Hypotheses

Seven hypotheses were tested in this study at 0.05 level of significant;

1. Technology-Enabled Assessment for Learning Package (TEALP) has no substantial main impact on student's attitude to, and achievement in basic science.
2. Gender has no substantial main impact on student's perspective to and attainment in, basic science.
3. Social Economic Background has no substantial impact on student's perspective to and attainment in basic science.
4. There is no significant first order collaboration impact of Technology-Enabled Assessment for learning Package (TEALP) and gender on student's perspective to and attainment in basic science.
5. There is no noticeable first order interaction effect of the Technology-Enabled Assessment for Learning Package (TEALP) and Social Economic Background on students' attitude to and achievement in basic science.
6. On students' attitude towards and performance in basic science, gender and social economic background had no noticeable first order interaction effects.
7. Technology Enabled Assessment for Learning Package (TEALP), Gender, and Social Economic Background do not appear to have any second order interaction effects on students' attitude towards and attainment in basic science.

1.5 Scope of the study

J.S. 2 students in Ibadan, Oyo State, were the subject of the study. The focus of the study is the impact of the Technology-Enabled Assessment for Learning Package (TEALP) on J.S. 2 students' performance and attitudes toward basic science. The effects of gender and social economic background on students' academic performance were also examined.

1.6 Significance of the Study

According to students' performance in basic science, the study will reveal how useful the Technology-Enabled Assessment for Learning Package (TEALP) is for teaching. The study looks at how gender and social economic background affect students' academic performance and attitudes about fundamental science. The findings of this study will have an impact on the curriculum planners, J.S. textbook publishers, STAN (Science Teacher Association of Nigeria), administrators, and the general public as well as students, teachers, parents, schools, and the government. It will help in reducing the teacher's workload, since it will be learning at one's pace, it will enhance an individual pace learning, thereby giving immediate feedback and remediation which largely determines the level of understanding of the student in Basic science.

The findings of this thesis will make stakeholders in education to understand importance of timely feedback and remediation to students. It will also encourage and motivate students in the acquisition of knowledge, help them to consider assessment as away of monitoring their learning progress. It will also be of assistance to the future researchers as it will serve as baseline for further research.

1.7 Conceptual Definition of Terms

Achievement in Basic science: The immediate pretest and posttest scores that are obtained by students in Basic Science Achievement Test (BSAT).

Attitudes towards Basic science: This is the temperament, nature, personality or disposition of students towards learning of Basic Science as measured by Basic Science Attitudinal Scale (BSAS) used by the researcher.

Social economic Background: Social Economic Background (SEB) is a state of distinguish between people's relative position in the society in terms of family status, finances, parental level of education, as measured by Social Economic Background

Scale (SEBS).

Learning Package: This is the breaking down and sequential arrangement of content to be taught using authoring tools like articulate or Learning Content Development System (LCDS) to be self and pace learning.

1.8 Operational Definition of Terms

Technology Enabled Assessment (TEA) - using computer to teach, give instruction and assess.

Technology- Enabled Assessment for Learning Package: Use of computer to teach Basic Science and to assess students periodically, monitor their learning progress, give their scores and provide on-going learning with immediate feedback to both students and teachers, in order to provide remediation for the wrongs.

Feedback: This is the immediate report or feedback scores given to students on Technology – Enabled Assessment for Learning Package on Basic Science on item right or wrong.

Remediation: This is the correction done and given on wrong item chosen in interacting with Technology –Enabled Assessment for Learning Package on Basic Science.

1.9 Acronyms

TEA: Technology Enabled Assessment

TEI: Technology-Enabled Instruction

TEALP: Technology Enabled Assessment for Learning Package

TEALF: Technology -Enabled Assessment for Learning Package with Feedback

TEALFR: Technology -Enabled Assessment for Learning Package with Feedback and Remediation

BSAT: Basic Science Achievement Test

SEBS: Social Economic Background Scale

BSAS: Basic Science Attitudinal Scale

BSDQ: Basic Science Diagnostic Questionnaire

BECE: Basic Education Certificate examinations

LCDS: Learning Content Development System

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Background

2.1.1 Constructivism Learning theory

Constructivism is a learning theory that emphasizes the active role of the learner in constructing their own understanding and knowledge. It posits that individuals build their own understanding of the world through their experiences and interactions with it, rather than simply absorbing information from the environment. Constructivism also stresses the importance of context and prior knowledge in shaping the learning process, and highlights the importance of collaboration and social interaction in the construction of knowledge. It is often associated with inquiry-based and problem-based learning approaches. The proponent of this theory is John Dewey (1998). The theory explains that individuals develop or assemble information on the world through experience and reflection on those things encounter or experienced (Fawns, 2019).

Constructivism is viewed as a theory that highlights learning with exercises or activities that is personal to the learners. At the point when an individual passed through an experience, it needs to be accommodated with past beliefs, possibly altering whatever is being admitted, placed as unimportant with regards to new facts. The theory of constructivism highlights fact that individuals are self-motivated and creator of their own vision. In other words, it is method of empowering learners to utilize dynamic strategies (tests, experiments, genuine critical thinking, real problem solving) to creates more information and afterward, consider and discuss what they are doing and the way their arrangement is evolving to create new knowledge. The instructor or teacher ensures learners' previous conception, and guides the activities to learn on their own (Anderson, Katz-Buonincontro, Bousselot, Mattson, Beard, Land, J. 2022).

Constructivism is a learning theory that views knowledge as being constructed by individuals through their experiences and interactions with the world around them. According to this view, learning happens when people actively create their own conceptions of the world by connecting brand-new knowledge to their past experiences and existing understanding (Powel and Kalima, 2009). According to constructivism,

individuals are not passive recipients of information but active constructors of their own knowledge. This approach emphasizes the role of the learner in the learning process and the importance of creating a supportive and collaborative learning environment that fosters creativity, critical thinking, and problem-solving skills (Yara, 2010). According to Bolhuis, and Voeten (2004)constructivism learning theory that involves thinking which upgrades learners' consistence and calculated development. The basic idea inside the constructivism learning theory is the method of learning which allows students to build knowledge and skills through their personal experience and interaction with their environment.

The constructivism is a learning theory that deals with individuals producing information and structure of importance in view of their encounters. Two of the critical ideas embedded within the constructivism learning theory which make for the development of an individual's new information, are expediency and longsuffering in the area of experience and learning. Assimilating makes an individual unite new encounters with the old encounters. This makes the individual foster new viewpoints, re-examine what their mistakes and assumptions were and assess what is significant and eventually changing their insights. People consider a specific style wherein the world works, at the point when things don't work inside that unique circumstance, they should oblige and reconsider the assumptions with the results.

This theory is frequently compared to objectivism, which is commonly referred to as constructivism. A considerable amount of objectivist hypothesis is formed by behaviorists like Skinner (1953.) Objectivists view individual snippets of data as images or money that can be acquired by individuals, and can be moved starting with one human then onto the next should the right learning conditions exist, (Sato and Oyanedel, 2019). While a huge piece of the early work in formal instructive arrangement got from objectivist hypothesis, present day insightful or current scholastic personalities come to the recognition that condition of learning which even more eagerly match the necessities of constructivist learning may be more propelled.

The perfect advantage derived from constructivist learning is large with the elaborate teaching; for instance, the decisive reasoning or conclusive thinking capacities are concerned (Cui, Kong, and Zhang, 2012).Assuming we recognize that constructivist theory is the best method for portraying learning, then it follows that to propel student as learning essential to laying out learning conditions directly opens learners to the material being thought of. For only by experiencing the world directly

would the students have the option to get significance from it. This gives raise to the view that constructivist learning ought to happen inside a proper constructivist learning environment. One of the central points of all constructivists learning is that it should be a working cycle as needs be, any constructivist learning environment ought to give the entryway to dynamic learning (Sato and Oyanedel, 2019).

2.1.1.1 Basic characteristics of Constructivism Learning Environments

So, and Hu,(2019) lists the following four essential attributes of constructivism learning conditions, which always considered as constructivist educational methodologies. These are: information to be divided among educators and learners, instructors and learners sharing authority, the educator's job as facilitator or guide, learning gatherings comprise of little quantities of various students learning at their pace.

2.1.1.2 Pedagogical Goals of Constructivism Learning Environments

Bunbury, 2020. The pedagogical goals of constructivist learning environments are based on the theories of constructivism, a philosophical and educational approach that emphasizes the active construction of knowledge through experience and interaction with the environment. The following are some of the main goals of constructivist learning environments:

1. Promoting student engagement and motivation: Constructivist learning environments aim to engage students in meaningful and authentic learning experiences that tap into their natural curiosity and enthusiasm for learning.
2. Fostering collaboration and communication: Constructivist learning environments encourage students to work together, share their ideas, and learn from one another through collaboration and communication (Bunbury, 2020).
3. Developing critical thinking and problem-solving skills: By providing opportunities for students to explore, experiment, and apply their understanding of concepts, constructivist learning environments aim to develop critical thinking and problem-solving skills.
4. Encouraging self-directed learning: Constructivist learning environments empower students to take control of their own learning, making decisions about what they want to learn and how they want to learn it.
5. Supporting the development of diverse perspectives: Constructivist learning

environments encourage students to consider different perspectives and embrace diversity, which can lead to a deeper understanding of complex issues and greater empathy for others.

6. Promoting personal and lifelong learning: Constructivist learning environments aim to foster a love of learning that will continue beyond the classroom, encouraging students to pursue their passions and interests throughout their lives (Bunbury, 2020).

2.1.1.3 Advantages of Constructivism Learning theory

The constructivism learning theory has several advantages, including:

1. Active learning: Constructivism emphasizes the active construction of knowledge through experience and interaction with the environment, promoting active learning and engagement.
2. Collaborative learning: Constructivism encourages students to work together and share their ideas, promoting collaboration and communication skills.
3. Development of critical thinking and problem-solving skills: By providing opportunities for students to explore, experiment, and apply their understanding, constructivism helps to develop critical thinking and problem-solving skills.
4. Student-centered approach: Constructivism focuses on the needs and interests of the student, rather than the teacher, promoting a student-centered approach to learning.
5. Personal relevance: Constructivism emphasizes the importance of personal relevance, encouraging students to connect new knowledge to their own experiences and interests (Fawns, 2019).
6. Adaptability: Constructivism is flexible and adaptable to a wide range of teaching and learning styles, allowing for individualized instruction.
7. Promoting lifelong learning: Constructivism encourages a love of learning that will continue beyond the classroom, promoting lifelong learning and personal growth.
8. Encouragement of diverse perspectives: Constructivism encourages students to consider different perspectives and embrace diversity, promoting greater understanding and empathy for others (Fawns, 2019)

2.1.1.4 Traditional Classroom and Constructivism Classroom

Traditional classrooms tend to focus on delivering information and testing recall, while constructivist classrooms emphasize active learning and the development of critical thinking and problem-solving skills.

Traditional Classroom:

1. Teacher-centered approach: In traditional classrooms, the teacher is the primary source of information, and students are passive recipients of knowledge.
2. Lecture-based instruction: Traditional classrooms often rely on lectures as the primary mode of instruction, with students taking notes and memorizing information.
3. Emphasis on rote learning: Traditional classrooms place a strong emphasis on memorization and recall of information, rather than on understanding and application.
4. Limited student involvement: In traditional classrooms, students may have limited opportunities to actively participate in the learning process and express their ideas (Yara, 2010).

Constructivist Classroom:

1. Student-centered approach: In constructivist classrooms, the focus is on the student and their needs, with the teacher serving as a facilitator of learning.
2. Experiential and hands-on learning: Constructivist classrooms emphasize hands-on, experiential learning, encouraging students to actively construct their own understanding of concepts.
3. Emphasis on understanding and application: Constructivist classrooms place a strong emphasis on understanding and application of knowledge, rather than just memorization and recall.
4. Increased student involvement: In constructivist classrooms, students are actively involved in the learning process, expressing their ideas, collaborating with peers, and taking ownership of their learning (Abedi, Rostami, and Nadi, 2015)

Table 2.1: Traditional Classroom and Constructivism Classroom

Traditional Classroom	Constructivism Classroom
Curriculum starts from the portions of the whole. Highpoints simple and elementary skills.	Curriculum stresses enormous theories, start together with the whole and mounting up to comprise the parts.
Based strongly on fixed curriculum.	Searching for students' ideas and recognition of their questions is appreciated.
They only make use of textbook and workbook.	Using of internet, primary source of ideas, and improvising.
Repetition is the basis of learning.	Interaction, group discussion, collaborating of ideas, and building on students' previous knowledge.
Teachers are always at the center of learning	It is students centered.
Teachers direct information (Yara, 2010).	Teachers make the instruction interactive, based on negotiation to help students' knowledge (Abedi, Rostami, and Nadi, (2015)

Along these lines, Abedi, Rostami, and Nadi, (2015) also explained constructivism as education which involve critical thinking, solving problem in the light of individual discovery, and the student is characteristically propelled. Also explained that student needs a responsive climate in which thought has been given to the student's singular style as a functioning, automatic, intelligent student. And as instructional goals and objectives which are negotiated rather than fixed. They see constructivism as a goal of instruction that is used to develop mental construction embedded in relevant learning environments that facilitate knowledge construction by learners, rather than specific instructional strategies.

Constructivism has been explained as a theory that depend on perception and logical approach to learning. This is relevant to the goal of utilizing Technology-Enabled Assessment Learning Packages (TEALP) to help students learn at their own pace and speed, and further assess their learning progress. Constructivism permits students to build their own insight, this is relevant to this study in the way TEALP gives opportunity to students to build their own understanding and develop self -paced information through learning and interaction with TEALP (Abedi, Rostami, and Nadi, 2015).

The theory is relevant to this study because it is students centered, it involves interaction, collaboration of ideas, and building on students' previous knowledge.

2.1.2 Behaviourism Learning Theory

Behaviorism is a learning theory, and a theory that proposes that all behaviors are learned through interactions with the environment through a process called conditioning, and can be explained in terms of stimuli and responses. It emphasizes the role of reinforcement (rewards and punishments) in shaping behavior, and argues that all behaviors can be reduced to a series of stimulus-response associations. The two main forms of reinforcement are positive reinforcement (rewards) and negative reinforcement (removal of unpleasant stimuli).

Classical conditioning, first described by Ivan Pavlov, involves the association of a neutral stimulus with a naturally occurring stimulus to produce a response. Operant conditioning, developed by B.F. Skinner, also established by Alexander, (2020) involves the reinforcement or punishment of a specific behavior to increase or decrease its frequency. Behaviorism has been influential in shaping our understanding of learning and has been applied in various fields, including education, psychology, and behavior therapy. However, it has been criticized for neglecting the internal processes and cognitive aspects of learning and behavior. This theory related to this study, in the way students learn through their environment and at their own pace.

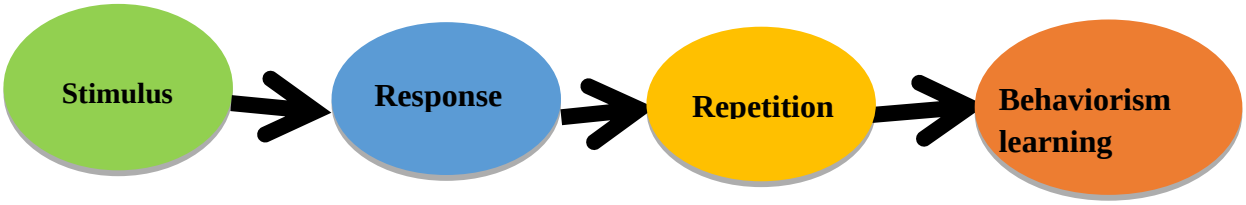

Fig. 2.1 Behaviorism approach

Source; Researcher (2022)

Behaviorism is a psychological theory that explains human behavior as a result of environmental stimuli and consequences. It holds that behavior can be learned through classical and operant conditioning, and can be changed through the manipulation of rewards and punishments. This theory, developed by B.F. Skinner and John B. Watson (1878-1958), argues that internal mental states such as thoughts and emotions are not directly observable and therefore should not be used as explanations for behavior. Instead, behaviorists focus on observable behavior and the events that precede and follow it.

Behaviorism is a learning theory that views behavior as a function of environmental stimuli and consequences. It proposes that behavior can be learned through classical and operant conditioning. Classical conditioning, first described by Ivan Pavlov, involves learning to associate a neutral stimulus (such as a bell) with a biologically significant stimulus (such as food) to elicit a specific response (salivation). Operant conditioning, described by B.F. Skinner, involves learning through the consequences of one's actions. This can be either positive reinforcement (rewards for desired behavior), negative reinforcement (removal of unpleasant stimuli for desired behavior), punishment (presentation of unpleasant stimuli for undesired behavior), or extinction (lack of reinforcement leads to decrease in behavior). (Alexander, (2020).

Behaviorism is often associated with a reductionist approach to understanding behavior and has been criticized for neglecting internal mental processes. However, it continues to be a prominent theory in fields such as educational psychology and behavior therapy.

2.1.2.1 Behaviourism application of Instructional Design

Behaviorism has influenced the field of instructional design by emphasizing the importance of observable behavior and the role of reinforcement in learning. Applications of behaviorist principles in instructional design include:

1. Task analysis: breaking down complex tasks into smaller, more manageable parts to facilitate learning.
2. Direct instruction: using clear and explicit explanations, demonstrations, and practice to teach new skills and behaviors.
3. Reinforcement: using rewards or consequences to increase the likelihood of desired behaviors.
4. Feedback: providing information on performance to help learners understand

their strengths and weaknesses and improve their skills.

5. Drill and practice: repeating tasks or exercises to help learners master new skills and behavior. Instructional designers who apply behaviorist principles often use a systematic approach to designing instruction and focus on the design and delivery of instructional materials that support learning. By emphasizing the role of reinforcement and feedback, behaviorist approaches can help learners to develop new skills and habits that support long-term learning and performance (Alexander, (2020).

2.1.2.2 Examples of Application of Behaviourism theory

Here are a few examples of the application of behaviorism theory:

1. Classroom learning: Teachers use positive reinforcement, such as praise or rewards, to encourage students to engage in desired behaviors, such as paying attention or completing homework.
2. Behavior modification programs: Psychologists and therapists use behavior modification techniques, such as operant conditioning, to help individuals change problematic behaviors, such as substance abuse or phobias.
3. Employee training: Companies use reinforcement, such as bonuses or promotions, to encourage employees to adopt desired behaviors, such as teamwork or meeting performance goals.
4. Animal training: Trainers use positive reinforcement, such as treats or praise, to train animals, such as dogs or horses, to perform specific behaviors.
5. Parenting: Parents use reinforcement, such as praise or allowance, to encourage children to engage in desired behaviors, such as cleaning their room or doing well in school (Rymarz, 2012).

These are just a few examples of the application of behaviorism theory in various settings. The principles of operant and classical conditioning can be applied in many different contexts to encourage desired behaviors and modify problematic ones. (Munn, Peters, Stern, Tufanaru, McArthur, and Aromataris, 2018).

The practice problem

Connect solution to the problem

The repletion causes the students to learn calculation on work

Fig. 2.2 Behaviourism Application

Source; Researcher (2022)

Students need to be informed about their clear results, so they can set assumptions and can decide for themselves if they have accomplished the learning result. (Rymarz, 2012). Online testing or other forms of testing and assessment should be integrated into the learning sequence to check the learner's achievement level and to provide appropriate feedback. This online testing or different types of testing need to be coordinated into the learning arrangement to check the student's accomplishment level and to give appropriate criticism. Computer mode of assessment which is used in this study through TEALP is relevant to Behaviourism learning theory, in the way it makes use of process of conditioning in learning, that involves stimuli and response which is reinforcement, that may be positive and negative reinforcement. In conclusion, this learning theory helps to encourage students to engage in desired behaviours, such as paying attention to learning through TEALP, to acquire skill and assessed which stimulates learners' reasoning (Munn, Peters, Stern, Tufanaru, McArthur, and Aromataris, 2018).

2.2 Conceptual Review

2.2.1 Basic Science as a Vital Foundation for all Science Subjects

Azman-Saini,Baharumshah, and Law, (2010) explains Basic science as the study of the most fundamental concepts and principles in a particular field of science. It aims to increase our understanding of the natural world, without any immediate practical application in mind. Basic science research is often conducted to answer basic questions, such as how things work, why they behave in certain ways, and what their underlying principles are. Examples of science subject's offshoot from basic science include physics, chemistry, biology, and astronomy. Basic Science is often contrasted with applied science, which involves using scientific knowledge to solve specific practical problems or to develop new technologies. Basic Science provides the foundation for applied science and is crucial for its advancement. Without a solid understanding of the underlying principles, it would not be possible to develop new technologies or find solutions to real-world problems.

Basic Science as the bedrock of all science subjects at the junior secondary classes. The subject prepares students at the junior classes for core science subjects (Biology, Chemistry and Physics) at the senior secondary classes. Elementary science, also refers to as Basic Science or Integrated Science, is the introductory level of

science education that is typically taught in primary schools and junior secondary schools.

It covers a broad range of scientific concepts and principles, including topics in physics, chemistry, biology, and earth science. The main objectives of basic science education are to give students a thorough understanding of the natural world and the scientific process, to foster critical thinking, and to help them comprehend how various scientific fields are interconnected.

It is considered as a foundational science as it lays the foundation for more advanced studies in science and technology. It also helps in developing sense of curiosity and inquisitiveness in students, encouraging them to explore the world around them and ask questions about how things work. Furthermore, basic science education also helps to promote an understanding of the relationship between science and society, and the importance of science in addressing real-world problems.

In Basic science framework, basic theoretical concepts are developed which become the basis for applied research. The main objective of junior secondary classes' basic science is for learning of skills of observing, reporting, organizing information, predicting and experimenting (Filgona and Linus, 2017). Basic understanding of science is necessary before an application can be developed; several scientific knowledge and understanding derived from basic science research in the past have resulted in many remarkable applications of great value. Oludipe (2012) explained that, the outcomes of basic science therefore, provide a concrete foundation for applied science and unfold natural phenomena, reactions and interactions in the nature or within a biological system.

Basic science, also known as fundamental or pure science, is a type of scientific research that aims to expand our understanding of the natural world without immediate practical applications. The primary goal of basic science is to gain a deeper knowledge of the underlying principles and mechanisms that govern the natural world. This type of research is often driven by curiosity and the desire to answer fundamental questions about how the universe works. Examples of basic science include physics, chemistry, biology, and astronomy. Basic science often serves as the foundation for applied science, which seeks to use scientific knowledge to solve practical problems and develop new technologies.

However, the outcomes of basic science can also have unexpected and significant practical applications, such as the development of the internet from the

research in quantum mechanics. It also referred to as the foundation of the sciences, equips students with the fundamental scientific information they will need in the future and prepares them for professions in fields like engineering, medicine, pharmacy, and other fields that will inevitably boost the country's economy (Asante, 2010). The impact of Basic Science has enhanced education in term of restructuring of educational programmes, improvement of classroom facilities due to inclusion of practical session. This restructuring process has provided learners with knowledge of specific subject areas, promoted meaningful learning, enhanced professional productivity and self-dependence (Sato and Oyanedel, 2019)

Biology as one of the science subjects that emanated from Basic Science and technology is concerned with life, its processes and the survival of life. A good grasp of biological sciences is necessary for human survival. Biology as an offshoot of knowledge has contributed to many domains like medicine, health, control of diseases, commerce and investigation. It has helped in the training of people in diverse fields thereby making them specialists. Biology education, which is one of the higher knowledge areas of Basic Science, is very important to any growing economy like Nigeria.

Many graduates of Biology education are self-employed and employers of labour; many own schools where people work and earn a living while some are into fishery and so on(Abe, 2011)**).** Also, Biology is a scientific subject that is critical to life and life processes. It opens students to the universe of self-information and information on their nearby and far off environment and climate. This, no doubt, suggests that if students are outfitted with sufficient information on their current circumstances through the information on Basic science and Technology in upper basic classes, it might result in making them unmindful of the advantages they could derive from science subjects in senior secondary classes. This could hinder attempts on their part, to secure, improve and support their current circumstance, in helping their community and environment.

Chemistry and Physics are also an off-shoot of Basic science that deal with chemical composition of matter, many industrial production and products such as dye, chemical, chalk etc. were made through the knowledge of chemistry. The 21st century is characterized by advancement in science and technology. For Nigeria to realize accelerated development in the 21st century, she needs quality science and technology education in her schools especially in our Upper Basic Educational Level. This will

serve as foundational classes for Post Basic Educational Level, where learners are expected to acquire skills to build up their careers such as engineering, medicine, architecture, to mention but a few and learn to be self-reliant. Urevbu (2001) emphasized that science acquaints students with certain basic knowledge, skills and attitudes needed for future work in science and science related fields. The goals of science education in Nigeria include cultivating, knowing, inquiring and buildings rational mind for the conduct of good life and democracy. It also aids in producing scientists for national development as well as providing understanding of the complexity of the physical world, the forms and the conduct of life Afuwape, and Aanu, 2010.

Science is a systematic and logical approach to discovering how things in the universe work. It is a process of acquiring knowledge through observation, experimentation, and logical reasoning. Scientists use the scientific method, which involves making observations, forming hypotheses, designing experiments, analyzing data, and drawing conclusions based on the evidence. Science encompasses a wide range of fields including physics, chemistry, biology, earth science, and many others. Science helps to explain the natural phenomena and provides a way to understand the physical and natural world, by using the scientific method to test hypotheses, and form theories. It is based on empirical evidence and logical reasoning, which allows for the development of technologies and the advancement of human knowledge. Additionally, science also has a practical application in areas such as medicine, agriculture, and engineering, and plays an important role in addressing real-world problems.

It is systematic action or activity that builds and organizes knowledge and information in the form of testable explanations and predictions about the universe. Science is all about life and all that makes life worth living. It involves knowing more about all things present in the environment and is both a body of knowledge and a process. Science is an organized body of knowledge in form of concepts, laws, theories and generalizations. It is exciting and useful, and a way of discovering what is in the universe, and how those things work today, how they worked in the past and how they are likely to work in the future. The knowledge generated by science is powerful and reliable.

It can be used to treat diseases, deal with many other sorts of problems and develop new technologies. According to Ajayi, (2017) science is a study of nature and natural phenomena. It has three interrelated aspects: content, attitude and process.

Content in Basic science can be divided into physical life and earth science, it is the understanding we gather about our environment. Attitudes involves openness and objectiveness (Omoifo, 2012). Process manages manners by which researchers approach gathering realities or information about climate. The course of science, in some cases called science process abilities, are mental apparatuses which incorporate noticing, estimating, recording, ordering, imparting, testing, conjecturing, breaking down, deduction making, inductive thinking, anticipating, building and summing up (Ajayi, 2017). This multitude of mental apparatuses of science, created give great development which can be alluded to as innovation of how to live and communicate well in the climate (Eriba, 2004).

Science is the motor of innovation through which life is made easy and comfortable; hardly can an average human being live a good and comfortable life or even survive for long without science and technology, Ojimba (2012). Effects of science in modern world are overwhelming and undoubtedly important agents of transformation. These massive impacts of science are easily discovered in the communication, agriculture, health, aviation, education and other sectors. Several countries of the world have been transformed from a declining economy through the increased integration and application of both the processes and products of science, which is an enlightening experience. The effect of science in the modern world and its importance made science to find its way into the educational system right from lower basic levels as science education.

Science education refers to the study and teaching of scientific concepts and principles, including topics such as biology, chemistry, physics, and earth science. The goal of science education is to help students understand the natural world and develop the skills and knowledge they need to think critically and make informed decisions about science and technology (Pondhe, 2014). Science education also aims to encourage students to pursue careers in science and to become informed and engaged citizens who can participate in discussions and debates about science-related issues. Kayri, Gencoglu,, and Kayri, (2012 explain that in science education, students are introduced to the scientific method, which involves observing the world, asking questions, forming hypotheses, conducting experiments, and analyzing data to draw conclusions. They also learn about key concepts and theories in science, including the structure and function of cells, the properties of matter, the behavior of light and sound, and the processes that shape the Earth and its ecosystems.

Effective science education should be engaging, hands-on, and relevant to students' lives. Teachers can use a variety of teaching methods, including inquiry-based learning, problem-based learning, and project-based learning, to help students understand and apply science concepts. In addition, technology, such as simulations and virtual labs, can be used to support and enhance science education. In other words, science education plays a critical role in preparing students for the future by developing their scientific literacy, critical thinking skills, and knowledge of the natural world. Also, without science education, information and communication technology would be impossible. Therefore, 21st century has been called a science century because of many science developments (Nwafor, 2012).

A portion of the accomplishments that have been made through sciences include utilization of hereditary qualities for agriculture business for creation of hybrids crops, livestock with beneficial characteristics and early developing assortments of plants and creatures; the utilization of organic technique rather than substance strategy in the control of horticultural bug; and the utilization of normally happening microorganisms to tidy up oil slicks and poisonous synthetic compounds. Likewise, in medication, utilization of science assists in development of single cell protein by miniature creatures to assist individuals with lack of protein. Essentially, in view of logical disclosures and their applications, many persistent problems of scarcity and poverty have been ameliorated and solved. In addition, to the myriad of problems facing the world even as we advance technologically, science offers great scope to meet these challenges, especially in the assurance of food, security and in the use of scientific discoveries to meet the needs for more food, fuel, fiber and animal feed (Nwafor, 2012.). Similarly, genetically designed microorganisms which are utilized for assembling substances that are hard to deliver, for example, insulin and interferon were created through the information science revealed. Once more, the utilization of half and half innovation to deliver anti-infection agents and in-vitro preparation that assist fruitless couples with having kids are accomplishments of science (Roth, and Surry, 2011).

2.2.2 Technology -Enabled Assessment for Learning Package

Technology-enabled assessment for learning package (TEALP) is a collection of tools and resources that can be used to support assessment in educational settings. It can help to improve the efficiency and effectiveness of assessment in educational settings.

By using digital tools and analytics, teachers can more easily assess student learning and provide feedback, allowing them to make informed decisions about instruction and support. Additionally, the use of technology in assessment can help to increase student engagement, motivation, and learning outcomes (Akinbode, 2014).

This package typically includes:

1. Digital assessment tools: Digital assessment tools, such as online quizzes, tests, and exams, can be used to assess student knowledge and understanding in real-time.
2. Learning Management Systems (LMS): An LMS is a platform that can be used to manage, organize, and track student progress, including assessment data.
3. Analytics tools: Analytics tools can be used to analyze student data and generate reports that help teachers and administrators understand student performance and identify areas for improvement.
4. Formative assessment tools: Formative assessment tools, such as self-assessment and peer assessment, can be used to support ongoing student learning and provide real-time feedback.
5. Automated grading and scoring systems: Automated grading and scoring systems can be used to grade student work and provide feedback quickly and accurately.
6. Educational data visualization tools: Data visualization tools can be used to display student data in an accessible and visually appealing format, making it easier for teachers and administrators to understand student performance (Akinbode, 2014).

According to Gipps and Simpson, 2011)changing the teaching approach while maintaining old method of assessment will almost always result in failure.TEALP can also be referred to the use of computers to assess students' progress in teaching and learning. They are tools for educational diagnosis. Assessments are ongoing and they give ongoing feedback to monitor students' progress in learning. TEALP is used to assess students' progress to give instant feedback, over the years, teaching and learning in the classroom has broughtgreat change in performance of learners through assessment and report given (Kayri, Gencoglu, and Kayri, 2012).In contrast, according to Roth, and Surry, (2011) assessment is a range of procedures of testing conducted by teacher during process of teaching to influence or promote performance of learner.

Pedagogical advantages of Technology- Enabled Assessment for Learning Package (TEALP) are; it enables the assessment of a wide range of topics very quickly, eliminates double marking, saves time and resources, monitors students' progress in learning, and identifies students' problem quickly. Also, in terms of advantages to students in using TEALP. It allows students to self-assess, check their progress at their own pace. In using TEALP for assessing students' learning progress, it mainly relates to the effectiveness and rapidity of spontaneously created (elaborated) feedback (Gipps and Simpson, 2011). Assessment is a process used to evaluate student learning and understanding of the material being taught. The main purpose of assessment is to provide feedback to both the teacher and the student about the student's level of understanding and progress in the subject. This information can then be used to inform instruction and guide future learning.

Assessment can take many forms, including traditional tests and quizzes, observation, projects, and portfolios. Student assessments are an important part of the educational process as they provide valuable feedback to both the students and teachers on the student's progress and areas where they may need to improve. It is important to note that, assessment is not only used to determine student's grade, but also to help identify areas where the student needs additional support and guidance. It is also a way to provide feedback to students on their performance, which can help them to identify their strengths and areas for improvement. The goal, is to help students learn from their mistakes, and to help them identify the next steps in their learning process.

In assessing and monitoring student's learning progress, the benefits of TEALP are mostly linked to the effectiveness of programmed instruction, which is used in giving detailed feedback according to Gripps, and Stobart, (2003),and to give assessment when it comes to item selection. Giving timely and specific feedback to students after assessment can have a positive impact on their learning. The TEALP (Technology-Enabled Assessment for Learning Package) model, proposed by Dennis, Falah-Hassani, and Shiri (2017), suggests that providing students with immediate feedback after assessment can help to close the gap between their current level of understanding and the learning objectives. This is because students can quickly identify areas where they need additional support and guidance, and adjust their learning strategies accordingly.

Furthermore, it can also be advantageous to give each student tailored feedback based on how they responded differently to the evaluation. Research has shown that students are more likely to engage with feedback that is tailored to their specific needs and that addresses their specific misconceptions (Kayri, Gencoglu, and Kayri, 2012).

However, this type of assessment using (TEALP), is to reveal to students what they did not understand or have not learnt. It gives them opportunity to reflect quickly the gaps and difficulties in their learning, and form a strategy on how to resolve these difficulties. Pedagogical advantages of using TEALP as a means of delivering assessment are numerous. These are;

- It is fun in usage.
- It enhances learning experience through self-monitoring and reflection
- It helps in motivating student, and helps in students' retention
- It is flexible, both as consolidation material and as a revision tool for exams
- It allows for more interactive learning.

  TEALP was developed by following Fenrich and ADDIE Model procedure, as learning management system (LMS) procedure.

2.2.2.1 Instructional designing process of Fenrich

1. Identify difficult topics in Upper Basic 2 Basic science curriculum
2. Identify instructional objectives for the topics
3. Determine the previous knowledge
4. Identify the sub –topics to emphasis on
5. Select the teaching strategy- Which computer-based design strategy will be used for the study for this study
6. Choose the design components
7. Develop the package (Fenrich, 2016).

2.2.2.2 Model ADDIE

ADDIE model is a five-phase instructional design model that stands for Analysis, Design, Development, Implementation, and Evaluation. It is a systematic approach to designing and delivering effective training and educational programs (Fenrich, 2016). The model provides a framework for creating instructional materials that meet specific goals and objectives, and ensures that all aspects of the learning experience are carefully considered and integrated. The ADDIE Model is widely used in education

and corporate training, and is recognized as a standard in the field of instructional design. The ADDIE Model is commonly used for the following purposes:

1. Designing instructional materials: The ADDIE Model provides a systematic approach to designing instructional materials that are effective and meet specific learning objectives.
2. Improving instructional quality: The ADDIE Model ensures that all aspects of the instructional design process are considered and integrated, leading to higher-quality educational and training programs.
3. Evaluating instructional effectiveness: The Evaluation phase of the ADDIE Model provides a framework for evaluating the effectiveness of instructional materials, which can help identify areas for improvement and inform future instructional design decisions.
4. Guiding the development of new educational programs: The ADDIE Model can be used as a roadmap for creating new educational programs, from analyzing learner needs to evaluating program effectiveness.
5. Training professionals in instructional design: The ADDIE Model is used as a standard in instructional design, and is often taught in courses that prepare professionals to work in the field (Allen, 2017).

The ADDIE Model is important for several reasons:

1. Provides a structured approach to instructional design: The ADDIE Model provides a systematic and organized approach to designing instructional materials, which can help ensure that the final product meets specific learning objectives and is of high quality.
2. Improves instructional effectiveness: By considering all aspects of the instructional design process, the ADDIE Model can lead to more effective and engaging educational programs (Peterson, 2003).
3. Facilitates collaboration and communication: The ADDIE Model can help facilitate collaboration and communication among instructional design team members, as it provides a shared language and framework for the design process.
4. Supports continuous improvement: The Evaluation phase of the ADDIE Model provides a means for evaluating the effectiveness of instructional materials, which can inform future design decisions and support continuous improvement.
5. Enhances the credibility of instructional materials: The ADDIE Model is

widely recognized as a standard in instructional design, and its use can enhance the credibility of educational and training programs (Bugis, 2018).

Overall, the ADDIE Model is a valuable tool for instructional designers, educators, and trainers, as it provides a structured approach to designing high-quality instructional materials and supports continuous improvement in the field of instructional design.

ADDIE Model

Analysis ——— Design —— Development — Implementation — Evaluation

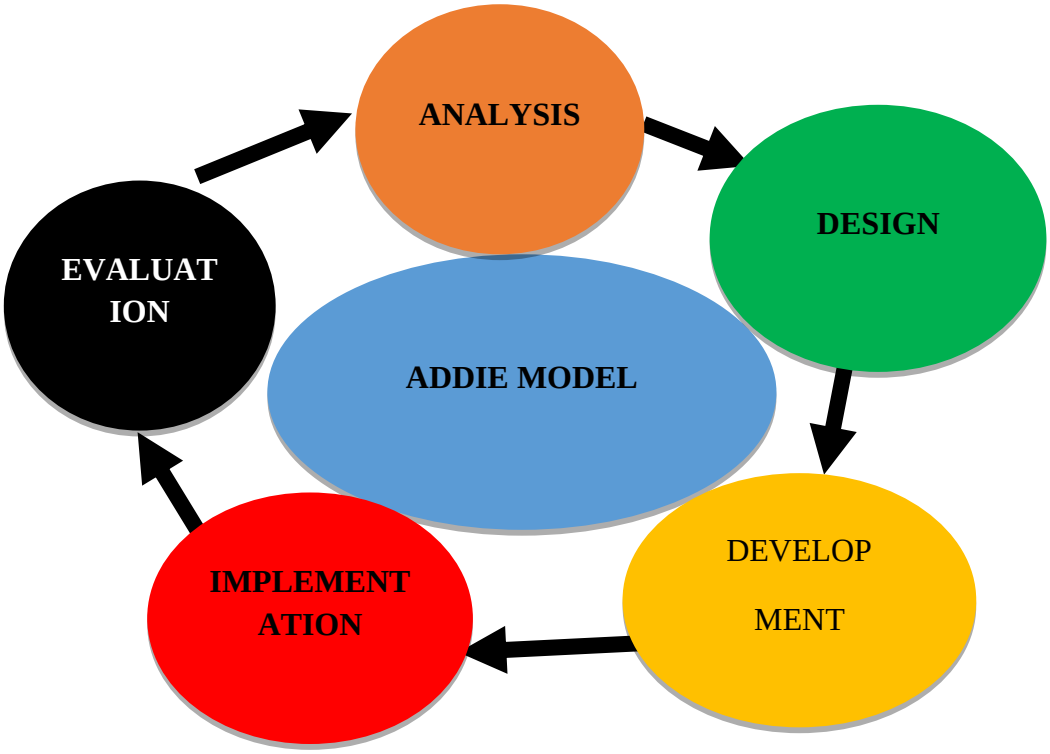

Fig 2.3: ADDIE Model adapted from Anthony Williams (2020)

2.2.2.3 Analysis Phase

The Analysis phase of the ADDIE Model is the first phase in the instructional design process and involves identifying the needs and goals of the intended learners, as well as the instructional objectives and desired outcomes. The key tasks in this phase include:

1. Conducting a needs assessment: This involves identifying the gap between the current knowledge or skills of the learners and the desired outcomes.
2. Defining learning objectives: This involves clearly articulating the specific knowledge or skills that the learners are expected to acquire.
3. Determining learner characteristics: This involves understanding the demographics, backgrounds, learning styles, and motivations of the learners.
4. Defining the instructional context: This involves considering factors such as the learning environment, available resources, and constraints that may affect the design and delivery of the instructional materials Anthony (Williams, 2020). The information gathered in the Analysis phase serves as a foundation for the subsequent phases of the ADDIE Model, and helps ensure that the instructional materials are designed to meet the needs and goals of the learners.

2.2.2.4 Design Phase

The Design phase of the ADDIE Model is the second phase in the instructional design process and involves creating a detailed plan for the instructional materials. The key tasks in this phase include:

1. Developing instructional strategies: This involves determining the best methods for delivering the instructional content and engaging the learners, such as lectures, hands-on activities, or multimedia presentations.
2. Creating content outline: This involves organizing the instructional content into a logical structure, such as a storyboard or script.
3. Designing assessments: This involves creating assessments, such as quizzes or exams, to measure the learners' understanding and retention of the instructional content.
4. Selecting media and technology: This involves choosing the appropriate tools and technologies to support the instructional delivery and assessment, such as multimedia presentations or online platforms.
5. Determining resource requirements: This involves identifying any additional

resources or materials that may be needed to support the delivery of the instructional materials, such as handouts or props (Allen, 2017).

The outcome of the Design phase is a comprehensive plan for the instructional materials that outlines the instructional strategies, content, assessments, media and technology, and resource requirements. This plan serves as a roadmap for the development of the instructional materials in the following phase.

2.2.2.5 Development Phase

The Development phase of the ADDIE Model is the third phase in the instructional design process and involves creating the actual instructional materials based on the plan created in the Design phase. The key tasks in this phase include:

1. Creating instructional materials: This involves developing the instructional content and assessments, creating multimedia presentations, or programming interactive activities, as outlined in the Design phase.
2. Piloting the instructional materials: This involves testing the instructional materials with a small group of learners to identify any issues or areas for improvement before full implementation.
3. Revising instructional materials: Based on the feedback from the pilot, this involves making any necessary revisions to the instructional materials to improve their quality and effectiveness (Peterson, 2003).

The outcome of the Development phase is a complete set of instructional materials that are ready for implementation in the next phase. It is important to ensure that the instructional materials are of high quality, well-organized, and meet the instructional objectives and learning outcomes defined in the Analysis phase.

2.2.2.6 Implementation Phase

The Implementation phase of the ADDIE Model is the fourth phase in the instructional design process and involves delivering the instructional materials to the learners. The key tasks in this phase include:

1. Training instructors and trainers: This involves providing training and support to the instructors and trainers who will be delivering the instructional materials.
2. Delivering instructional materials: This involves implementing the instructional materials in the learning environment, such as a classroom or online platform.
3. Monitoring implementation: This involves observing and tracking the

implementation of the instructional materials to ensure that they are being delivered effectively and meeting the instructional objectives and learning outcomes (Branch, 2018)

The Implementation phase is crucial for the success of the instructional materials, as it ensures that they are delivered to the learners in a way that meets their needs and supports their learning. It is important to closely monitor the implementation process to identify any areas for improvement and ensure that the instructional materials are having the desired impact on the learners (Anthony Williams, 2020).

2.2.2.7 Evaluation Phase

The Evaluation phase of the ADDIE Model is the final phase in the instructional design process and involves evaluating the effectiveness and impact of the instructional materials. The key tasks in this phase include:

1. Collecting data: This involves gathering data on the learners' performance and understanding of the instructional content, such as through assessments or surveys.
2. Analyzing data: This involves analyzing the data collected to determine the effectiveness of the instructional materials in achieving the instructional objectives and learning outcomes.
3. Determining impact: This involves evaluating the impact of the instructional materials on the learners, such as their improved knowledge, skills, or attitudes.
4. Making recommendations: Based on the evaluation results, this involves making recommendations for improvement to the instructional materials, such as revising content, adjusting delivery methods, or using different assessments Anthony Williams (2020). The Evaluation phase is essential for continuous improvement in the instructional design process. It provides feedback on the effectiveness of the instructional materials and helps to identify areas for improvement. The evaluation results can be used to inform future iterations of the ADDIE Model and to ensure that instructional materials are of the highest quality and meet the needs of the learners (Allen, 2017).

2.2.2. 8 Phases associated with Product Development.

The phases associated with product development typically include the following:

1. Ideation
2. Concept Development
3. Design and Development
4. Testing and Validation
5. Launch
6. Monitoring and Evaluation
7. Operation analysis (Abdullahi, 2021)

2.2.2. 8. 1 Ideation

This phase involves generating ideas for a new product or improving an existing product. It includes market research, brainstorming sessions, and feasibility studies.

2.2.2.8. 2 Concept Development

This phase involves refining the idea into a more specific and well-defined concept. This includes creating prototypes and testing the concept with target customers.

2.2.2.8.3 Design and Development

This phase involves creating detailed designs for the product, developing engineering specifications, and manufacturing prototypes for testing.

2.2.2.8.4 Testing and Validation

This phase involves conducting rigorous testing of the product to ensure that it meets the necessary standards and specifications. This may include laboratory testing, field testing, and simulation.

2.2.2.8. 5 Launch

This phase involves launching the product into the market and making it available to customers. This may include marketing, advertising, and distribution activities.

2.2.2.8. 6 Monitoring and Evaluation

This phase involves monitoring the performance of the product in the market and evaluating its success. This may include customer feedback, sales data, and market

research.

2.2.2.8. 7 Operation analysis

This is the stage of itemizing or analysing the procedures to follow in using or operating the product.

These phases may overlap or occur simultaneously in some cases, and the specific steps involved in each phase may vary depending on the product and the development process. The overall goal of the product development process is to bring a high-quality, market-ready product to market in a timely and cost-effective manner.

2.2.2. 9 Better approaches for Thinking about Assessment

Lately the innovators in the assessment field have made genuine endeavors to make sense of the massive contrasts between appraisals of learning and assessment for learning Kolawole, and Ala, (2014) A first step in evaluation requires investigating appraisal as a training that has, basically, three unique purposes:

1. Pre-assessment: Pre-assessment is regulated to students toward the start of an educational unit to distinguish earlier information or misguided judgments they might have about a subject. Such data decides a sensible beginning stage for guidance.
2. Developmental assessment: Formative assessment are utilized all through guidance to gather proof of learning for motivations behind checking progress and directing guidance.
3. Summative assessment: Summative assessment appears as paper and pen-based tests, capstone exhibitions, which adhere to guidance and are utilized to:
    - decide how well student " amount to" a norm
    - contrast student with each other and assign position
    - allocate grade

Assessment for learning fill different needs than pre-assessment or summative assessment since the motivation is to give significant input to teachers and students about the progress of students in arriving at significant learning objectives. Marks on assessment for learning are utilized to illuminate and sensitize students to learn. The data given through assessment is utilized to monitor progress and direct students toward getting the hang of, relearning, or elective figuring out how to further develop inspiration and confidence Kolawole, and Ala, (2014).

2.2.2. 10 Continuous Assessment Practices in Nigerian's School Education

Assessment does not really mean testing (Osokoya, 2013), it is an interaction by which the nature of a singular work or execution is verified or tried. In Comparing school programme Kolawole, and Ala, (2014) describes assessment as system or action that is intended to gather data or information, demeanor, and abilities of student. Accordingly, with regard to schooling, assessment can be characterized as a foreordained interaction through which the nature of a students' presentation in the three spaces of instructive goals (mental, full of feeling, with psychomotor) stands for verification. Assessment of learning of student on a concept in educational program contents in the subject matter, abilities, and values is a significant pre-control of numerous instructive changes.

This is on the grounds that outcomes from such assessment do not just give criticism as regards the instructive advancement of learners, it also legitimizes the measuring stick for checking the adequacy of the teacher, the nature of guidance, and to some extent the usefulness of any educational program change. Continuous assessment is a test or appraisal conducted in an on-going cycle Osokoya, (2013) is an unbiased verdict measured as a significant piece of organized assessment deliberately planned, also controlled in empowering an instructor to assess part of students' explicit time. Various portrayal of Continuous assessment occurs in researches, for example in the study of Bunbury, (2020). referred to in Osokoya (2013) Continuous Assessment is not just persistent testing, consistence assessment do not exclusively rely on prescribed examination.

Assessment is more important than testing students, involves more than testing. It covers each decision the instructor makes while presenting a concept to the class in an effort to raise student achievement. The process of continuous by watching student and learning about what they know, comprehend, and are capable of doing in order to develop an ongoing assessment of the student's performance is known as continuous assessment. Osokoya, (2013)CA is a formative assessment methodology concerned about finding out, in a precise way, the general acquisition student has made with regard to information, perspectives and abilities after a given arrangement or learning experience of opportunity for growth (Holmes, 2015)

Comprehensive meaning of continuous assessment is explained by Kimball, Friedensen, and Silva (2017) as an instructive setting that is orderly, and systematic a goal cycle of deciding the degree of student's performance and individual normal

changes in the way of behaving having undergone same training or course of study in a persistent and moderate way. It further limits such a course of study and allows a prudent gathering of all snippets of data got from this reason, with the end goal of utilizing them to guide and shape the students, and act as bases for significant choice about the kid or ward.

Continuous assessment can also be explained as a component by which the last reviewing of a student is mental, emotional and psychomotor areas of conduct considered in an orderly and manner, can be given judgement. It is also a means through which every one of his performance or presentation during a giving time of tutoring can be appraised.CA is a continuous analysis of school process that utilizes varieties of appraisal devices to gauge or measure student achievement (Holmes, 2015).

Continuous assessment is also seen as piece of equipment that is used to determine scoring of learners' advancement in the area of cognitive, affective and psychomotor domains of learning, methodically assessing all enactment of students during a period of tutoring (Gripps, and Stobart 2003)). In the light of this explanation, one could interpret CA as an appraisal approach that includes the utilization of an assortment of evaluation instruments (for example tests, projects, collections, task, conversations, agendas, rating scale, inventories, episodic), evaluating different parts of learning activities, the reasoning cycles (mental) yet including mentalities, thought processes, convictions, ways of behaving, character attributes (emotional) and expertise (psychomotor). Continuous evaluation aids in learning facts and occasionally gathering data to determine what a student knows and what he can grasp with the goal of continuously judging how a pupil is performing in studying Powell and Kalina. Continuous evaluation, according to (2009), is a continuous process of making judgments about how things are done that are analogous to explicit rules and can be used to make decisions that will improve a learner's development.

Rahmati, (2015) described continuous assessment as a method of assessment that is carried out at predetermined intervals, typically harmonizing with certain guidance or units of instruction of educational system, for the purpose of monitoring the progress of pupils and the overall learning performance. Periodically, continuous assessment is conducted with the goal of enhancing both student and teaching and learning process performance overall. Yan and Carless (2021). A constant evaluation

plot is one that includes a deliberate assortment of imprints or grades into a last score considered in choosing the up-and-comer's last grades.

It is appropriate to pay attention to the following in light of the conceptualizations of CA that have been reviewed. Regular and ongoing continuous assessment takes place; it is a continuous cycle of the formative and summative phases, and it includes reviewing students' grades or output is incorporated with instructing, includes a deliberate assortment of imprints or grades into a last score, might be utilized to decide the up-and-comers' last grades, mirrors students' capacities throughout some undefined time frame, considers improvement, deals with students' learning in the three space of instructive goals, and it is a combined interaction.

This way, a basic assessment of the different perspectives and meanings of persistent appraisal introduced before, shows a few distinct qualities which teachers have reliably underlined. That C.A., is (1) deliberate; (2) thorough; (3) total; and (4) direction situated as indicated by Osokoya (2013). All these highlights make it workable for both the learners and instructors, to have essential information that will direct future improvement of students in terms of subjects to be taken and profession of choice in the future.

2.2.2. 11 Assessment in Education

Assessment is an important part of the learning process that ensures the learning objectives of a course has been achieved. The learning target is the goal of a certain learning process that must be accomplished at the conclusion of the session. Whether the learning objectives have been reached or achieved depends on assessment, which is a crucial phase in the learning process. Assessment in education is the organization of various data or marks of learner to check learning progress. The data helps in monitoring and diagnosing student’s learning progress and helps in bridging gap between content retention and better student performance. Assessments are great ways to gauge student’s performance, learning and understanding, it also helps teacher to understand learner’s problem and how to solve them (Sato, and Oyanedel, 2019).

In education, assessment refers to the gathering of information from students' activities throughout instruction and learning in order to gauge their degree of comprehension and learning progress. Analysis of the evaluation data reveals the student's strengths, weaknesses, and progress. To make learning more participatory, assessment is included into classroom education.

The research on English as a Second Language was inspired by the character of continuous evaluation Hamp-Lyons (2016). According to them, the term interactive assessment describes an intentional process through which the teacher checks each student's progress and needs, and applies timely interventions to help learners produce a better performance. The teacher has worked with them for a long time and is familiar with the performance. They claim that interactive assessment will motivate the learner to demonstrate a higher-level performance. (Bunbury, 2020).

William (2011) said that assessment provides evidence of student's understanding which is interpreted by teachers, learners, parents and peers to determine next steps to modify or change learning initiatives. Helping teacher to plan lesson effectively and it is one of the reasons for assessment in education. It is a way to let the teacher know if the objectives have been achieved. The learning objectives listed at the beginning of the lesson or course are mapped to the assessments (Anderson, Katz-Buonincontro, Bousselot, Mattson, Beard, Land, 2022).

2.2.2. 12 Student and Assessment

Center of movement for assessment lies in the grouping of two activities. The first, is the insight by the student of a gap between an ideal objective and their current learning of information, and additionally understanding, as well as expertise. Second is the activities taken by student to fill up the gap between a supreme objective and their current state (Akinbode, 2014). Assessment is not only served students but also served teachers. It works as an excellent feedback mechanism to let the student know their learning progress. (Williams, 2011)

Assessment refers to the process of evaluating a student's performance, knowledge, skills, and abilities in order to determine their level of mastery of a particular subject or task. Assessment can take many forms, including tests, quizzes, essays, projects, and oral presentations, and can be used to provide feedback to students, identify areas for improvement, and track progress over time. Effective assessment should be well-designed, aligned with learning objectives, and provide reliable and valid results (Gravett, 2022).

2.2.2. 13 Formative Assessment

Formative assessment is a type of assessment that takes place during the learning process to provide ongoing feedback to both the student and the teacher (Holmes,

2015).Dennis, Falah-Hassani, and Shiri, (2017) suggest that the aim of formative assessment is to support and improve student learning, rather than simply evaluating it. This type of assessment is used to monitor student progress, identify areas of strength and weakness, and make adjustments to instruction as needed William (2011). Examples of formative assessment include in-class discussions, quizzes, and group projects.

Unlike summative assessment, formative assessment is typically less formal and focuses on the process of learning, rather than just the end results (Torrance,(2007).Formative assessment is a type of assessment that takes place during the learning process to provide ongoing feedback to both the teacher and student about the student's progress and understanding of the material. The goal of formative assessment is to inform instruction and adjust teaching strategies to meet the needs of individual students. Some examples of formative assessment include:

1. Classroom quizzes and tests: These assessments help the teacher determine what the students have learned so far and what they still need to work on.
2. Class discussions and group work: These activities provide the teacher with information on how well students understand the material and their ability to apply it.
3. Exit slips: At the end of a lesson, students write a quick reflection on what they have learned and what they still have questions about.
4. One-minute paper: Students write down one thing they learned and one question they still have after a lesson.
5. Self-assessment: Students reflect on their own learning and provide feedback on their strengths and weaknesses.

Formative assessment is important because it provides students with immediate feedback on their learning and helps teachers adjust their teaching strategies to meet the needs of individual students. This leads to more effective and efficient learning for the students.

2.2.2. 14 Traditional Versus –Student Centred of Assessment

Traditional assessment focuses on testing students' recall of information and mastery of specific skills and is usually conducted through paper-and-pencil tests, essays, and written exams. This approach emphasizes the teacher's role in determining what will be assessed and how the results will be interpreted.

Student-centered assessment, on the other hand, focuses on the individual needs and interests of each student and emphasizes their active participation in the

assessment process. This approach aims to provide students with opportunities to demonstrate their learning in authentic and meaningful ways, such as project-based assignments, portfolio assessments, and self-reflection. The goal is to assess students' overall understanding and ability to apply their knowledge and skills, rather than just testing their memorization of facts. Also, in Figure 2.4 variety reveals of ways by which information about student learning can be collected, communicated to students, and used to inform and guide instruction toward enhanced learning.

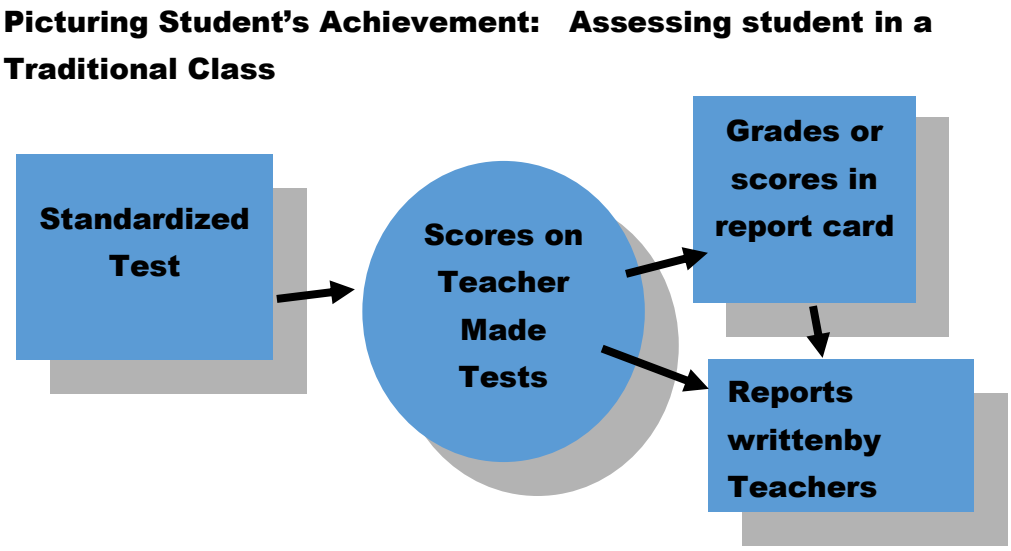

Fig. 2.4 Assessment in a Traditional Classroom

Source; Researcher (2022)

Student-Centred Classroom

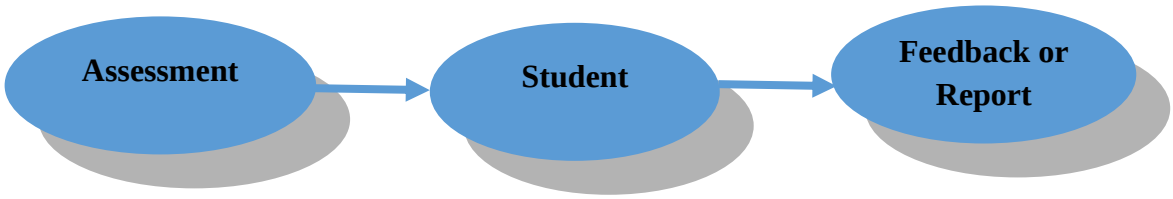

Fig. 2.5 Assessment in a student – Centred Classroom

Source: Researcher (2022)

2.2.2. 15 Summative Assessment

Summative assessment is a type of evaluation that takes place at the end of a learning period and summarizes the student's learning progress and achievements. It is used to measure the student's knowledge, skills, and understanding of specific learning objectives and is often used to assign grades or determine course completion. Examples of summative assessment include final exams, standardized tests, and research papers. The focus of summative assessment is on measuring the student's mastery of content, and the results are used to make judgments about the student's overall performance and academic progress. Summative evaluation is the process through which teachers evaluate their students' learning by comparing their performance to predetermined standards and goals. According to this view of assessment, summative measurements are used to determine and communicate the learning of pupils to parents and educational stakeholders.

2.2.2. 16 Feedback as a Report from Teacher to Student

Feedback is information a teacher gives to learner regarding how they performed on a test. Feedback should be visible as one of the most extraordinary techniques for working on students' learning as indicated by Hattie and Gan (2011). Giving students feedback allow conceivable opportunity to bridge the difference or gap that exists between what students know and what they should learn, though teachers need feedback to figure out where students are missing or need more help with their learning interactions. It simply helps to adjust instructing exercises to the requirements and need of students (Stobart, 2008).

Hattie and Timperley (2007) characterized feedback as data given by teacher to student to help them understand what they have learnt and understand. Feedback is also useful in order to make assessment as effective as possible (Adewale and Anjorin, 2012).

2.2.2. 17 Feedback as Information

Feedback is information provided to an individual about their performance, behavior, or work. In an educational setting, feedback can refer to the information given to a student about their performance on assignments, tests, or projects. Feedback can take many forms, including written comments, grades, oral comments, or a combination of these. Feedback is important because it provides students with information about their strengths and weaknesses and helps them identify areas for improvement. It also helps teachers to

assess the effectiveness of their teaching methods and make changes where necessary (Buckley, 2020).

Effective feedback should be:

1. Timely: Feedback should be provided in a timely manner so that students can use it to improve their performance.
2. Specific: Feedback should be specific and focused on a particular aspect of the student's performance.
3. Objective: Feedback should be objective and not subjective, avoiding personal opinions or biases.
4. Constructive: Feedback should be designed to help the student improve, rather than simply criticize.
5. Actionable: Feedback should provide students with specific actions they can take to improve their performance (Carless and Boud, 2018).

Feedback can be a powerful tool for improving student performance and promoting learning. When used effectively, it can help students to identify their strengths and weaknesses, set goals for improvement, and build their confidence and motivation (Carless and Boud, 2018).

2.2.2.18 Programmed Instruction

Programmed instruction is a teaching method that uses a systematic and step-by-step approach to present information and provide practice opportunities to learners. It was first developed in the 1950s and 1960s as a way to deliver self-paced instruction in educational and corporate settings. Programmed instruction typically involves the use of a programmed text or computer-based program, where learners are presented with a series of questions or tasks and receive immediate feedback. The questions are structured to gradually increase in difficulty and build upon previously learned material. The self-paced nature of programmed instruction allows learners to proceed at their own speed and focus on areas where they need more practice. (Gan and Hattie, 2011).

Programmed instruction is based on the principles of behaviorism and focuses on the acquisition of specific knowledge and skills. It is often used to teach subjects that are well-structured and lend themselves to a step-by-step approach, such as mathematics, sciences, foreign languages, and typing. While programmed instruction has been largely replaced by more interactive and multimedia instructional methods, it

continues to be used in certain situations where self-paced learning is desired and is still considered a valuable approach for certain types of learning. There are two types of programmed instruction or learning which are; Linear programming and Branching programming. In linear programming, students use a single set of materials and follow a straightforward step-by-step process to progress from one problem to the next all the way to the program's conclusion. It is more difficult compare to program branching instructions (Ferguson, 2011).

2.2.2.19 Feedback as Reinforcement

Programmed instruction stressed out ways to deal with learning. It allows the effect of feedback on learning activities. Feedback is used in learning to motivate or reinforce learners by giving them report of their learning activities. (Mulliner, M. and Tucker, (2015) The essence of planning learning activities in such a way that feedback is given immediately or later is to help student's to discover their learning problems and how to solve the problems, and also assist student to discover what they intends to learn and to meet course learning objectives.

Whenever a student is informed that a response is right, or by giving him or her a feedback of a right response, the learner is helped to answer accurately again on another test (Filgona, and Linus, 2017). Feedback is the teacher response to student work, in order to help them and motivate them in learning. (Ferguson, 2011).

2.2.2.20 Model of Feedback

There are several models of feedback that have been proposed in the literature, including:

1. Norman's Four-Component Model: This model consists of four components - description of performance, interpretation of performance, expectation for improvement, and prescription for improvement.
2. Hattie and Timperley's Feedback Model: This model emphasizes the importance of goal-directed feedback, which focuses on the desired learning outcomes and provides information on what needs to be done to achieve them.
3. Feedback Loop Model: This model emphasizes the importance of a continuous cycle of assessment and feedback, where students receive feedback, reflect on it, and use it to make adjustments to their learning strategies.
4. Carol Dweck's Feedback Model: This model focuses on the importance of feedback that promotes a growth mindset and encourages students to view their

abilities as malleable and improvable (Filgona, and Linus, 2017).

Regardless of the model, effective feedback should be specific, timely, relevant, and actionable. It should also be delivered in a supportive and non-threatening manner, and be focused on promoting student learning and improvement.

Figure 2.5 shows a diagram of Hattie and Timperley's Feedback Model. It is a well-known model in education that focuses on the importance of goal-directed feedback. The model proposes that effective feedback should have three key elements:

1. Alignment with learning goals: Feedback should be linked to the learning objectives and be focused on helping students understand what they need to do to achieve the desired outcomes.
2. Description of performance: Feedback should provide specific information about what the student has done well and what needs improvement.
3. Expectation for improvement: Feedback should set expectations for future performance and provide clear and actionable suggestions for improvement.

According to the model, effective feedback should also be timely, delivered in a supportive and non-threatening manner, and involve the student in the process of reflection and adjustment. The goal is to promote student learning and help students understand how they can improve their performance. The Hattie and Timperley's Feedback Model is widely used in education and is considered an important tool for promoting student learning and improvement.

Model of feedback to improve leaning

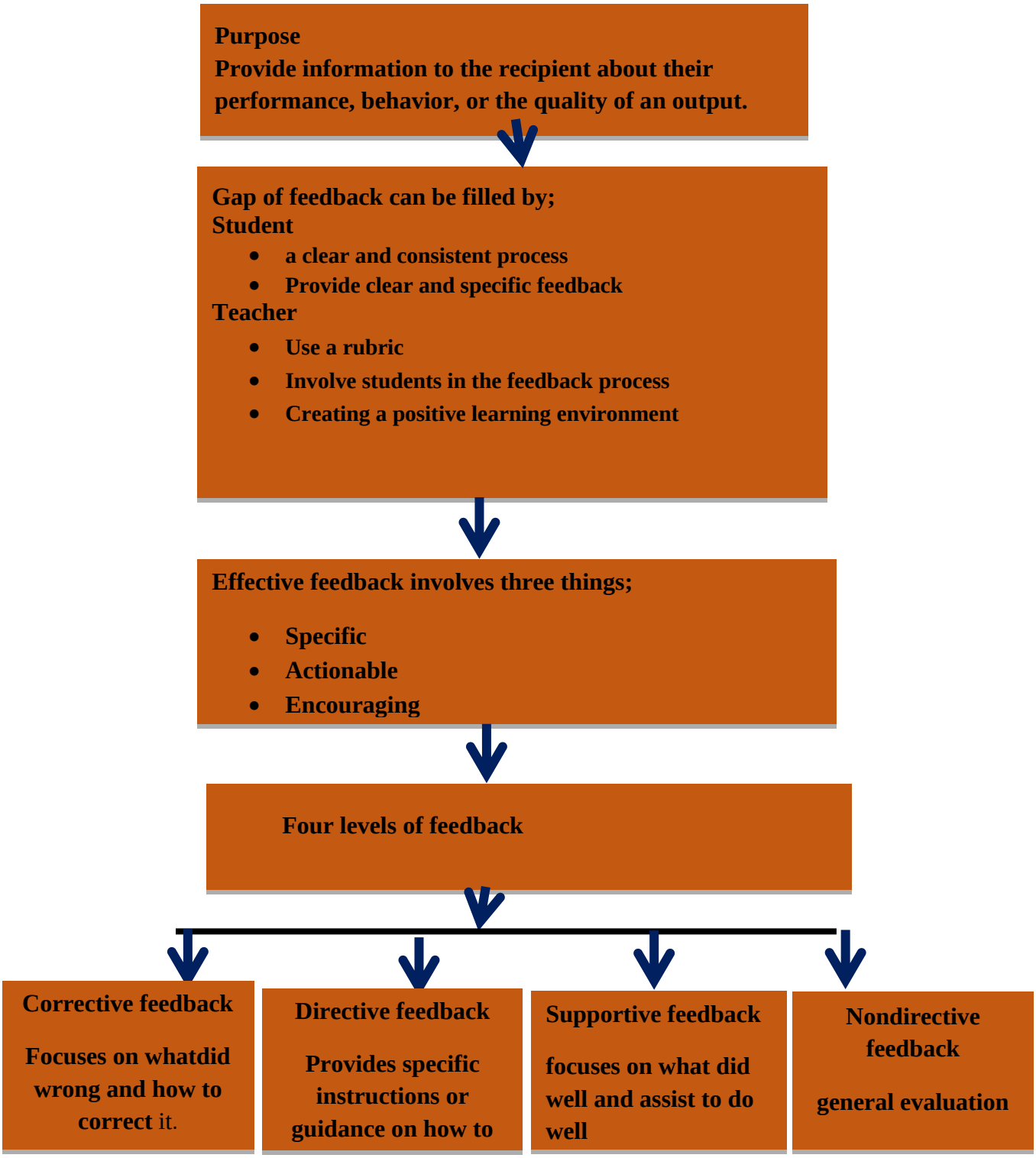

Fig. 2.6 Model of feedback for leaning improment. **John and Timperley, (2007) (Adapted, 2022)**

2.2.2. 21 Difference between Current and Desired Understanding as Learning concept

The difference between current understanding and desired understanding refers to the gap between an individual's existing knowledge, skills, and attitudes, and the level of understanding that they would like to achieve. Current understanding refers to an individual's current level of knowledge, skills, and attitudes about a particular topic. This can include what they know, what they don't know, and any misconceptions or gaps in their understanding (Mulliner, and Tucker, 2015). Desired understanding, on the other hand, refers to the level of knowledge, skills, and attitudes that an individual wants to attain. This could be in the form of a specific outcome, such as mastering a particular skill, gaining a deeper understanding of a topic, or changing a negative attitude.

The difference between current and desired understanding is an important consideration in the design and implementation of learning experiences. Understanding the gap between the two can help learners set goals, create a plan for reaching their desired understanding, and track their progress. It can also help educators and trainers to design instruction that addresses the specific needs and goals of their learners.

2.2.2. 22 Certitude Model of Feedback

Anderson, Kulhavy, and Andre, (1972) projected a model of feedback as a composed guidance that endeavors to explain and make sense of past discoveries in writing. This model additionally goes beyond essential clarifications to make testable expectations by hypothetical reasoning. The model was examined by (Bangert-Drowns, 1991) as the most thorough treatment of input in working with gaining from composed guidance. It coordinates variables of student’s confidence, feedback intricacy, and blunder rectification, which has been examined under various methods of presentation and timing. (Mulliner, and Tucker, (2015) explains that much of past researches on feedback is conceptually flawed. Scientists generally regarded reactions as being totally correct or wrong, a polarity that for all intents and purposes overlooked the intricacy of learning conduct. Considering that as a right response might be only a fortunate supposition or that of base response might be anything from an indiscreet misstep to an absolute miscomprehension of the material. Even more bewildering was concentrates on the point that, right responses which can be changed to wrong reactions on a posttest, and cases in which introductory blunders were rarely amended,

regardless of what was remembered for in the feedback, Winstone, and Carless,(2021). The model recommends feedback interaction which contain three cycles that comprises of informative occurrence. In cycle one, student is given a task to be resolved and necessitate providing an answer. In cycle two, feedback is introduced in view of the contribution of student in cycle one. In cycle three, the first assignment is introduced again as a test thing to which the student answers. Inside each cycle, a typical series of steps follows. Each cycle includes a contribution from the main task to the student, an examination of the contributions' reference, which give outcomes as a result.

The adapted feedback model from (Dempsey, Driscll and Swindell, (1993) is adjusted to explain the method of learning that goes along with constructivist theory of input, process and output. In the first model, supporter materials and informative materials are utilized to supplement the assignment introduced again to the student in cycle two, yet the adjusted one utilized no subordinate materials. All informative materials utilized has been remembered for the instructive bundle utilized as errand for the students like video, pictures, voice, varieties and others that can stimulate the student's interest in the subject to improve the posttest which is output as shown in fig.2.6

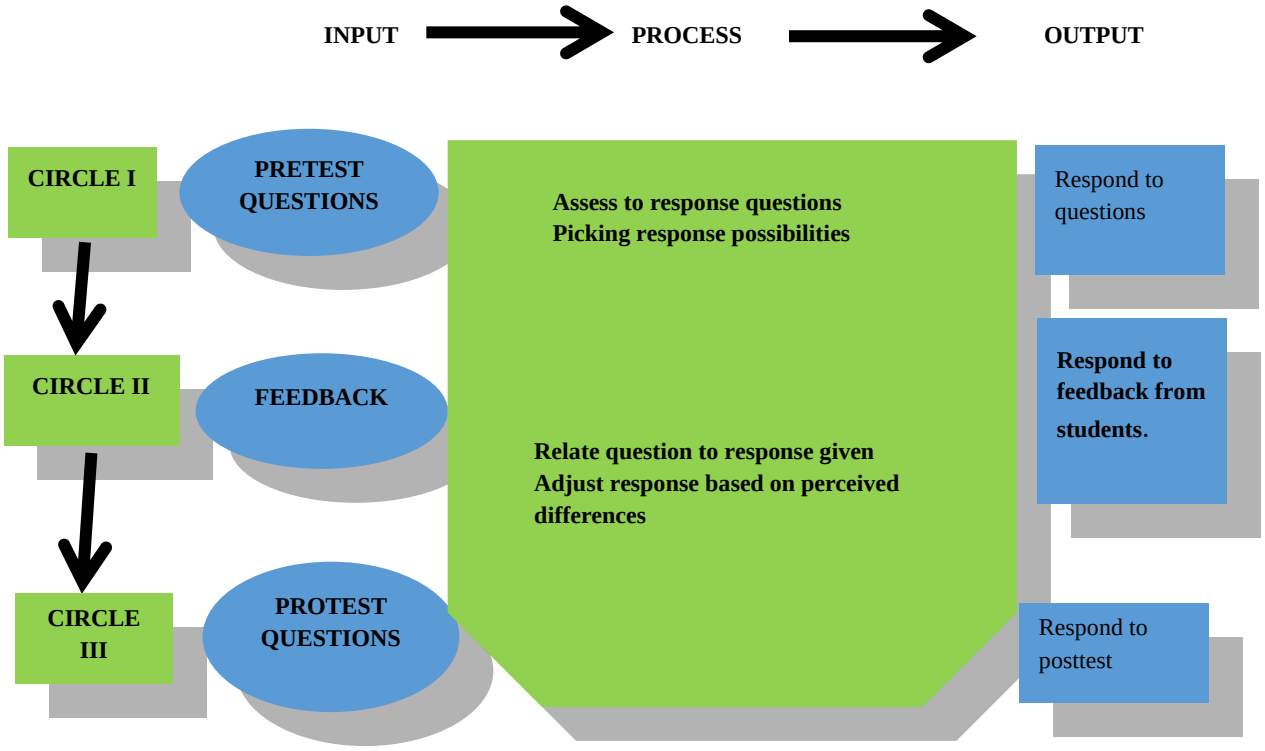

Fig 2.6 Adapted Model of feedback from (Dempsey, Driscoll, and Swindell, 1993).

2.2.2. 23 Importance of feedback

(a) It allows self-assessment development (reflection)
(b) Gives high quality information
(c) Buoy up dialogue
(d) Improves motivational belief and self-esteem
(e) Provision of opportunities to close the gap
(f) It gives information to teachers to improve teaching (Winstone, and Carless, (2021).

2.2.2. 24 Usefulness of Feedback to Students

(a) Feedback helps students to have good understanding of stated objectives through their performance.
(b) It streamlines advancement process of personal-assessment.
(c) It provides good feedback to learners concerning their learning.
(d) Feedback gives opportunity to peer interaction in learning.
(e) It gives chances to the gap in the middle of current and desired performance

In this study, feedback is relevant and necessary, for the study involves self-pace learning which allow for self-assessment and helps students to have good understanding of the concept they are leaning through their academic achievement.

2.2.2. 25 Remediation as a Method of Correcting Wrongs

Remediation is a method of correcting problems in students who are performing poorly. Anjorin, (2008), explain remediation as a way to rectify, to make good of a student, or action taken to correct problems of students not performing well. It can also be explained as the assessment of competence in a student to advance to next level. Remediation as seen as a method of correcting problems in students must be given immediate approach to remove, and reduce other factors like home factors that affect student's achievements in learning. Remediation is used to focus on the area where students are deficient to enhance their performance. Remediation is a corrective system intended to enhance and improve performance.

2.2.2.26 Objectives of Remediation

Remediation refers to the process of addressing and correcting academic or performance deficiencies in individuals. The objectives of remediation can vary

depending on the specific needs of the individual, but some common goals include:

1. Improving academic skills: The primary goal of remediation is to help individuals improve their academic skills and performance in areas where they are struggling. This may involve addressing specific weaknesses in reading, writing, mathematics, or other subjects (Anjorin, (2008).
2. Closing skill gaps: Remediation can be used to help individual close skill gaps and reach their full potential. For example, remediation may be used to help students who are behind their peers in reading or mathematics catch up and perform at the same level as their peers.
3. Improving self-esteem: Remediation can also help individuals improve their self-esteem and confidence by addressing their weaknesses and helping them achieve their goals.
4. Promoting long-term success: Remediation can help individuals develop the skills and habits necessary for long-term academic and career success. For example, remediation may be used to help students develop better study habits or to help employees develop new skills that are relevant to their job.
5. Preparing for further education or training: Remediation can also be used to help individuals prepare for further education or training by addressing any areas where they need additional support (Akinbode, 2014).

2.2.2.28 **Principle of Remediating for Student with Learning Challenge**

The principles of remediation for students with learning challenges are centered around the goal of providing individualized and effective support to help them overcome their difficulties and succeed academically. Some key principles include:

1. Assessment-based: Effective remediation begins with an accurate assessment of the student's strengths and weaknesses. This helps to identify the specific areas where they need support and to design a remediation plan that addresses their unique needs.
2. Individualized: Remediation should be individualized to meet the needs of each student. This may involve using different strategies or approaches for different students, depending on their specific learning challenges.
3. Evidence-based: Effective remediation should be based on sound educational research and proven instructional strategies. This helps to ensure that the interventions used are effective and have the best chance of success.

4. Collaborative: Remediation is often most effective when it involves collaboration between the student, the teacher, and other educational professionals, such as special education teachers, tutors, or speech therapists (Aldabus, 2022).
5. Structured and systematic: Effective remediation should be structured and systematic, using a step-by-step approach to build skills and knowledge. This helps students to make progress and achieve their goals.
6. Focused on the long-term: Remediation should be focused on the long-term goal of helping students overcome their learning challenges and succeed in the future, rather than just providing short-term support.
7. Positive and supportive: Effective remediation should be positive and supportive, creating a safe and encouraging learning environment where students feel motivated to participate and make progress (Winstone, and Carless, (2021).

These are some of the key principles of remediation for students with learning challenges. By following these principles, educators and other educational professionals can help students with learning difficulties overcome their challenges and reach their full potential.

2.2.2.28 Gender and Science Education

Gender and science education refers to the ways in which gender affects students' experiences, opportunities, and outcomes in science education. Gender can impact a range of factors in science education, including:

1. Student interest and participation: Research has shown that girls and women are less likely to be interested in and participate in science and technology fields compared to boys and men.
2. Stereotyping and bias: Gender stereotypes and biases can impact the way that students, teachers, and others perceive and evaluate the abilities and interests of girls and women in science and technology.
3. Curriculum and instruction: Science education curricula and instructional practices can reinforce gender stereotypes and discourage girls and women from pursuing science and technology careers.
4. Teacher gender and expectations: Students' views of science as a subject and their own scientific skills and interests might be influenced by the gender of

their science teachers. In order to break down gender stereotypes, female teachers can act as good role models for young girls.

5. Access to resources and opportunities: Girls and women may have limited access to resources and opportunities in science education, such as laboratory equipment or mentorship programs (Winstone, and Carless, (2021).

To address these issues, it is important for science educators and policy-makers to actively work towards promoting gender equity in science education. This can include providing equal opportunities for girls and women, challenging gender stereotypes and biases, and promoting female role models in science. Additionally, science curricula and instructional practices can be designed to be more inclusive and supportive of all students, regardless of gender.

2.2.3.29 Social Economic Background and Learning

Social economic background can have a significant impact on a student's learning experiences, opportunities, and outcomes. Some ways in which social and economic background can impact learning include:

1. Access to resources: Students from lower social economic backgrounds may have limited access to educational resources such as books, technology, and extracurricular activities, which can impact their learning and achievement (Mena and ArizaBrulla (2022).
2. Home environment: Children from lower socio-economic backgrounds are more likely to grow up in poverty and experience environmental stressors such as food insecurity, limited access to healthcare, and exposure to violence, which can negatively affect their learning and overall health(Okioga, 2013), (Osokoya and Adegoke 2014).
3. Parental involvement: Parental involvement in children's education is a critical factor in academic success. However, parents from lower socio-economic backgrounds may have limited time and resources to support their children's learning, including lack of access to technology and limited time due to work commitments.
4. Teacher expectations: Research has shown that teachers may have lower expectations for students from lower socio-economic backgrounds, which can negatively impact students' motivation and academic performance.
5. Curriculum and instruction: Students from lower socio-economic backgrounds may not have access to the same quality of education as their wealthier peers,

with fewer resources and experienced teachers.

These disparities can be addressed by supporting students from lower socio-economic backgrounds. It is important for educators and policy-makers to provide equal access to educational resources and opportunities, as well as to address issues such as poverty, food insecurity, and other environmental stressors that can impact learning. Additionally, teacher training and support can help to promote positive attitudes and expectations towards students from diverse backgrounds, and evidence-based interventions can be used to support students' academic success (Mirza**,** 2001).

2.2.2.30 Social Economic Background and Science Education

Social and economic background can have a significant impact on a person's access to science education. Children from disadvantaged backgrounds may not have access to the same resources, such as high-quality schools and educational materials, as those from more privileged backgrounds. This can lead to disparities in educational outcomes and limit their opportunities to pursue careers in science-related fields. Moreover, societal attitudes and beliefs about certain groups can also play a role. For example, women and underrepresented minorities may face implicit biases or obstacles that discourage them from pursuing science, technology, engineering, and mathematics (STEM) education and careers.

However, many initiatives and programs aim to increase access to science education and address these disparities. For example, outreach programs, science clubs, and mentorship opportunities can help provide underprivileged children with the resources and support they need to succeed in science. In conclusion, social and economic background play a crucial role in shaping a person's access to science education and opportunities in Mathematics fields. Addressing these disparities through equitable policies and programs is essential for promoting diversity and inclusiveness in science and technology.

2.3 Conceptual Framework

Conceptual framework shows the collaboration of effects of Technology-Enabled Assessment for Learning Package with feedback (TEALP), and effect of Technology-Enabled Assessment for Learning Package with feedback and Remediation (TEALPF) on attitude and achievement of JSS 2 students on Basic science. Gender and Social Economic Background as moderator variables, which can have effect also on the result of collaboration as shown in fig. 2.7.

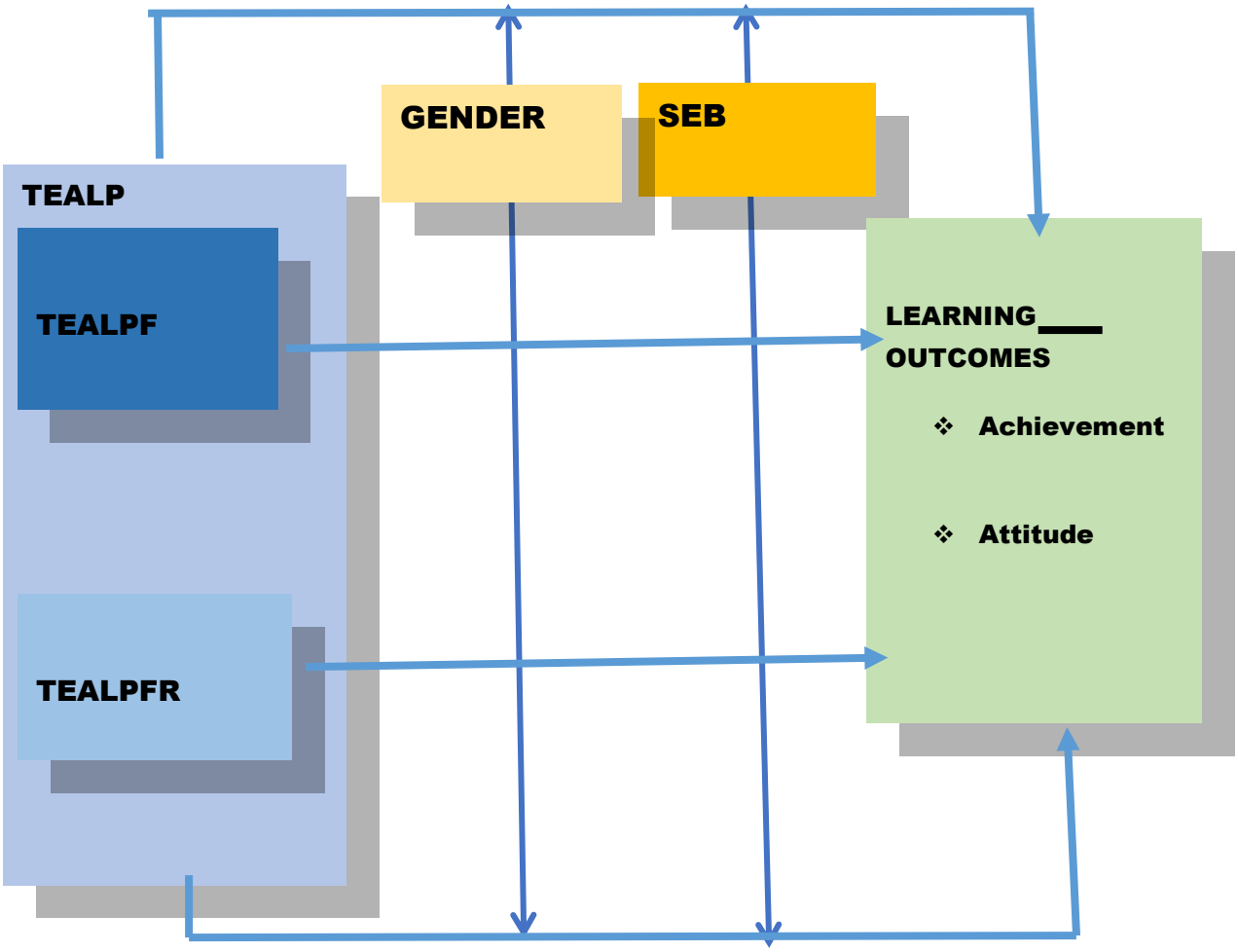

Fig 2.8 Source: Researcher (2022)

TEALP – Technology- Enabled Assessment for Learning Package

TEALPF – Technology- Enabled Assessment for Learning Package with Feedback

TEALPFR – Technology- Enabled Assessment for Learning with Feedback and Remediation

SEB – Social Economic Background

2.4 Empirical Review

2.4.1 Technology- Enabled Assessment for Learning Package and Achievement in Basic Science

Computer usage to support teaching and learning to govern assessments education has increased speedily over decades. Without doubt, the use of computer in educational assessment has a great advantage to teaching and learning. Technology-Enabled Assessment Package as a tool used for educational diagnostic which is useful for improving students' performance. Assessment is the process of evaluating a person's knowledge, skills, aptitudes, and characteristics. In education, assessment is used to determine a student's mastery of specific learning objectives and to make decisions about grades, course completion, and educational progression.

It may be formative or summative, and also continuous as continuous assessment (CA). Assessments can be utilized to get realities and data about student accomplishment and study advancements. Great and common strategies to survey students' accomplishment or learning results is by giving continuous assessment as an instrument or strategy for noticing weakness of student(Gripps, and Stobart, 2003). Blossom, (1971) presented the term developmental appraisal, it portrays the motivation behind this type of evaluation as giving student data or input on their learning, subsequently giving ideas to future learning. A few different reasons for developmental appraisal are; spurring understudies to study, giving understudies direction, keeping up with understudies, deciding the viability of informative projects.

Technology- Enabled Assessment for Learning Packages used in Basic science give instant feedback to the students to have instant remediation and get right ability or skill. This might further develop the learning result of learners in Basic Science and achievement of students in it is further established utilizing Technology-Enabled assessment for learning package with the assistance of prompt feedback (Ajogbeje, 2012).

2.4.2 Feedback and Achievement in Basic Science

Feedback in learning is information provided to a learner regarding their performance or understanding of a particular concept or skill. Feedback can come in many different forms, including verbal feedback from a teacher or mentor, written comments on an assignment, grades or scores on tests, or even self-assessment. Feedback is an essential part of the learning process because it helps the learner understand what they have

done well, what they need to improve, and how they can improve. By receiving feedback, learners can identify areas where they need to focus their attention and adjust their learning strategies accordingly. Feedback can also help learners build their confidence, motivation, and engagement with the learning process.

Research has shown that effective feedback should be specific, timely, and actionable. It should clearly communicate what the learner did well, what they need to improve, and how they can make those improvements according to Winstone, and Carless, (2021). Feedback should also be delivered in a supportive and constructive manner, focusing on areas of improvement rather than shortcomings.

Also, feedback enhances learning when it is provides with clear information about what students need to do to improve, can help students to better understand and apply new information and skills. Feedback that helps students to monitor their own progress and take responsibility for their own learning can promote self-regulation and autonomy. It also helps in fostering growth mindset, when feedback that emphasizes the process of learning, rather than just the outcome is given, it can help to foster a growth mindset and encourage students to persevere in the face of challenges (Boud, and Dawson, 2021).

It is important to note that feedback is most effective when it is aligned with students' learning goals and when students are actively involved in the process of receiving and using feedback. Feedback should be timely and specific, focusing on both strengths and areas for improvement. Additionally, feedback should be paired with opportunities for students to apply what they have learned and receive additional feedback on their progress. Feedback is an important part of the learning process, and learners should be encouraged to seek out and use feedback to improve their performance and deepen their understanding of a subject. Overall, feedback is a powerful tool for promoting student achievement and should be an integral part of any effective instructional strategy (Winstone, and Carless, 2021). For improvement of students' achievement in basic science through feedback given, there are strategies to follow:

1. Set clear goals: Establish specific and achievable goals for what you want to accomplish in basic science. This will help you stay focused and motivated, and will give you a sense of direction for your studies.
2. Be consistent: Make sure to dedicate consistent time and effort to studying basic science, and set up a regular study routine. This will help you stay on

track and make progress over time.

3. Use active learning strategies: Passive learning, like reading or listening to lectures, can be helpful, but actively engaging with the material will help you retain the information better. Try working through practice problems, creating concept maps, or explaining concepts to a study partner.
4. Seek help when needed: Don't be afraid to reach out to your teacher or tutor for help if you're struggling with a concept. It's much better to seek help early on, rather than waiting until you're really struggling.
5. Take advantage of resources: Use a variety of resources, including textbooks, online resources, and practice exams. There are many great resources available for basic science, so find the ones that work best for you.
6. Stay motivated: Finally, make sure to stay motivated and focused on your goals. Celebrate your progress along the way, and remind yourself of the benefits of learning basic science. A positive attitude and a growth mindset can go a long way towards achieving success in any subject.

2.4.3 Remediation and Achievement in Basic Science

Remediation in Basic Science refers to the process of providing additional support and education to students who are struggling in the subject. This could involve review of fundamental concepts, one-on-one tutoring, or participation in special programs designed to help students catch up to their peers (Chikwature and Oyedele, 2016). The goal of remediation is to help students overcome any learning difficulties and achieve a better understanding of the subject matter.

Remediation in learning refers to the process of providing additional support or instruction to learners who are struggling with a particular skill or concept. The goal of remediation is to help learners overcome their difficulties and achieve mastery of the content. It can take many forms, depending on the learner's needs and the nature of the challenge they are facing. For example, remediation might involve:

- Providing extra practice exercises or assignments to help learners build their skills and confidence.
- Offering one-on-one or small-group tutoring to address specific areas of difficulty and provide individualized support.
- Using technology-based tools or multimedia resources to help learners engage with the material in different ways.

- Providing additional explanation or examples of the content to help learners better understand the concepts they are struggling with.
- Modifying the learning environment to better support the learner's needs, such as providing extra time for assignments or using assistive technology to help with reading or writing.

Moreover, the goal of remediation is to support learners in overcoming their difficulties and improving their achievement in learning. Effective remediation requires a thorough understanding of the learner's needs and challenges, as well as the ability to provide targeted support and feedback to help them achieve their goals and improve their performance. (Anderson, Beattie and Autonak, 2008).

2.4.4 Gender and Achievement in Basic Science

Gender can have an impact on students' academic achievement and experiences in education. Some ways in which gender can impact achievement include:

1. Stereotyping and bias: Gender stereotypes and biases can affect the way that teachers, peers, and students themselves perceive and evaluate the abilities and interests of girls and boys. This can lead to lower expectations and opportunities for girls, particularly in science subjects. Interest and participation: Research has shown that girls and boys have different interests and levels of participation in different subjects. For example, girls may be less likely to participate in science, technology, engineering, and math fields, while boys may be less likely to participate in Arts and Languages subjects. (Squazzoni, Bravo, Grimaldo, Gsrcia-Costa,Farjam, Mehmani, 2021)
2. Interest and engagement: Girls and boys may have different interests and motivations for learning, which can affect their achievement in different subject areas. (Asante, 2010)
3. Curriculum and instruction: The curriculum and instructional practices used in schools can reinforce gender stereotypes and discourage girls and boys from pursuing certain subjects and careers. (Owolabi and Etuk-Iren, 2014)
4. Teacher gender and expectations: The gender of teachers can impact students' perceptions of certain subjects and their own abilities and interests in those subjects, female teachers can serve as positive replicas for girls and help to counter gender stereotypes (Azman-Saini, Baharumshah, and Law, 2010).
5. Family and cultural influences: Family and cultural influences can impact the

opportunities and expectations that girls and boys have for their education and future careers. (Godpower-Echie 2017).

According to Godpower-Echie (2017), to promote gender equity in education and address the impact of gender on achievement, it is important for educators and policy-makers to actively work towards challenging gender stereotypes and biases and providing equal opportunities and resources for all students, regardless of gender. Additionally, curriculum and instruction can be designed to be more inclusive and supportive of all students, and teacher training and support can help to promote positive attitudes and expectations towards students from diverse backgrounds (Achor, Imoko, and Jimin, 2012).

2.4.5 Social Economic Background and Achievement in Basic Science

Social economic background of students can impact their achievement in Basic Science. Research has shown that students from low-income families and communities often face challenges that can affect their ability to succeed academically, including limited access to resources and support, higher levels of stress and insecurity, and lower expectations from teachers and peers(Chikwature, and Oyedelele, 2016). These factors can make it more difficult for students to achieve in subjects like Basic Science, where success often requires consistent effort, dedicated study time. More so, access to resources such as textbooks and educational technologies material may be reduced or lacked (Ajilaand Olutola, 2016).

Okioga, (2013) on the other hands explain that students from more affluent backgrounds may have access to better resources, more opportunities for educational enrichment, and higher expectations for academic success, which can all contribute to higher achievement in Basic Science. It is important to note that while social economic background can have an impact on achievement, it is not the only factor. Other factors such as individual motivation, teacher support, and school resources can also play a role. The goal of education is to create an environment where all students have the opportunity to succeed, regardless of their background.

Therefore, achievement in Basic Science of students sometimes may be associated with their social economic background of the family. Higher social economic background of students can have impact on their academic achievement.

2.4.6 Technology-Enabled Assessment for Learning Package and Attitude to Basic science

The use of technology in education can have a significant impact on students' attitudes towards Basic Science in Adedeji, and Mudasiru, (2010). When technology is integrated effectively into the learning process, it can make learning more engaging, interactive, and fun. For example, virtual simulations, animations, and interactive multimedia resources can help students visualize and understand complex concepts, making Basic Science seem more relevant and accessible. In addition, technology can also provide students with more control over their learning, allowing them to work at their own pace and review information as many times as needed. This can foster a sense of independence and ownership over the learning process, leading to higher levels of engagement and motivation.

However, if technology is not used effectively, it can have the opposite effect. For example, if students are simply presented with endless lists of facts to memorize, or if technology is used in a way that feels disconnected from the rest of the curriculum, students may become disengaged and view Basic Science as dry and uninteresting. In conclusion, the impact of technology on students' attitudes towards Basic Science cannot be underestimated. When integrated effectively into the learning process, technology can help to make Basic Science more engaging, interactive, and relevant to students, leading to positive attitudes and increased engagement (Abe, 2011).

2.4.7 Feedback and Attitude to Basic science

The attitude of students towards basic science can vary greatly depending on individual factors such as personal interests and prior experiences. However, some common factors that can influence students' attitudes towards basic science include the teaching methods used, the relevance of the material to their lives, and the level of engagement and interaction in the classroom according to Aitokhuehi and Ojogho, (2014). Feedback from teachers and peers can also play a role in shaping students' attitudes. Positive feedback and recognition for their efforts can boost students' confidence and motivate them to pursue their interests in science. On the other hand, negative feedback or a lack of support can lead to a negative attitude towards the subject. Overall, creating a supportive and engaging learning environment, that gives positive feedback where students feel valued and motivated, is crucial in shaping

positive attitudes towards basic science(Abakpa, and Iji, 2014).

Feedback using Technology-Enabled Assessment for Learning Package (TEALF) can refer to the use of technology to provide students with information about their learning and performance. This can be done through using computer to grade assignments and tests, providing students with immediate feedback on their performance. And, also using of built-in tools for providing feedback, such as commenting tools, rubrics, and grading scales. TEALF which is an interactive tool can provide students with real-time feedback on their performance and help them understand the impact of their decisions and providing students with personalized feedback based on their performance (Akinbode, 2014).

Computer-based feedback (TEALP) has several advantages, including the ability to provide immediate feedback, the potential to be more objective and consistent, and the ability to provide more detailed and specific feedback than traditional methods. However, it is important to use technology in a way that enhances the feedback process and supports student learning, rather than replacing human interaction and support (Kim, Almond, and Shute, 2016).

2.4.8 Remediation and Attitude to Basic science

Remediation can play a role in shaping students' attitudes towards basic science by addressing their learning needs and helping them overcome any difficulties they may be facing in the subject explained by Chukwuedo, Mbagwu, and Ogbuanyait, (2021). When students receive effective remediation, it can increase their confidence and motivation, and help them develop a more positive attitude towards the subject. For example, providing individualized instruction, hands-on activities, and real-world connections can help students understand the relevance and importance of basic science in their lives. This can make the material more engaging and foster a positive attitude towards the subject (Kahu, and Nelson, 2018).

However, if the remediation is not well-designed or executed, it can have the opposite effect and further discourage students from pursuing their interests in science. For instance, if remediation only focuses on rote memorization and does not provide students with opportunities for hands-on exploration, it can lead to a negative attitude towards the subject. Therefore, it's important for educators to provide effective and engaging remediation that addresses students' individual learning needs and fosters a

positive attitude towards basic science.

2.4.9 Gender and Attitude to Basic science

Research has shown that gender can play a role in shaping students' attitudes towards basic science. Historically, basic science subjects, such as physics and mathematics, have been male-dominated fields, which may discourage girls and young women from pursuing their interests in these subjects. Yan, and Brown, (2017)

Studies have found that girls often face gender-based stereotypes and bias, which can lead to a negative attitude towards basic science subjects. For example, girls may receive messages that they are not as good as boys at science and math, which can lead to self-doubt and a lack of confidence in these subjects (Liu, and Schunn, (2020). However, with proper support and encouragement, girls can develop a positive attitude towards basic science. Encouraging girls to participate in science and math activities, providing role models and mentors, and promoting a growth mindset can help to overcome gender-based stereotypes and bias and foster a positive attitude towards basic science (Owolabi and Etuk-Iren, 2014). It is important to note that while gender can play a role in shaping students' attitudes towards basic science, it is not the only factor. Other factors, such as prior experiences, teaching methods, and individual interests and abilities, can also play a role in shaping students' attitudes towards the subject (Steidtmann and Steffensky,2022).

2.4.10 Social Economic Background and Attitude to Basic science

Social and economic background of students can have an impact on their attitudes towards basic science. Students from lower socio-economic backgrounds may face a variety of challenges that can affect their attitudes and performance in science, including limited access to resources and support, lower educational expectations, and a lack of exposure to scientific careers (Ahmar, and Anwar, 2018)). These factors can lead to lower levels of motivation and engagement in science, which can in turn lead to lower performance and achievement. On the other hand, students from higher socio-economic backgrounds may have greater access to resources and support, higher educational expectations, and more exposure to scientific careers, which can lead to higher levels of motivation and engagement in science and better performance and achievement (Okioga, 2013).

However, it is important to note that socio-economic background is one of the major factors that can influence students' attitudes towards basic science, and that every student is unique and has the potential to succeed in science with the right support and resources from parents or guidance. Teachers and schools also can play an important role in promoting positive attitudes towards science by providing engaging and inclusive instruction, supporting students in their learning, and helping students see the relevance and importance of science in their lives and future careers, but majorly, home factors have greater influence (Okioga, 2013). This gives understanding about the great relationship between social economic background and attitude to learning, especially learning of Basic science.

2.5 Appraisal of Literature reviewed and Gap filled

From the literature, Technology-Enabled assessment for Learning Package with feedback and remediation are facilitator to students' learning, and also influence greatly their learning outcomes. TEALP is used to right away fill the distance between the student's current repute in the getting to know system and the supposed learning final results. Research suggested how technology can be adapted to turn out to be more suit for educational motive. Feedback provided by using this system encourages student to improve on weak areas of mastering, enhance their attitude to learning, analyze competencies and become independent thinkers.

This approach anchor on constructivism learning theory that is mainly a theory that focused on perception and logical review of how individuals learn. Also, Behaviourism which is based on the proposition that behavior can be changed without resort to inner mental states. Assessment is going, and it gives ongoing feedback to monitor students' progress in learning a particular concept. TEALP refers to the use of computers to assess students' progress in teaching and learning and to give instant feedback, and as a tool for educational diagnosis. The aim of this study, is to investigate the effects of Technology-Enabled Assessment for Learning Packages (TEALP) on junior secondary students' achievement in and attitude to basic science in Ibadan.

Also, feedback is the information given to students by their teacher, about how they performed on a test classwork or assessment, and it is a potent tool for improving learning and performance. Results of studies have revealed that remediation as a method of correcting problems in students who are performing poor. It is a way to

rectify or to make good of a student, or it is action taken to correct problems of student that is not performing well. Research indicates that academic skill development is slower in low SEB households and communities than in higher SEB households and communities.

Moreover, several studies reveal that students using ICT (Computer) facilities mostly show higher learning gains than those who do not use. ICT has the potential to transform the way students learn and can provide new and innovative ways of delivering educational content. Also, reducing inconsistence of learning during any environmental crisis or epidemic. Above all, it appears to provide good ways of assessing students with immediate feedback and remediation that will allow them to fill the gap between their errors and stated objectives immediately. It also helps to enhance learning in a variety of ways, by leveraging the latest technology. Educators can provide students with engaging and effective learning experiences that support their growth and success, through the use of Technology- Enabled Assessment for Learning Packages in following their career and to live independently in future.

CHAPTER THREE
METHODOLOGY

This chapter presents the research methodology under the following sub-headings: research design, variables of the study, target population, sampling procedures and sample, instrumentation, validation of the instruments, development of Technology-Enabled Assessment for Learning Package (TEALP) and treatment procedures, procedures of data collections and method of data analysis.

3.1 Research Design

The study used a quasi-experimental technique with a control group, pretest, and post-testdesign.

3.2 Study's variables

The following variables are used in this study:

3.2.1 Independent variable

Treatment –Technology- Enabled Assessment Learning Package used at two levels:

I. Technology- Enabled Assessment Learning Package with Feedback
II. Technology -Enabled Assessment Learning Package with Feedback and Remediation

3.2.2 Modifying factors: There are two moderator variables that are to be controlled in this study:

1. Gender	(a) Female
	(b) Male
2. Social economic background	(a) High
	(b)Medium
	(c) Low

3.2.3 Dependent factors: Are:

I. Students' attainment in fundamental science

II. Students' attitudes to fundamental science

The structure of the research design is shown below:

Experimental group I	O_1	X_1	O_2
Experimental group II	O_1	X_2	O_2
Control	O_1	X_3	O_2

Where;

O_1 - Represents pre-test for experimental groups 1, 2 and control

O_2 - Represents post-test for experimental groups 1, 2 and control

X_1 - Represents experimental group 1 which will be exposed to TEALP with Feedback mode.

X_2- Represents the experimental group 2 that will be exposed to TEALP with Feedback and Remediation mode.

X_3- Represents Textbook Reading

3.3 Factorial Design

The study adopted factorial matrix of 3x2x3 which is approved for the determination of each independent variables as well as the chance to assess and combined effect of independent and moderating variables. Shown in table. 3.1

Table 3.1: Explains 3x2x3 Factorial Matrix

		Treatment (TEALP)		
		(TEALPF) assessment (with comprehensive feedback) in terms of item right or wrong) **E_1**	(TEALPFR) assessment (with comprehensive feedback)and immediate remediation **E_2**	(CONTROL) Textbook Reading **E_3**
Gender		Male Female	Male Female.	Male. Female
SEB (Social Economic Background)	High			
	Moderate			
	Low			

KEY:

E_1 =EXPERIMENTAL GROUP 1 (TEALPF)

E_2= EXPERIMENTAL GROUP 2 (TEALPFR)

E_3= CONTROL GROUP (TEXTBOOK READING)

3.4 Population of the Study

The population of this study was J. S 2 students in public secondary schools in Ibadan City, Oyo State, where there are minimum of 25 functional computers. All public secondary schools in Ibadan are spread within eleven local governments areas which are educationally zoned into four.

For the purpose of this study, Ibadan city was mainly used, that is, Zone 1 and Zone 2 were considered. There are 196 secondary schools in the two zones. Distribution of public secondary schools in Ibadan, Educational Zones in Ibadan Metropolis and Educational Zones in Ibadan City were shown on Table 3.2, Table 3.3 and Table 3.4 respectively.

Table 3.2: Distribution of public secondary schools in Ibadan

Educational Zones	Number of public schools
Ibadan Zone 1	59
Ibadan Zone 2	60
Ibadan Zone 3	43
Ibadan Zone 4	34
TOTAL	**196**

Table 3.3 Educational Zones in Ibadan Metropolis

S/N	Educational zone in Ibadan Metropolis	Local governments
1	Zone 1	South East
		South West
2	Zone 2	Ibadan North
		Ibadan North East
		Ibadan North West
3	Zone 3	Egbeda L. G
		Oluyole L. G
		Ona-Ara L. G
4	Zone 4	Akinyele L. G
		Lagelu L. G

Table 3.4 Educational Zones in Ibadan City (These were used for the study)

S/N	Educational zone in Ibadan Metropolis	Local governments	Number of public schools
1	Zone 1	South East	59
		South West	
2	Zone 2	Ibadan North	60
		Ibadan North East	
		Ibadan North West	

3.5 Strategies for Sampling and Sample

The study's participants were chosen using multi-stage sampling techniques.

At the beginning, which is the first stage, public schools in Ibadan city in existing stratification into two zones, Zone I and zone 2 were used. At the second stage, schools with 25 functional computers were selected. At the third stage, three (3) schools from each zone (zone 1 and zone 2) 25 functional or working computers were selected at random for the study. Following factors were taken into consideration when selecting schools: schools with a computer room, having at least twenty-five functioning computer systems;

i. co-educational schools and;
ii. Schools that are far from one another to prevent excessive infiltration among the participants.

Hence, a total number of six schools participated in the study. At the fourth stage, twenty-five students from J.S were randomly selected from each of the selected schools which participated in the study. In total, seventy-five (75) students participated in each of the educational zones and a total of one hundred and fifty (150) Basic 8 students participated in the study. At the fifth stage, the selected schools were assigned to treatment by using simple random technique. Each treatment was assigned to two schools (1) Technology Enabled Assessment Package with Feedback TEAPF (2) Technology Enabled Assessment Package with Feedback and Remediation TEAPFR (3) Control group using textbook for learning of topics of study, then the computers for answering pre-test and post-test. Multi-stage sampling technique procedure and Schematic grouping shown on Table 3.5 and 3.6 respectively.

Table 3.5 Multi-stage sampling technique procedure

Stages	Sampling technique	Sample size	Total
First stage	Schools were picked using existing schools' stratification into two zones in Ibadan city.	Two (2) educational zones Zone 1 and Zone 2	2 zones
Second stage		15 schools with 25 functional computers from the two zones were chosen	15 Schools
Third stage	Simple Random sampling	Three schools with 25 functional computers from each zone.	3 x 2 = 6 schools
Fourth stage	Simple Random sampling	Twenty-five (25) Upper Basic 8 students from each school.	25 x 6 = 150 students
Fifth stage	Simple Random sampling	Assign selected schools to each of the treatment. Each treatment was assigned to two schools	2 x 25 students = 50 students for each treatment

Table 3.6 Schematic grouping

Group	No. of schools
1.TEALP with feedback	2
2. TEALP with Feedback and Remediation	2
3.Control group with textbook and topics of the study	2
Total	**6**

3.6 Instrumentation

These are instruments developed by the researcher for collection of data for the study;

1. Basic Science Diagnostic Questionnaire (BSDQ)
2. Basic Science Attitudinal Scale (BSAS)
3. Social Economic Background Scale (SEBS)
4. Technology- Enabled Assessment for Learning Package with Feedback on Basic science (TEAPFBaS)
5. Technology- Enabled Assessment for Learning Package with Feedback and Remediation on Basic science (TEALPFRBaS)
6. Basic Science Achievement Test (Technology - Enabled) (BSAT)

3.6.1 Basic Science Diagnostic Questionnaire (BSDQ)

Basic Science Diagnostic Questionnaire (BSDQ) was used to measure difficult to learn or teach topics of Basic Science, and participants responded on four Likerts' scale which were; VDL, DL, LDL and NDL**.** It was constructed by the researcher, this was done through interview carried out for both teachers and students on teaching and learning of Basic science, it has two Sections A and B. School, class, gender, and age are all part of Section A's demographic information about the respondents, whereas Section B's three basic science themes include all the topics covered in each theme.

Main objective of Basic science Diagnostic questionnaire is to select those topics considered by teachers and students to be difficult to teach and learn respectively, using J.S 2 syllabus. The topics were from three theme of Basic science of J.S 2 syllabus. Validation of this instrument was done in two steps. For face and content validity, it was given to a basic science specialist, and was given to experts in items' construction in the Institute of Education and was further subjected to statistical analysis using Cronbach Alpha and the resulting reliability co-efficient was 0.73.

3.6.2 Basic Science Attitudinal Scale (BSAS)

Basic Science Attitudinal Scale (BSAS)was subdivided into two sections, section A and BThe respondents' demographics are listed in Section A and include their age, gender, school, and class. Section B has fifteen questions measuring students' attitudes toward basic science. The respondents provided their responses using the four Likert scales MA, A, LA, and NA. The scale was intended to gauge students' attitudes regarding the subject of basic science. Students were able to rate their attitudes toward

basic science before and after interacting with the basic science package using items from a scale. The scale was adapted from the work of Opolot- Okarot, (2015).Validation of this instrument was done in two steps. It was given to experts in research instruments construction in the Institute of Education for statistical validity and necessary adjustment was carried out. Thereafter, instrument was administered to respondents who are representative of the target population but outside the study coverage for statistical reliability and resorting co-efficient was reported to be 0.73 using Cronbach Alpha.

3.6.3 Social Economic Background Scale (SEBS)

The Social Economic Background Scale (SEBS) measures the respondent's economic background. The scale, which has two components, section A and section B, was modified from the study by Ahmar and Anwar (2018).Section A contains information about the respondent's age, school, gender, and class. Respondents are prompted in Section B to provide information on their parent's occupation, level of education, place of living, type of devices, and income. This instrument's validation was carried out in two stages.

For face validity and statistical validity, it was given to researchers with experience in the development of research instruments at the Institute of Education., necessary adjustment was carried out. Thereafter, instrument was administered to 25 respondents who are representative of the target population but outside the study coverage for statistical reliability which was 0.75 using Cronbach Alpha and resorting is co-efficient 7.1.

3.6.4 Technology - Enabled Assessment for Learning Package on Basic Science (TEALPBaS)

Technology-Enabled Assessment for Learning Package on Basic science (TEAPBaS) were used to teach students those topics that students thought would be challenging to learn. There were two parts to the package, section A is the demographic of respondent; age, class, gender, school. Section B contains the learning contents. It was constructed using designing process of Fenrich, (2016), and ADDIE model which include, text, voice, pictures and videos that was used to explain the concept of each topic for proper understanding by the students and their motivation. Experts in the scientific field verified the package, especially experienced teachers of Basic science,

computer science, educational technologist, package developers and my supervisors. The sound, accessibility of text used and ease of use of the package were considered. The package was developed following the ADDIE Model (Analysis, Design, Development, Implementation and Evaluation): An Instructional system design model that consider the learners' age, characteristics, previous knowledge, instructional objectives and learning outcome. Also, the package verification was done with the items in each of its unit, the keys, the distractors were checked. Corrections, comments and advice given was considered.

3.6.5 Technology - Enabled Assessment for Learning Package on Basic Science with Feedback (TEALPFBaS)

This is assessment for learning package, it has assessment with immediate feedback given to the students whether wrong or correct. The package was validated by experts in the field of science, especially experience teacher of Basic science, computer science, educational technologist, package developers and my supervisors. They considered the loudness, accessibility of text used and easiness of the package, colour used, also verified the items in each unit of the package if it was along with the curriculum, checked the items' keys and the distractors. Corrections, comments and advice given were considered.

3.6.6 Technology-Enabled Assessment Learning Package on Basic science with Feedback and Remediation (TEALPFRBaS)

The main objective of this package was to use the text, voice, pictures and video embedded in it as Microsoft power point Package for improvement of teaching and learning of Basic science, it contained assessment with immediate feedback and immediate remediation, that is, re-teaching of item got wrong for proper understanding. The package was validated by experts in the field of science, especially experience teacher of Basic science, computer science, educational technologist, package developers and my supervisors. They considered the loudness, accessibility of text used and easiness of the package, also verify the items in each unit of the package, checked the items' keys and the distractors. Corrections, comments and advise given will be considered.

3.6.7 Basic Science Achievement Test (Technology - Enabled) (BSAT)

Basic science Achievement Test (BSAT) was adapted from Anjorin (2008) study. Sixty objectives test items form Basic Science syllabus were developed (multiple-choice) having four choices (A,B,C, and D). The content validity of the BSAT was ensured by using Test Blueprint covering the six levels of Bloom's taxonomy of educational objectives. The initial 60 items were vetted by the researcher's supervisor who is an experienced Basic science teacher. Corrections were made and thereafter, items were pilot tested on 60 J.S 2 students from co-educational school having computers and having same characteristics with the targeted samples. This is done in order to determine each item's difficult and discriminating indices. Final selection contained 40 question items with difficulty indices ranging from 0.40 to 0.75 and discriminating indices larger than 0.36. The BSAT's reliability score was 0.79. (KR - 20).

Every correct answer was awarded one (1) mark while every wrongly answered item was scored zero (0). This makes the total obtainable mark to be forty. The package translated the pupils' cumulative grades into a percentage. Table 3.7 shows Basic Science Technology-Enabled Achievement Test's Specifications Table (BSTEAT) used for the test items.

Table 3.7: Specification table for Test Items on Basic science

THEME	Knowledge	Comprehension	Application	Analysis	Evaluation	TOTAL
Learning about our Environment (Chemicals)	5	-	1	4	-	10
You and Energy	4	5	5	-	4	18
Science and Development (Crude oil and Petroleum)	9	2	1	-	-	12
TO`TAL	18	7	7	4	4	40

3.7 Trial Testing of the Learning package

In each Ibadan zone, three schools were chosen for the package's trial testing. Six schools total, three from each zone, were chosen at random; these schools were not among the population chosen for the study. The trial testing was done for the purpose of collecting data from students and teachers for the validation and improvement of the packages. In each school, twenty-five (25) students of J.S.S2, were randomly picked, they interacted with the instructional package and answered the assessment questions.

The programs were created with embedded sound, text, graphics, and video that helped with Basic science teaching and learning in an approachable and "learning at your own pace" manner without teacher aid. Assessments without immediate feedback follow each concept of sub-topic, which were done by the students after interacting with the main teaching package. Science teachers that specialize in the subject of science validated the package, especially experience teacher of Basic science, computer science, educational technologist. The loudness, accessibility of text used and easiness of the package were verified, suggestions were given was given on the voice of the package to be increased, colours to be reduced which were done, and necessary amendment on reshuffling distractors was made, also verification of the items in each unit of the package were checked with the keys and the distractors. They commented on the voice of the package to be given more volume, mistakes on the distractors, some items were duplicated, and was corrected. All the corrections and comments given were considered and used.

3.8 Procedure for Package Administration

The learning package to be administered was developed with the topics considered to be difficult to learn by the students, teachers also discovered they are difficult to understand by the students. This was discovered through the diagnostic questionnaire (DQBS) given to both teachers and students. The topics are- Chemicals, Energy, Crude oil and petroleum. The mastery in these topics helped in improving academic achievement in, and attitude to Basic science using Technology - Enabled Assessment for Learning Package.

3.8.1 Group 1- Experimental group 1

Basic Science Instructional Package with Technology-Enabled Assessment for Learning with immediate Feedback, and no Remediation was given.

This experimental group observed the following steps;

Step 1: Student sat in front of computer system

Step 2: Student launched the instructional package (TEA) installed in the computer system

Step3: Students interacted with the educational package to gain knowledge using computers.

Step 4: Student answered the assessment questions that follow in the instructional package.

Step 5: Student received immediate feedback for each question in term of item right or wrong, and no remediation. Correct answer was supplied if the answer picked is wrong.

3.8.2 Group 2-Experimental group 2

Basic Science Instructional Package with Technology -Enabled Assessment for Learning (TEA) comprehensive feedback and remediation were given. This is a group where package designed, Basic Science Instructional Package (TEA) was used to teach the student, with animation, video and voice included in it, for easy interaction by the student and to learn at their own pace. This experimental group observed also the following steps;

Step1: Student sat in front of computer system

Step 2: Student launched the instructional package installed in the computer system

Step 3: Student interacted with the instructional package to learn through the use of computer

Step 4: Student answered the assessment questions that follow in the instructional package.

Step 5: Student received immediate feedback for each question in term of item right or wrong.

Step 6: Student received immediate comprehensive remediation, that is, supplying correct well explained answer, if the answer picked is wrong.

3.8.3 Control Group

Control group has no treatment of learning package, but they made use of their textbooks of the same Basic science topics of the study. Control group observed also the following steps;

Step 1: Student sat in the class during scheduled time for the study

Step 2: Student put textbook in front on the reading table

Step 3: Student opened the topic of the week and read through

Step 4: Student answered questions below the topic as their evaluation's questions

Step 5: Student received no immediate feedback or remediation

Step 6: No intervention of teacher, they learned at their pace. Teachers were in the class with the student to monitor and guide them for proper concentration on the study.

3.8.4 Development of Basic Science Technology - Enabled package

The packages were in two modes, learning package with feedback, Learning package with feedback and remediation. The two were developed using Articulate storyline 360 following the instructional designing process of Fenrich, (2016), and also using ADDIE model and followed the phases involved in product development.

3.8.4.1 Articulate Storyline

Articulate storyline is a powerful e-learning authoring tool for developing a learning package. It is used by instructional designers, corporate trainers, educators, and others to create engaging, interactive and adaptive learning package or e- learning experiences (Branch, 2018). The software includes new functions and features as well as support for mobile devices and improved navigation system. There are different versions of Articulate storyline like Articulate 2, articulate 3 and Articulate 360, but the latest version of the software is articulate storyline 360, which contain more advanced and comprehensive set of features, such as scripts, variables, and advanced interactions (Nugraheni,2017)

According to Sapitri, (2020) the features of Articulate storyline include, creating scripts, variables and custom interactions of a project or package to be developed. Any project to be developed with Articulate storyline needs to be clean, organised, and well designed for learning delivery. Articulate has interface like PowerPoint, it has slides, the difference of Articulate is that the slides are not used for learning activities like PowerPoint but slides are used in modules. The module has themes and templates, activities on module involve;

- create a Theme
- format a master slide
- create layouts

- save a theme
- load a theme
- add slide navigation to the slide master
- create variables (Sapitri, 2020)
- add trigger for a progress indicator
- create and use a template

To use Articulate storyline, there are features to understand;

1. learn to use storyline 360 to develop and customize interactive e- learning courses.
2. understand how to use storyline ‘s drag -and -drop and timeline-based interaction.
3. acquire knowledge on how to utilize Articulate Storyline 360 template tools to rapidly build learning package.
4. get familiar with creating and formatting components of a course in Articulate Storyline 360 such as triggers, slides, characters, and text.
5. Understanding the art of working with shapes and graphics.
6. Acquire knowledge about creating and interacting with quizzes, scenarios and games.
7. Be able to efficiently use results and variables that enable tracking learner progress.
8. Learn how to preview and publish a storyline) project (Nugraheni, 2017)

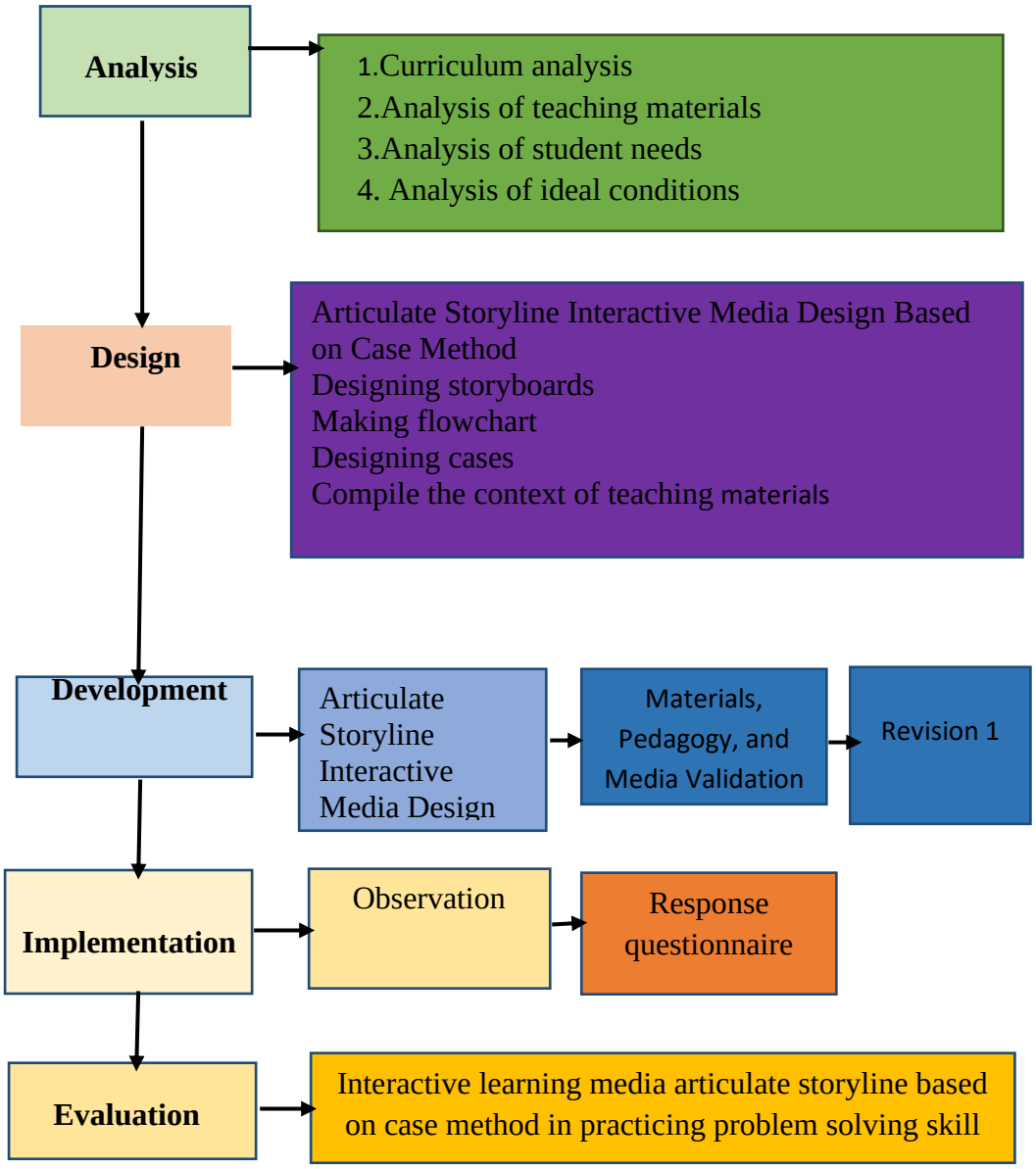

Fig. 3.1 Flow Chart of Articulate Storyline Interactive Media Design Based on ADDIE Model (Adapted from Nugraheni, 2017) By the researcher

3.9 Reliability and Validity Procedure

Forty multiple-choice items were constructed by the researcher on the topic selected through diagnostic questionnaire, the topics were; Chemicals, Energy and, Crude oil and petroleum, which were validated using test blue print covering the five Bloom's taxonomy's levels of learning goals (Knowing, Understanding, Applying, Analyzing, and Evaluating). Opinions of teachers and research analysts were sought concerning appropriateness of the items. Its reliability has been established using Kuder-Richardson Formula 20, as 0.71.

Science teachers, particularly experienced teachers of basic science, computer scientists, educational technologists, and the researcher's supervisor, validated the packages. They considered the loudness, accessibility of text used and easiness of the package, also verify the items in each unit of the package check the keys and the distractors. Corrections, comments and advise given were considered and amendment was made.

3.10 Ethical Consideration

The consent of the respondents (Students and teachers) was sought and they gave their kind permission and support. The researcher promised to keep all information given and that it will be used for research purpose only.

3.11 Data collection procedure

3.11.1 Visitation of schools

At the start of conducting the research, letter of introduction was collected from the Head of ICEE, Institute of Education, University of Ibadan, to the principals of the schools that were involved in the study. In order to secure the cooperation of principals and the Basic science teachers who had received training as research assistants and were under the researcher's supervision when dispensing the package, the researcher visited the schools that had been chosen. Also, the researcher inspected and install Computer Basic science package instructional modes on the computers in the laboratory used in the schools. Basic science students of upper basic 2 classes, were randomly picked, and were used for the study.

3.11.2 Training of Research assistants

In the second week, all research assistants were trained alongside with the orientation given to the students on what they are expected to do.

3.11. 3 Students Orientation and Administration of Pretest

Students were enlightened on how to fill questionnaires for the pre- test, those that are paper based and the one of computer based. Researcher and the research assistant administered pre-test questions to all students that will be involved in the study. The pre-test questions are, Basic Science attainment's test (computer based), Basic Science attitudinal scale (paper based) and social economic background scale (paper based). All of these tools were used to assess students' level of knowledge prior to the start of treatment.

3.11.4 Treatment Procedure

3.11.4.1 Summary of the treatment procedures

Treatments were carried out on experimental groups and control group, which lasted for seven weeks. The research assistant (Basic science teachers), assisted students to interact with the training package themselves. The researcher visited every school to watch students and research assistants participate in the processes. In the tenth week, all students received a post-test of basic science achievement test (computer-based).

The same instrument that was used for the pre-test was again used for the post-test and statistical adjustments were made.

Week 1: Pre-testing of participants, installation of the TEALP package, educating the instructors (The teachers), and visits to schools to meet with principals and basic science teachers.

Week 2: Administration of a pre-test on the participants, orientation for students, and training of basic science teachers (research assistance)

Week 3-9: Administering of the learning packages

Week 10: Administering of post test

3.12 Method of Data Analysis

Pre-test and post-test scores were used to categorise the data collected for the study, which were then analysed using descriptive and inferential statistics to test the seven

null hypotheses at the 0.05 level of significance. Estimated Marginal Mean (EMM) was then used to determine the size and direction of the group differences.

3.13 Methodological Difficulties

One of the biggest problems was trying to acquire permission from the administrators of the chosen schools to enter the computer rooms. The management of the schools were reticent to the point of rejecting the offer because they were concerned about theft, destruction, and upkeep. A computer engineer was able to remedy the system update issue, which involved Microsoft updating PCs to the most recent version without which the package would not function.

Also, the principals of the schools also began to worry that the program at the school might be disrupted and that the involved pupils' academic pursuits might be hampered. These challenges were overcome by using forty minutes immediately after the school hours, in order not to delay the selected students. The power supply also had a different issue. A generator was used throughout the course to get around this. Another difficulty was the researcher's, the research assistants', and the students' anxiety over how to use computers with the packages, issue was solved by traveling to schools prior to the start of treatments to direct students and research assistants.

The students' punctuality throughout the period of the experiment was another issue. The researcher urged the teachers to keep an eye on the children and inspire them to stay engaged throughout the experiment period.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

Results are discussed and presented in relation to the study's hypothesis.

4.1 Social – Demographic Characteristics of the Samples

For the final experimental study, 150 students were used. A cross tabulation of schools used, gender and age ranges how in Table 4.1

Table 4.1 Data Collection for Experimental Study

Students Characteristics								
Schools	**Gender**	**Frequency**	**%**	**Age Range**		**Frequency**	**%**	**%**
				10-13	**14-17**		**10-13**	**14-17**
1	M	07	72	3	4	7	43	57
	F	18	28	11	7	18	61	39
2	M	13	52	11	2	13	85	15
	F	12	64	8	4	12	67	33
3	M	11	44	7	4	11	64	36
	F	14	56	9	5	14	64	36
4	M	10	40	6	4	10	60	40
	F	15	60	12	3	15	80	20
5	M	09	36	7	2	09	78	22
	F	16	64	13	3	16	81	19
6	M	11	44	11	0	11	100	0
	F	14	64	13	1	14	93	07

Table 4.1 presents students' characteristics, which are schools, gender and age distribution of students. The table reveals the percentage of females and males for each school, so also percentages of age distribution for each school, both for males and females, wherein females have higher percentage in all the schools. This indicates that on average, there were more female students than the male students in the junior secondary schools. Also, the table shows higher percentage of age distribution of females in schools than males.

4.2 Hypotheses A

4.2.1 Hypothesis 1a

The Technology-Enabled Assessment for Learning Package (TEALP) has no substantial main impact on students' achievement in Basic Science. Analysis of covariance was used to test this hypothesis at the 0.05 significant level (ANCOVA)

Table 4.2: Summary of the students' analysis of covariance (ANCOVA) Achievement in Basic Science by Treatment (TEALPF,TEALPFR), Social Economic Background (SEB) and Gender.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	73657.951[a]	18	4092.108	61.108	.000	.894
Intercept	11970.794	1	11970.79	178.76	.000	.577
Pretest	1126.883	1	1126.883	16.828	.020	.114
Treatment	39427.422	2	19713.71	294.39	.000	.818
Gender	319.822	1	310.822	4.776	.061	.035
SEBlevels	351.007	2	175.503	2.621	.077	.038
Treatment * Gender	151.700	2	75.850	1.133	.325	.071
Treatment * SEBlevels	580.722	4	145.181	2.168	.076	.062
Gender * SEBlevels	190.497	2	95.249	1.422	.245	.021
Treatment *Gender * SEBlevels	301.088	4	75.272	1.124	.348	.033
Error	8772.422	131	66.965			
Total	591448.00	150				
Corrected Total	82430.373	149				

R Squared = .894 (Adjusted R Squared = .879) SEB = Social Economic Background

The results of the analysis of covariance (ANCOVA) of the post-test achievement scores of students in Basic Science are summarized in Table 4.2 by treatment ((Package + feedback), (Package + Feedback + Remediation), Social Economic Background, and Gender. The treatment (Package + Feedback + Remediation) has a considerable impact on students' performance in basic science, as shown in the table. Following correction for covariance, $F_{(2,131)} = 294.4$, $p < 0.05$, (pre-test score in Basic Science).

This led to the rejection of the null hypothesis, which claimed that there was no main effect of treatment on students' achievement in Basic Science. This suggests that the pupils' academic performance and learning were significantly impacted by the treatment. Additionally, the data reveals that Cohen judged the Partial Eta Square, (2) was 0.82 to be a substantial effect size (1988). Table 4.3 show the results of the pairwise comparison of students' Basic Science performance.

Table 4.3 further reveals that Experimental Group 1 (Package +feedback+ remediation) has the highest mean score $\bar{x}$= 82.30 followed by participants in Experimental Group 2 (Package + feedback) with $\bar{x}$=63.04 while the control group (Textbook reading) had $\bar{x}$= 32.10. This indicates that the group with remediation performed better than the other groups, while the group with feedback had greater achievement scores than the textbook reading group. Figure 4.2 further displayed the computed marginal mean score.

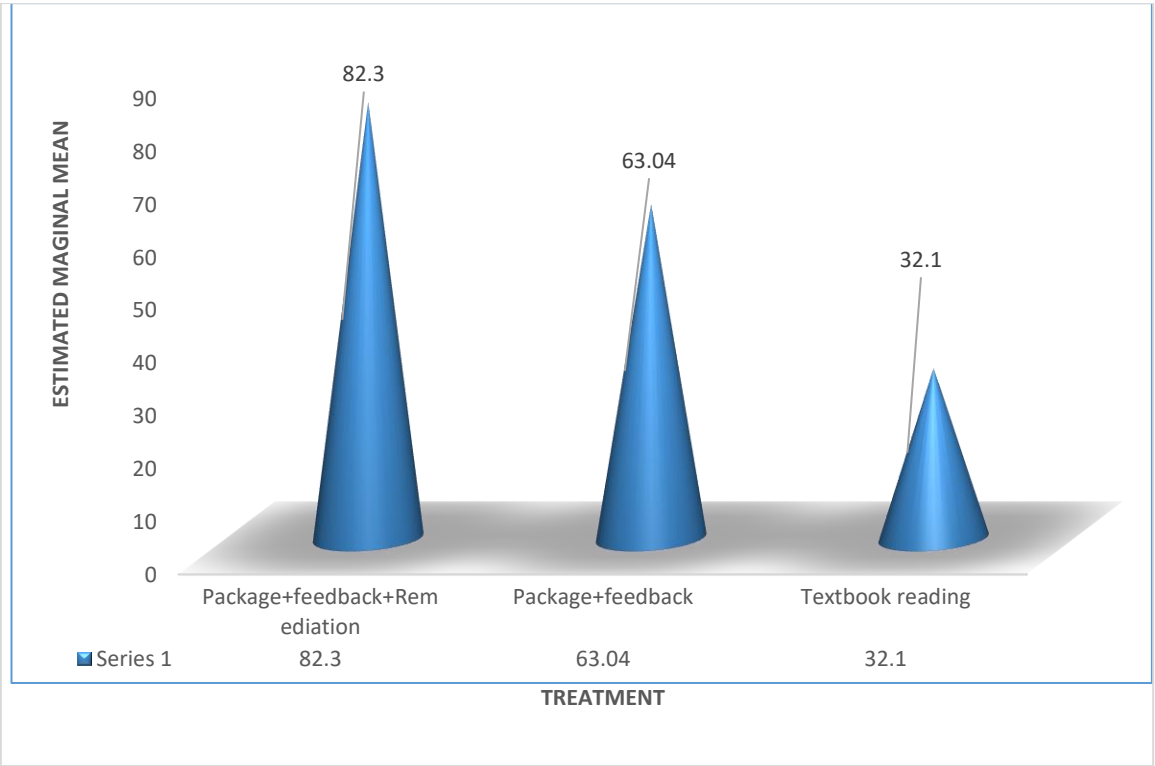

Figure 4.1 Chart showing Estimated Marginal mean of Students' achievement in Basic Science by Treatment (TEAPRF, TEAPF and Textbook reading)

Table 4.3: Pairwise Comparison of Students' Basic Science Achievement by treatment (TEALPFR, TEALPF)

(I) Treatment		Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
Package+feedback+Remediation	Package+feedback	19.261	2.063	.000	14.273	24.250
	Textbook reading	50.202	2.153	0.000	44.995	55.409
Package+feedback	Package+feedback+Remediation	-19.261	2.063	.000	-24.250	-14.273
	Textbook reading	30.940	1.827	0.000	26.521	35.360
Textbook reading	Package+feedback+Remediation	-50.202	2.153	0.000	-55.409	-44.995
	Package+feedback	-30.940	1.827	0.000	-35.360	-26.521

According to Table 4.3, difference between experimental group II (Package + feedback) and control group (Textbook reading) was statistically significant. This suggests that when students in experimental group II interact with the treatment by receiving feedback, their scores are higher than those of the control group, which read textbooks without receiving any feedback.

There was highest difference mean of treatment of group1 I (Package + feedback + Remediation) and control group, here the interaction with the treatment, giving them feedback and remediation make great difference in the scores of the students in the two groups. Furthermore, the difference between experimental group II (Package + feedback) and experimental group I (Package + feedback + Remediation) was also statistically significant, here student in Experimental group 1 had higher mean than Experimental group II because of the opportunity of immediate remediation.

4.2.2 Hypothesis 2a

There is no significant main effect of Gender on students' achievement in Basic Science.

Gender has no substantial main impact on pupils' achievement in basic science. $F(1,131) = 4.78$, $p>0.05$, in Table 4.2, demonstrates that there was no substantial impact of gender on students' performance in Fundamental Science. Since there is no discernible major effect of gender on students' achievement in Basic Science, the null hypothesis which says that, there is no significant main effect of gender on students' achievement in basic science was not rejected. The findings are presented in Table 4.2, and Fig. 4.2 shows the estimated marginal mean of students' achievement in basic science.

Based on estimated marginal mean (EMM), male has highest mean achievement score of 60.86 while female has 57.43. The performance of male having highest mean score achievement over female can be traced to the effect of treatment giving to them which is the use of computer. Males sometimes stay bold in dealing with things, some females do fidget, especially when it is technological based. Also, it may be attributed to the socio-cultural believe that females are weaker sex, some vocation like engineering (computer engineering), agriculture, web design, graphic design to mention view, are attributed to males and not females. Consequently, many females go to school with this fixed mind, thereby weakening their minds in technology-based subjects. Figure 4.2 also displayed the calculated marginal mean score.

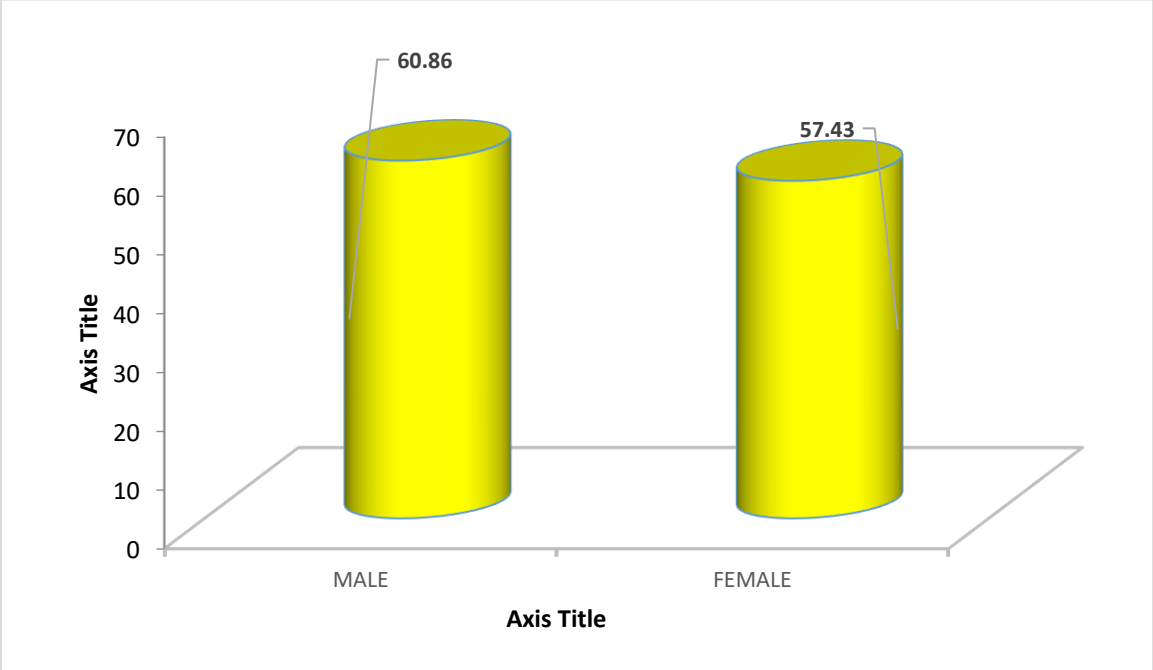

Figure 4.2. Chart showing Estimated Marginal mean of Students' achievement in Basic Science by Gender

Table 4.4: Pairwise Comparisons of student's Achievement in Basic Science by Gender (Female and Male)

Gender	Gender	Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Male	Female	3.43	1.57	0.031	0.325	6.537
Female	Male	-3.43	1.57	0.031	-6.537	-0.325

The mean difference between the counterparts of male and female students was 3.4, and this difference was statistically significant, according to the pairwise comparisons of the mean score in Table 4.4.This finding reveal that men did better than women when utilising technology to teach students, and this occurred through the phobia certain girls occasionally have to science and computer usage.

4.2.3 Hypothesis 3a

There is no significant main effect of Social Economic Background on students' achievement in Basic Science

The table 4.2 shows the results of an analysis of variance (ANOVA) that was conducted to examine the effect of social and economic background on students' performance in Basic Science. The F-value of 2.6 and the p-value greater than 0.05 in the table show that the major effect of social and economic background on students' performance was not significant.

This indicates that there was insufficient information to conclude that pupils' fundamental science performance was significantly impacted by their social and economic backgrounds. Because of this, the null hypothesis, to which social economic background had no substantial effect on students' performance in fundamental science, was not rejected. Figure 4.3 also included a representation of the calculated marginal mean score. With a mean achievement score of 61.81, students from high social economic backgrounds outperformed those from low social economic backgrounds and moderate social economic backgrounds, who both had mean achievement scores of 58.49 and 51.13 respectively. The performance of those in high SEB group can be attributed to the support given them at home, as regards innovative learning through assistance and opportunities presented by their parents. The performance of those in low SEB group can be owned to their openness to the innovative strategies which their background has denied them over years.

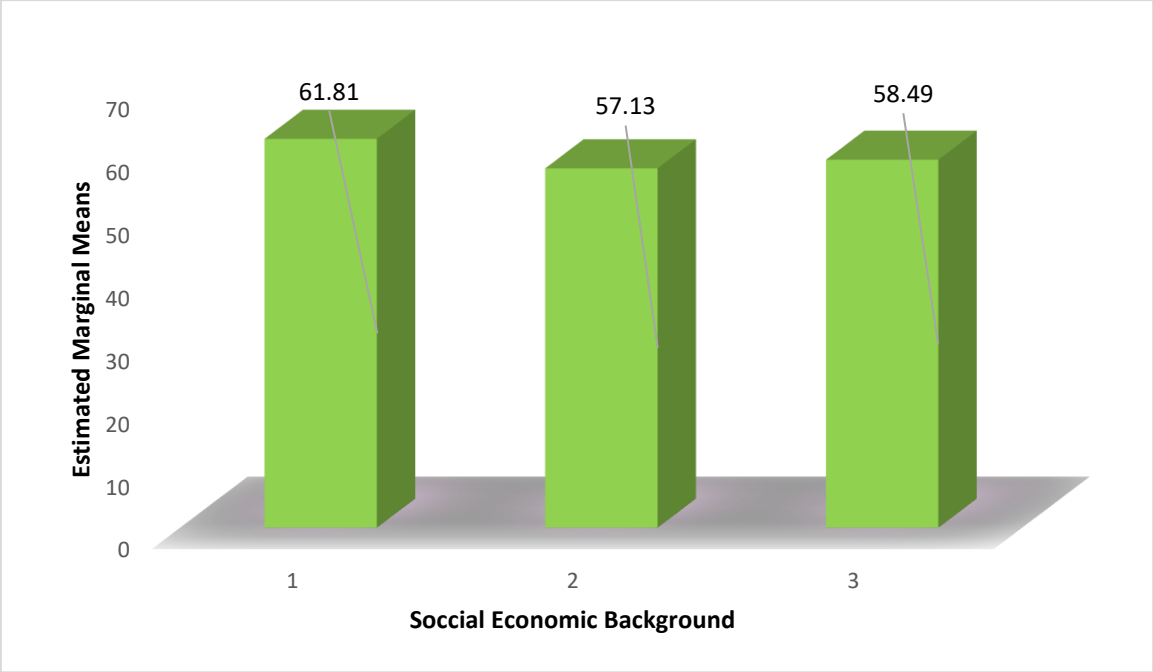

Figure 4.3 Chart showing Estimated Marginal mean of Students' achievement in Basic Science social economic background

1- **High level**
2- **Moderate level**
3- **Low level**

Table 4.5: Basic Science Student Achievement by Social and Economic Background, Pairwise Comparison

Social Economic Background	Social Economic background	Mean Difference	Sig.	95% Confidence Interval for Difference	
				Lower Bound	Upper Bound
High level(1)	2	4.684	0.07	-0.274	9.643
	3	3.323	0.282	-1.594	8.24
Moderate(2)	1	-4.684	0.07	-9.643	0.274
	3	-1.361	0.799	-5.383	2.66
Lowlevel(3)	1	-3.323	0.282	-8.24	1.594
	2	1.361	0.799	-2.66	5.383

The mean differences between high level (1) and moderate level (2), high level (1) and low level (3), and medium (2) and low level (1) are shown in Table 4.5 pairwise comparisons of the mean score, but these differences are not statistically significant.

4.2.4 Hypothesis 4a

The table 4.2 shows the results of an analysis of variance (ANOVA) that was carried out to examine the interaction effects of gender and the Technology-Enabled Assessment for Learning Packages (TEALF, TEALFR) on students' achievement in basic science. According to the table, there was no significant first-order interaction effect of treatment and gender on students' performance in Basic Science, as indicated by the F-value of 3.25 and the p-value greater than 0.05. This means that there was not enough evidence to suggest that the Technology-Enabled Assessment for Learning Package (TEALF, TEALFR) had a different impact on students' performance based on their gender. The null hypothesis, which asserted that there was no obvious first-order interaction effect of therapy and gender on students' achievement in Basic Science, was not rejected.

Table 4.6: Basic Science Student's Achievement Estimated Marginal Mean of Treatment and Gender

Treatment	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Package+feedback+Rem ediation	MALE	84.974	2.136	80.748	89.200
	FEMALE	79.619	2.312	75.046	84.192
Package+feedback	MALE	65.377	2.133	61.157	69.598
	FEMALE	60.693	1.466	57.793	63.593
Textbook reading	MALE	32.222	1.654	28.950	35.494
	FEMALE	31.968	1.891	28.226	35.709

The treatment has its own effectiveness and potency, regardless of the participant's gender because it is not gender sensitive. Nevertheless, the mean score of males which is 84.97 is higher than that of female (79.61) in group one (Package+feedback+Remediation), mean score of males which is 65.38 is higher than that of female(60.69) in group two (Package+feedback) as well as in control group the mean score of males 32.22 is high than that of females (31.97)**.**

4.2.5 Hypothesis 5a

The Technology-Enabled Assessment for Learning Package (TEAF, TEAFR) and Social Economic Background had no appreciable first order interaction effects on students' achievement in Basic Science.

Table 4.7: Basic Science Student's Achievement Estimated Marginal Mean by Treatment and Social Economic Background

Treatment	Social economic background	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Package+feedback +Remediation	1	88.718	3.782	81.236	96.201
	2	76.153	2.277	71.649	80.657
	3	82.018	1.578	78.897	85.140
Package+feedback	1	65.096	2.698	59.759	70.432
	2	63.004	1.929	59.189	66.820
	3	61.005	2.027	56.995	65.016
Textbook reading	1	31.619	2.026	27.612	35.627
	2	32.223	2.056	28.156	36.290
	3	32.441	2.378	27.738	37.145

Covariates appearing in the model are evaluated at the following values: Pretest = 30.13.

The achievement of students in basic science is not significantly impacted by the relationship between treatment and Social Economic Background (SEB). Analysis of Covariance was used to test for interactions between the effects of the treatment and Social Economic Background (SEB).The overview can be found in Table 4.2.

Table 4.2. demonstrates that at $F_{(4,131)} = 2.2$, $p > 0.05$.There was no statistically significant correlation between students' performance in basic science and their socioeconomic background. As a result, it was decided not to reject the null hypothesis, which states that there was no interaction between treatment and social economic background (SEB). A relatively small effect size is confirmed by the partial Eta square, (η^2) = 0.6. Table: According to experiment 1 (Package + Feedback + Remediation) group high level SEB students recorded the highest mean score of 88.72, while experiment 1 (Package + Feedback + Remediation) group low level SEB students also recorded a mean score of 82.02, and experiment 1 (Package + Feedback + Remediation) group moderate level students recorded the lowest mean score of 76.15. The performance of those in high level of SEB (Social Economic Background) group can be owned to home support given to them in having access to different types technological devices. The higher mean of low-level group over moderate mean, can be attributed to their openness to innovative strategies which their background has derived them over years.

4.2.6 Hypothesis 6a

Gender and Social Economic Background have no substantial first order interaction influence on students' ability in basic science.

Table 4.8: Basic Science Student Achievement Estimated Marginal Means by Gender and Social Economic Background

Social economic background	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1 (high level)	MALE	65.625	2.343	60.990	70.261
	FEMALE	57.997	2.396	53.258	62.736
2(moderate level)	MALE	57.654	1.780	54.133	61.175
	FEMALE	56.600	1.583	53.468	59.731
3(low level)	MALE	59.293	1.726	55.880	62.707
	FEMALE	57.683	1.562	54.594	60.773

4.2.7 Hypothesis 7a

There is no substantial second order collaboration impact of Technology-Enabled Assessment for learning Packages (TEAF, TEAFR) Gender and Social Economic Background on students' attainment in Basic science.

Table 4.9: Estimated Marginal mean of Students' Achievement in Basic Science by Treatment, Social Economic Background

Treatment			Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Package+feedback +Remediation	1	MALE	96.297	4.751	86.899	105.695
		FEMALE	81.140	5.828	69.610	92.670
	2	MALE	76.843	3.679	69.564	84.121
		FEMALE	75.463	2.622	70.276	80.650
	3	MALE	81.782	1.971	77.883	85.681
		FEMALE	82.254	2.397	77.513	86.996
Package+feedback	1	MALE	69.891	4.740	60.514	79.267
		FEMALE	60.301	2.589	55.179	65.422
	2	MALE	63.838	2.728	58.441	69.234
		FEMALE	62.171	2.728	56.775	67.567
	3	MALE	62.403	3.346	55.784	69.022
		FEMALE	59.607	2.276	55.105	64.110
Textbook reading	1	MALE	30.689	2.217	26.303	35.075
		FEMALE	32.550	3.348	25.928	39.173
	2	MALE	32.282	2.858	26.627	37.936
		FEMALE	32.165	2.900	26.429	37.901
	3	MALE	33.695	3.352	27.064	40.327
		FEMALE	31.188	3.439	24.384	37.992

Table 4.2. showed that the association impact of treatment, Gender and Social Economic Background on student's accomplishment in Basic science was not measurably critical $F_{(4, 131)} = 1.12$, $p > 0.05$, the invalid speculation was accordingly not dismissed. The partial Eta square, (η^2) = 0.33 confirms a very low effect size according to Cohen (1988) which implies that treatment, Social economic background and gender account for 33% of the observed variation in students' Basic science attainment scores.

4.3 Hypotheses B

4.3.1 Hypothesis 1b

No substantial main impact of Technology Enabled Assessment Learning Package (TEAF, TEAFR) on student’s Attitude to Basic science.

Table 4.10: Presents a summary of the analysis of covariance (ANCOVA) of students' Basic Science Attitude by Treatment (TEAPFR, TEAPF), Social Economic Background, and Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	26698.674	18	1483.260	33.870	.000	.823
Intercept	8153.81	1	8153.812	186.192	.000	.587
Pre-attitude	21.100	1	21.100	.482	.489	.004
Treatment	12537.94	2	6268.971	143.152	.000	.686
Gender	151.44	1	151.439	3.458	.065	.026
SEBlevels	41.130	2	20.565	.470	.626	.007
Treatment * Gender	11.977	2	5.988	.137	.872	.002
Treatment * SEBlevels	284.473	4	71.118	1.624	.172	.047
Gender * SEBlevels	119.034	2	59.517	1.359	.260	.020
Treatment * Gender * SEBlevels	284.815	4	71.204	1.626	.171	.047
Error	5736.819	131	43.793			
Total	325128.000	150				
Corrected Total	32435.493	149				

R Squared = .823 (Adjusted R Squared = .799)

Table 4.10 provides summary of the findings from analysis of covariance (ANCOVA) of students' perceptions of Basic science by treatment (Textbook Reading, Package+ Feedback+ Remediation, and Package+ Feedback), social background, and gender. According to the table, the effect of treatment on students' attitudes in Basic science was statistically significant, $F_{(2, 131)} = 143.2$, p 0.05, after controlling for covariance (pre-attitude students to Basic science). With the result revealed, the null hypothesis, which claimed of treatment that had no main influence on students' attitudes about basic science was rejected. Additionally, the results on the table shows that the partial Eta square, (η^2) was 0.7., which Cohen regarded as a moderate impact size (1988). This is the proved that, the treatment had a big impact on how students felt about fundamental science. Fig. 4.3. display the calculated marginal means and Table 4.3. also shows the pairwise comparison of the students' opinions toward Basic science.

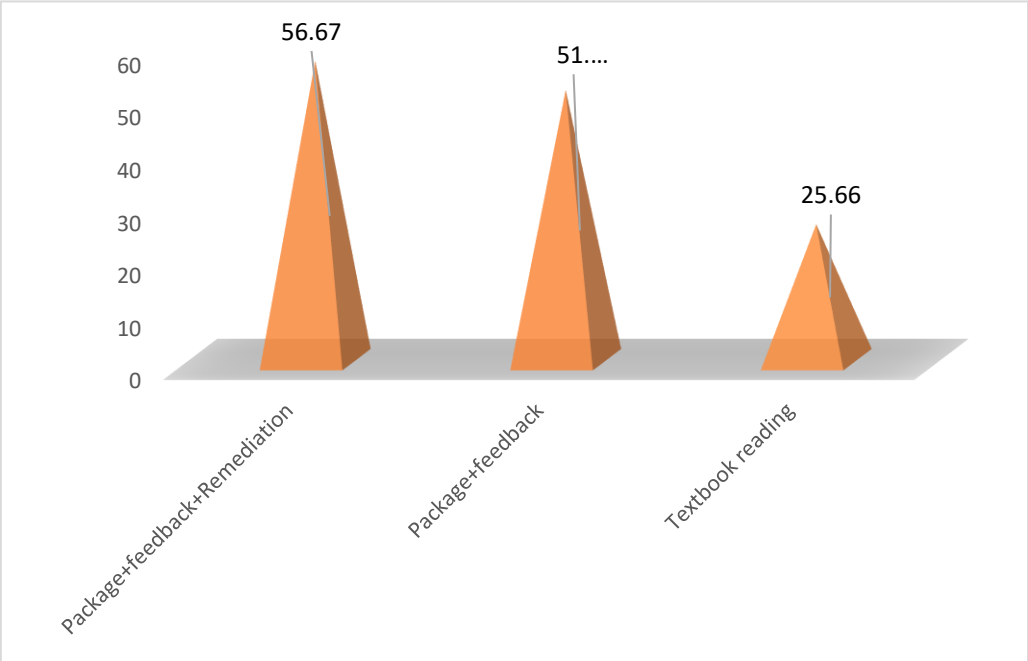

Fig. 4.4 Estimated Marginal Mean of Student's Attitude to Basic Science by Treatments (TEAPFR, TEAPF and TEXTBOOK READING).

TEAPFR –Technology- Enabled Assessment for learning Package with Feedback and Remediation.

TEAPF - Technology - Enabled Assessment for learning Package with Feedback.

Experimental Group I (Package+ Feedback + Remediation, (TEAPFR)) shown on fig. 4.4 had highest mean score $\bar{x}$= 56.67 followed by participants in Experimental Group II (Package + Feedback, (TEAPF)) with the mean score of $\bar{x}$= 51.13 while the Control group (Textbook reading) had the least mean score $\bar{x}$= 25.66. The highest mean score of groups I ($\bar{x}$= 56.67) over group two and textbook reading group indicates that remediation given in group one has greater effect on the students' attitude to Basic Science which implies that it simplifies most difficult topics or concepts that seem to be a problem.

Table 4.11 Pairwise comparison of Student's attitude to Basic Science by treatment (TEAPFR, TEAPF).

Treatment		Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Package+feedback +Remed	Package+feedback	5.53	1.698	.004	1.426	9.642
	Textbook reading	31.00	2.069	0.000	25.999	36.008
Package+feedback	Package+feedback +Remediation	-5.53	1.698	.004	-9.642	-1.426
	Textbook reading	25.47	1.662	0.000	21.449	29.490
Textbook reading	Package+feedback +Remediation	-31.00	2.069	0.000	36.008	25.999
	Package+feedback	-25.47	1.662	0.000	29.490	21.449

The difference between Control Group (Textbook Reading) and two Experimental Groups (TEAPF, TEAPFR) was statistically significant, according to Table 4.11. This suggests that the students' attitudes towards basic science were genuinely impacted by the teaching method, the treatment, which involved the use of computers.

4.3.2 Hypothesis 2b

The main influence of gender on students' views on fundamental science is negligible. There was no discernible main influence of gender on students' attitudes toward basic science, as shown by $F(1,131) = 3.46$, $p > 0.05$. Therefore, the null hypothesis, which claimed that there was no significant influence of gender on students' attitudes toward Basic science, was not disproved. The estimated marginal mean score was shown Figure 4.5

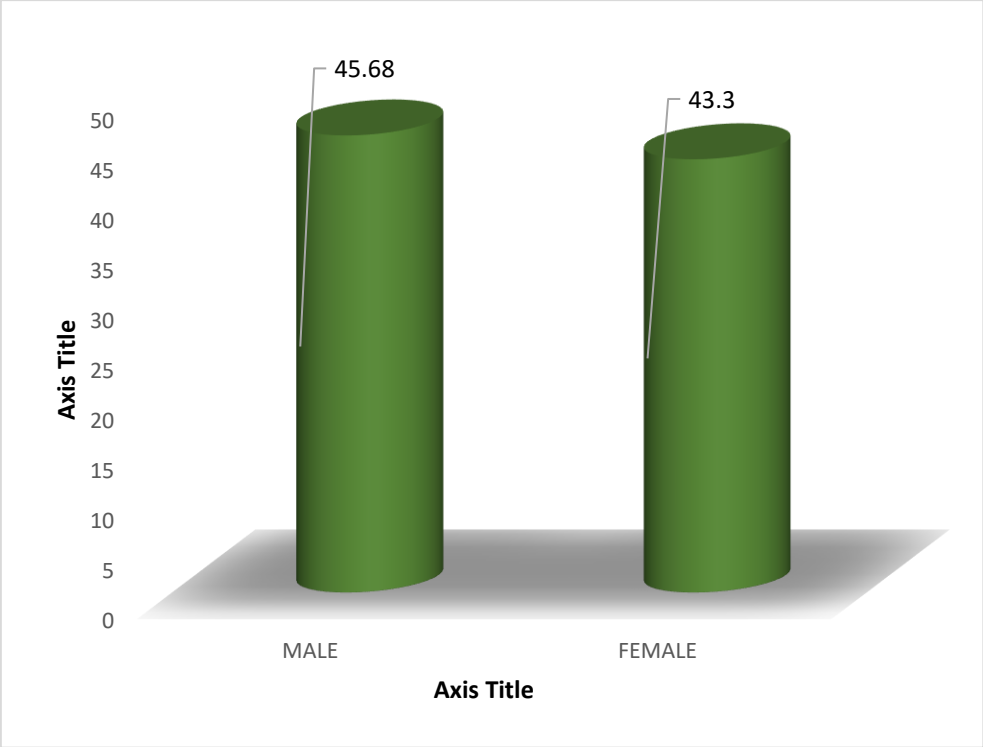

Figure 4.5 Chart showing Estimated Marginal Mean of Student's Attitude towards Basic Science through Gender

Table 4.12 Pairwise Comparison of Students' Attitude to Basic Science by Gender

Gender	Gender	Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Male	Female	2.381	1.280	.065	-.152	4.913
Female	Male	-2.381	1.280	.065	-4.913	.152

4.3.3 Hypothesis 3b

Students' attitudes toward basic science are unaffected by their social economic background. There was no main influence of social economic background on students' views toward basic science, as shown by $F_{(2,131)} = 0.47$, $p > 0.05$. The null hypothesis, which stated that social economic background (SEB) has no substantial main effect on students' attitudes toward basic science, was therefore allowed to stand.

The calculated marginal mean of students' attitudes toward basic science is shown in fig. 4.6. The highest mean is found at high social economic background levels.

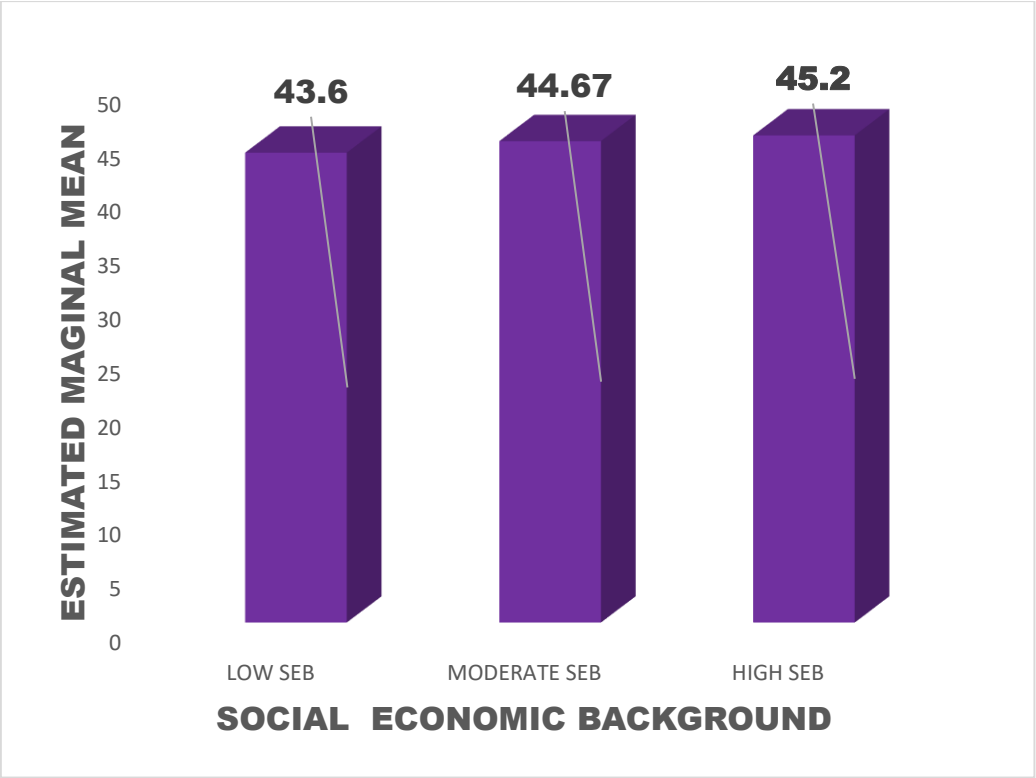

Figure 4.6 Chart showing Estimated Marginal Mean of Student's Attitude toward Basic science through Social Economic Background

Table 4.13: Pairwise Comparisons of Student's Attitude toward Basic Science by Social Economic Background

Social economic background		Mean Difference	Std. Error	Sig.	95% Confidence Interval for Difference Lower Bound	Upper Bound
Low SEB	Moderate SEB	-1.068	1.658	.890	-5.078	2.941
	High SEB	-1.594	1.645	.705	-5.574	2.385
Moderate SEB	Low SEB	1.068	1.658	.890	-2.941	5.078
	High SEB	-.526	1.342	.972	-3.771	2.719
High SEB	Low SEB	1.594	1.645	.705	-2.385	5.574
	Moderate SEB	.526	1.342	.972	-2.719	3.771

The mean difference between Low SEB and Moderate SEB is 1.07, the mean difference between Low SEB and High SEB is 1.6, and the mean difference between High SEB and Moderate SEB is 0.53, according to the pairwise comparison of the mean score in Table 4.13.

4.3.4 Hypothesis 4b

The Technology Enabled Assessment Packages (TEALF, TEALFR) and Gender did not have discernible first order collaboration impact on student's attitude toward Basic Science. Treatment and gender had no discernible first order interaction effects on student's attitude toward basic science. ANCOVA was used to test first order treatments (TEAPF, TEAPFR) and gender interaction effects. The results are summarized in Table 4.11.

Table 4.11 shows that the first order interaction effect of treatment and gender on students' attitudes toward basic science was not statistically significant at F (2,131) = 0.14, p> 0.05. As a result, the null hypothesis, which asserted that there was no first-order interaction between treatments and gender and student views about Basic Science, was not rejected. The lack of an effect size was supported by the partial Eta square, which had a value of (2) = 0.002.

Table 4.14: Estimated Marginal Mean of Students' Basic Science Attitude by Gender and Treatment

Treatment	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Package+feedback +Remediation	MALE	57.550	1.787	54.014	61.085
	FEMALE	55.785	1.916	51.996	59.574
Package+feedback	MALE	52.785	1.729	49.366	56.205
	FEMALE	49.481	1.220	47.067	51.895
Textbook reading	MALE	26.701	1.519	23.696	29.705
	FEMALE	24.627	1.648	21.367	27.888

4.3.5 Hypothesis 5b

There is no substantial first order collaboration impact of Technology-Enabled Assessment Package (TEALPF, TEALPFR) and Social Economic Background on student's attitude Basic Science. Student's attitude toward Basic Science do not significantly change as a result of treatment and Social Economic Background (SEB). The results are given in Table 4.10 Analysis of covariance was performed to test for the first order interaction effects of treatments (TEALPF, TEALPFR) and Social Economic Background (SEB).

According to Table 4.10, the first order interaction between treatment and Social Economic Background (SEB) did not have statistically substantial effect on students' attitudes toward basic science ($F(4,131) = 1.62$, $p > 0.05$). Therefore, the null hypothesis, which claimed that there was no first order interaction impact between treatments and Social Economic Background (SEB), on students' attitudes toward basic science, was not disproved. An extremely small effect size was confirmed by the partial Eta square, $(\eta^2) = 0.47$.

Table 4.15 Estimated Marginal Mean of Students' attitude to Basic science by Treatment and Social economic background

Treatments	Socialeconomic background	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Package+feedback +Remediation	Low SEB	57.52	3.045	51.495	63.545
	Moderate SEB	56.52	1.912	52.741	60.306
	High SEB	55.96	1.439	53.113	58.805
Package+feedback	Low SEB	47.62	2.183	43.297	51.933
	Moderate SEB	53.61	1.562	50.519	56.698
	High SEB	52.18	1.634	48.945	55.408
Textbook reading	Low SEB	25.67	1.763	22.180	29.154
	Moderate SEB	23.88	1.805	20.304	27.446
	High SEB	27.45	2.025	23.443	31.456

4.3.6 Hypothesis 6b

Students' attitudes toward basic science are not significantly impacted by the first order interplay of gender and socioeconomic background. The null hypothesis was not rejected since Table 4.11 demonstrates that there was no significant first order interaction effect of Social Economic Background (SEB) with Gender on student's attitude toward Basic Science($F(2, 131) = 1.36$, $p > 0.05$).

Table 4.16: **Estimated Marginal Mean of Students' Attitude by Social Economic Background and Gender**

Socialeconomic background	Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Low SEB	Male	44.498	1.919	40.702	48.295
	Female	42.703	1.941	38.862	46.543
Moderate SEB	Male	44.920	1.433	42.085	47.756
	Female	44.418	1.283	41.880	46.956
High SEB	Male	47.617	1.376	44.895	50.338
	Female	42.773	1.265	40.271	45.275

4.3.7 Hypothesis 7b

There is no substantial second order collaboration impact of Technology-Enabled Assessment for Learning Packages (TEALPF, TEALPFR), Gender and Social Economic Background on student's attitude to Basic Science.

Technology-Enabled Assessment for Learning Packages (TEALPF, TEALPFR), Gender and Social Economic Background, have no appreciable second order effects on student's attitude via Basic Science. The second order interaction effect of treatments (TEALPF, TEALPFR), gender, and social economic background (SEB) on student's perceptions of Basic Science was not statistically significant, according to Table 4. 11 ($F(4,131) = 1.6$, $p > 0.05$, Therefore, null hypothesis stated was not disapproved.

4.4 Discussion of Findings

4.4.1 Essential Effect of Treatment on Students' Fundamental Science Attainments

After accounting for covariance, it was determined that the main effect of treatments (TEALPFR, TEALPF) on students' performance in Basic Science was statistically significant (pre-test score in Basic Science).It indicates that there was variation in students' Basic Science test scores as a result of treatment adjustment.

In other words, students in each group performed differently, the best performance come from the TEALPFR (experimental 1) (Technology-Enabled Assessment Package with Feedback and Remediation) group, followed by their peers in the TEALPF (experimental 2) (Technology-Enabled Assessment Package with Feedback) group, and the worst performance coming from the control group (Textbook Reading) students. This result may not be unconnected with the fact that students were not only provided with the feedback of their assessment with remediation alone but they were also made to learn at their own pace with the use of computer alongside identifying the source of their errors with the solution to errors from the computers beside another assessment was given to them on the same concept to test the level of their understanding.

The findings from the study revealed that among the two treatments (TEALPFR and TEALPF), and control group, TEALPFR (Technology – Enabled Assessment Package with Feedback and Remediation) participants improved significantly as against TEALPF (Technology – Enabled Assessment Package with Feedback) group. TEALPFR were given feedback and remediation while TEALPF were subjected to feedback alone. The least performance came from the control group that read at their own pace and were subjected to assessment alone using computer.

The treatments for the experiment I and experiment II were significant, not only because of feedback and remediation but the participants were able to learn at their own pace with the use of computer adding colours, videos, pictures, animations voice and graphics that can motivates learning. This is in line with the findings of Kocakaya, (2010) that feedback offered by the use of technology encourages learner to monitor their learning and correcting their errors to empower them becoming an independent thinker. The results of the study show that within the two experimental groups, significant differences were obtained in favour of the remediation group.

These results are in line with the findings of Ajogbeje (2012) who revealed that students with remediation accomplishes higher level of cognitive achievement than students undergoing learning activities with feedback alone or with no feedback at all, and without remediation. The outcome could be explained in terms of feedback and remediation, and use of computers to which the students were subjected, to learn, and to assess at their own pace without bully or scolding from teacher or classmate. Using computer to learn motivates children at all levels, so also remediation offers students chance to go through their errors and identify their strengths and weaknesses. Also, remediation was expected to be useful in correcting errors during learning and assessment. Beside this, studies have shown that student become basically motivated when subjected to learning through the use of computer, giving report, and correcting errors, which is remediation, and also understanding the usefulness of learning at one pace without bulling or scolding, Levin, (2003), Kpolovie, and Obilor, (2013).

In the same vein, the finding revealed that participants in experiment II (TEALPF) group had good performance compared to their counterpart in the control group (Textbook reading). This result may be explained by the active participation of students at every stage learning using computer and their being given feedback immediately which offered students opportunities to go through their wrongs and to make amendment which strengthen their weakness in learning a concept. This technique of learning at one's pace using computer (TEALP) with videos, pictures, voice and graphics including in it allows learners to adequately engage learning without duress, flogging or scolding of cane by class teacher Nazimuddin, (2014). Assessment, consisting of lots of feedback and opportunities to use that feedback, enhances performance and achievement. Ojimba, (2012), in his findings revealed that feedback was among the most powerful influences on achievement, acknowledges that he has "struggled to understand the concept"

The low performance observed in the control group (Textbook reading), might be because of opportunity denying them of the use of learning through computer (TEALP). They were restricted to learning through reading of textbooks, though were assessed using the computer like the other groups. Despite their learning at their own pace reading textbooks with pictures that explain more of the concept they are learning, lack of videos, voice and graphics to motivate their learning compared to other groups. This finding showed that employing frequent assessments alone was insufficient to improve students' performance in basic science; instead, it was

necessary to include instructional methods of 21st century, such as computer or instructional technology. This revealed the findings of Ajogbeje (2012) who explained that continuous assessment alone did not provide enough stimulus or learning a concept in physics, but using relevant instructional materials that can help student obtaining right and useful skill. Hence, existing development of assessment without feedback and remediation in school system is a contributory factor in hindering learning than promoting it. It has to be addressed, as regards enhancing performance of learners through the use of computer, for assessment and learning.

4.4.2 Main Impact of Gender on Students' Basic Science Achievements

The fact that both males and females were exposed to the identical learning approach, which helped them both gain in the same way, may be related to the non-significant result that was produced when gender was taken into account. This is in accordance with the findings of (Abakpa and Iji, 2014) Omotayo 2016) that discovered no gender differences in junior secondary school's academic performance in mathematics. According to the results, which were taught using the same methodology for both male and female students, male had the greater mean achievement score of 60.86, while the female had 57.43.

The performance of male having highest score achievement over female can be traced to the effect of treatment given to them is the use of computer, males sometimes stay bold in dealing with things, some females do fidget, especially when it has to do with technology, also it may be attributed to the socio-cultural believe that females are weaker sex, some vocation like engineering (computer engineering),agriculture, web design, graphic design to mention view are attributed to males and not females. Consequently, many females go to school with this fixed mind, thereby weakening their minds in technology-based subjects. However, the result differs from that of Opolot-Okurot, (2015) which found sex–related differences in mathematics achievement.

This also negates the study of Asante (2010) who said that sometimes, gender differences in science achievement remains a source of concern as scientists seek to address the low-representation of females at the highest levels of physical sciences and engineering. Some vocations and professions have been regarded for the males like engineering, arts and crafts, agriculture while others are regarded as female laden domains for instance, catering, nursing, typing and decorations. Consequently, an

average Nigerian female goes to school with these fixed stereotypes. Gender is one of such factors that have considerable effects on student's academic performances especially in science subjects (Pondhe, 2014). Significance of investigating achievement in relation to gender, is based mainly on socio-cultural differences between girls and boys. When suitable teaching strategies or procedures are applied, the results of this study and certain earlier studies provide sufficient support for the claim that gender is not a barrier.

4.4.3 Main Effects of Social Economic Background on Student's Achievement in Basic Science

The non-significant difference of the varied SEB (Social Economic Background) levels was unpredicted because students of high SEB background always expected to be better stimulated and motivated than the lower levels and were also expected to perform better. However, the result supported findings of Okioga (2013) but contrasted that of Osokoya and Adegoke (2014) which both reported that the students that come out from low social economic background relations seem to be performing below required academic standard like children from high social economic background families. Bhat et.al. (2016)also revealed that student that has parent in the field of science and health used to do better academically than student whose parent are in art and social science. Olorundare (2014) also explained that occupation of father and level of education of parent has effect on the student's performance that was obtained in physics.

According to the findings of Osokoya and Adegoke (2014), students from low social economic background seems not performing well in school like children from high social economic background. Home can be viewed as one of the factors that has a great influence on the child's social, emotional and psychological state. Mena and ArizaBrulla (2022) asserted that the state of home affects individual since the parents are the first socializing and educative agents in an individual's life. This is because the family background and context of a child affect his reaction to life situations and his level of performance. Social- economic background is the foundation for children's development, in terms of family structure, size and resources.

All these are facts in child's development from home but there are changes to a child's educational development when there is external intervention or motivator that boost a child' psychological state which helps in improving his performance (Asikhia,

2017). The non-significant result obtained in this study could be explained in terms of the use of computer by the participants with the inclusion of videos and voices which stimulated and motivated them to learn at their own pace. The low SEB group were not expected to perform better, but their performance can be traced to their openness to the innovative strategies which their background has denied them over years.

4.4.4 Impacts of Treatment and Gender on Students' Fundamental Science Attainments

On students' performance in basic science, the interaction impact of therapy and gender was not statistically significant. Less than one percent of the variation in students' achievement in basic science was explained by the interaction effects of treatment and gender. Although treatment had a considerable impact on students' Basic Science performance, gender had no discernible influence. The fact that both males and females were exposed to the identical learning approach, which made them both profit in the same way, may be related to the non-significant result that was obtained. This supports Kolawole and Ala, (2014)'s findings, which show that male and female students improved similarly on the science achievement test. Also, supports Omotayo (2016), who came to the conclusion that there was no discernible interaction between treatment and gender and student achievement in mathematics.

This result differed from that of Achor, Imoko, and Jimin (2012) who found a statistically significant interaction between gender and teaching strategy on geometry achievement. This study demonstrated that student achievement is more strongly influenced by treatment than by gender. Gender inequality in the educational achievement and opportunity has in recent years been recognized as one of the major obstacles to women in the national development. Various findings revealed gender differences in performance and teaching of sciences both in junior and senior secondary schools.

4.4.5 Interaction Effects of Treatment and Social Economic Background on Students' Achievements in Basic Science

The collaboration between treatment and social economic background had no discernible impact on student achievement. This remark indicates that the combined impact of a student's treatment and social economic background on their basic science accomplishment is relatively minor and only partially explains the difference in student

performance. The impact of these factors accounted for less than 1% of the total variation in student achievement. When the two variables are compared on their own, the treatment significantly affects students' performance in basic science while the social economic background has no impact, indicating that the social economic background has no direct bearing on the students' performance. The author, Asikhia (2017), argues that a student's family educational background and social economic background have a significant impact on their learning achievement. According to the author, these two factors are closely related and should not be treated separately. The author suggests that by using specific indicators such as occupation, income, and educational attainment, one can more accurately define a student's social standing and understand how it affects their learning achievement.

The finding was not expected because students from high social economic backgrounds are expected to perform better, especially in science, but the finding may be so because of treatment given to which allow them to interact with computers individually. The use of computer to learn on individual pace has been a great motivation which brings equality between level of SEB, that is, High, moderate and low level. This study supports the findings of Thomson (2017) that the relationship between socio-economic background and achievement is only moderately strong and that the effects of socio-economic background are minimal when cognitive ability is taken into account. This suggests that while socio-economic background may have some influence on achievement, other factors such as cognitive ability may be more important in determining student achievement.

4.4.6 Gender and Social Economic Background Interaction Effects on Students' Basic Science Achievement

Interaction effects refer to the way in which two or more variables combine to have a combined effect on outcome. In the context of the relationship between gender, social economic background, and student achievement in basic science, research has found that both gender and social economic background can have significant effects on student achievement. However, the interaction between these two variables may also play a role in determining student achievement, as the impact of either gender or social economic background may be different for students from different backgrounds.

For instance, research has shown that young ladies generally perform preferable in fundamental science over young men, but this gender gap may be larger

or smaller depending on the students' social economic background. Similarly, students from lower socio-economic backgrounds tend to perform worse in basic science than those from higher socio-economic backgrounds, but the size of this achievement gap may also be influenced by the students' gender.

According to this claim, there is no statistically significant relationship between a student's gender and social economic background and their performance in basic science. Additionally, the impact of these factors on student achievement only explained a very small percentage (less than 1%) of the total variation in student achievement. This means that these factors have little effect on student achievement in basic science, and other factors none. Social economic background was expected to have a significant impact on students' achievement when taking into account students from high social economic backgrounds, but this was not the case due to treatments the students were exposed to, which served as a great motivation for their learning and served as a leveler between students from high social economic background and student from low social economic background.

This finding supports the conclusions of Ajogbeje (2012) and Diana (2014), who both found that there was no significant interaction between gender and social economic background on student attainment in mathematics. This suggests that regardless of a student's gender or socio-economic background, their performance in mathematics is not determined by these factors. This finding is consistent with the study that the interaction effects of gender and social economic background (SEB) were not statistically significant and less than 1% of the variation in students' attainment in basic science was explained by the interaction effects of gender and SEB.

4.4.7 Interaction effects of Treatment, Gender and Social Economic Background on Students' achievement in Basic science

The interaction effect of treatment, gender, and social economic background on students' achievement in basic science refers to how the combined effect of these variables on student achievement may be different from the effect of each variable alone. In other words, the impact of a specific treatment on student achievement may vary depending on the gender and social economic background of the students. For example, a particular educational intervention may be more effective for girls than boys, or it may have a greater impact on students from lower socio-economic backgrounds.

In order to fully understand the impact of a treatment on student achievement in basic science, it is important to consider not only the main effect of the treatment, but also the interaction effects between the treatment, gender, and social economic background. This can help to identify potential disparities in the effectiveness of the treatment and guide the development of targeted interventions to improve student achievement in basic science.

The result of this study revealed that there was no significant effect of treatment, SEB and Gender on students' achievement in Basic science. Though only treatment, considered alone, had a substantial impact on students' performance in basic science, SEB and gender, considered alone and jointly, had no discernible effect. This confirmed the earlier findings that when a level of ground environment is provided, there would not be any disparity in students' performance irrespective of their sex. According to this study, treatment, social economic background, and gender together only have a very minor impact on students' fundamental science achievement and account for a very small portion (less than 2%) of the overall variation in student achievement. This is not in line with Ajogbeje's (2012) findings, which showed that treatment, social economic background, and gender had a significant interaction on mathematics' student achievement. This suggests that while these factors may have some impact on student achievement in mathematics, they have little effect on student achievement in basic science.

4.4.8 Core effect of Treatment on Students' Attitudes in Basic science

Finding revealed impact of treatment on student's attitude to Basic Science that was statistically significant after controlling for covariance (pre-attitude students to Basic science).The results of the study indicate that the students in the control group (who only used textbook reading as a method of instruction) had the lowest mean score on the achievement test. On the other hand, students in the Experimental I group (who used the TEAPRF method of instruction) and the Experimental II group (who used the TEAPF method of instruction) had the highest mean scores. The difference in mean scores between the Experimental I, Experimental II and Control groups was statistically significant, meaning that the difference is likely not due to random chance. This suggests that the TEAPRF and TEAPF methods of instruction were more effective in improving student achievement than the traditional textbook reading method.

Finding reveals that students of experimental groups were found more excited and have good perception towards learning Basic science than the control group. This shows that using computer for learning instruction is an effective and successful method contributing to students' attitude towards learning. The findings of the study support the findings of Sikiru and Adewale. (2007) who found that computer was significantly more viable than conventional teaching in learners' achievement and attitude in physics. The findings of the study are in line with the findings of many research outcomes in which it was found that computer assisted instruction which is also refers to as Technology-Enabled Instruction, has positively affected learners' perceptions about computer supported instruction and their academic accomplishment (Azar and Sengulec, 2011, Kayri, Gencoglu, and Kayri, (2012)

The findings of this study further collaborates with related studies on Technology for teaching that giving feedback with remediation and Technology for teaching rather than giving feedback alone when "integrating into teaching - learning activities increase attitude in the subject according to Azar and Sengüleç (2011). role-play strategy was used in teaching history and learners showed no interest and attitude in learning history as a school subject. He concluded that involving the learners in teaching process through role play strategy may not necessarily increases learning and enhanced students' attitude.

4.4.9 Main Effect of Gender on Student's Attitude to Basic Science

The effect of gender on students' attitudes towards basic science is a complex issue that has been widely studied in educational research. Some studies have suggested that there may be gender differences in attitudes towards science, with girls sometimes exhibiting lower levels of confidence and interest in science compared to boys. However, other research has found that the effects of gender on attitudes towards science can be influenced by a variety of other factors, such as cultural and societal attitudes, educational experiences, and individual differences. Additionally, some studies have suggested that gender differences in attitudes towards science may be decreasing over time as the stereotype that science is a "male" subject becomes less prevalent(Asante, 2010). It is important to note that while gender may play a role in students' attitudes towards science, it is not the only factor that influences these attitudes. Other factors such as personal interests, prior experiences with science, and teaching strategies like TEALP (Technology-Enabled Assessment for Learning

Packages) can have a significant impact.

According to the study's findings, there is no discernible difference between male and female students' attitudes towards basic science. Although, there was a difference in the mean score of 2.38 in favor of male students, this difference was not statistically significant. This means that gender does not have a significant impact on students' attitudes towards basic science. It may be associated with the fact that both males and females were exposed to the same instructional strategies which is the use of technology for self - learning. Hence, they tend to benefit the same way. This finding is in accordance with the study conducted by OPolot-Okurot (2015) who found that for all the attitudinal variables (motivation, confidence and anxiety), males had higher mean scores than females. Also, the finding is in contrary to many other research findings in gender literature (Asante 2010).

4.4.10 Main Effect of Social Economic Background on Student's Attitude to Basic Science

The social economic background of students can have a significant impact on the students' attitudes towards basic science. Research has shown that students from lower socio-economic backgrounds are more likely to have negative attitudes towards science and to perform worse in science subjects compared to students from higher socio-economic backgrounds. One possible explanation for this disparity is that students from lower socio-economic backgrounds may not have access to the same resources and opportunities for learning and engagement with science as their more affluent peers. For example, they may attend schools with fewer resources and fewer experienced science teachers, and may not have the same access to science equipment, museums, laboratory, and other extracurricular activities that related to science.

In addition, students from lower social economic backgrounds may also face more social economic and cultural barriers to pursuing science careers. For example, they may not have the same financial resources or networks as their more affluent peers, and may not have the same level of exposure to positive role models in the scientific community. However, it is important to note that the relationship between social economic background and attitudes towards science is complex and multi-faceted. Other factors, such as individual differences, prior experiences with science, and using teaching strategies like TEALP also play a significant role in shaping students' attitudes towards science.

In conclusion, the social economic background of students can have a significant impact on their attitudes towards basic science, but it is not the only factor that influences these attitudes. It is important for educators to be aware of these disparities and to work to provide equal opportunities for learning and engagement with science for all students, regardless of their background.

This finding discovered no substantial difference on student's attitude toward Basic Science based on their social economic background. This implies that social economic background had no significant impact on students' attitudes toward basic science. This finding may be unexpected because, students from high social economic background are expected to develop better attitude towards their studies. This finding may be so, because of the use of computer which has put all the students on the same level. All the categories of social economic background, low level, moderate level and high level were put into the same condition of using technology to learn at their own pace. This might be a great motivator for learning rather than SEB.

This finding was contrary to the study of Ahmar and Anwar, (2018) who think that education is important in determining one's skill set for getting a job and in differentiating between those from higher and lower social economic backgrounds.

4.4.11 Collaboration Impacts of Treatment and Gender on student's Attitude to Basic Science.

In accordance with the study's findings, there was no significant interactions between treatment and gender and students' attitudes about fundamental science. The lack of gender discrimination in the sample technique, which entailed randomly allocating people to treatments regardless of their sexes, may account for the lack of a significant interaction between treatment and gender on students' attitudes to basic science. This may be connected with fact that a well - implemented instructional strategy may neutralize gender effect. That is, when students were provided with instructional plan that put them on the same level of operation without any preferential treatment, they tend to benefit equally. This finding agrees with Akinbode (2014) that discovered no collaboration impact on effect of treatment and gender on the attitude of students. However, the finding negates the result of Omotayo (2016) who concluded that there was significant interaction effect between gender and instructional strategy on learning a concept in a study.

4.4.12 Treatment and Social Economic Background Interaction's Effect on Attitude of Students to Basic Science.

Interaction between treatment and students' social economic background can have an impact on their attitudes towards basic science. This study has shown that the treatment which is the use of technology was a powerful tool for engaging and motivating students, especially those from lower socio-economic backgrounds. For example, the use of interactive simulations and virtual aids provides hands-on experiences with scientific concepts and processes, which can help to increase students' interest and confidence in science. However, access to technology and technology skills can be a significant barrier for students from lower socio-economic backgrounds. Students who do not have access to technology or who do not have the skills to effectively use technology may miss out on opportunities to engage with science and may have negative attitudes towards science as a result.

In addition, the use of technology can be influenced by a variety of other factors, such as teacher training, school culture, and district policies. Teachers who are not trained in using technology effectively may not be able to take full advantage of its potential for engaging and motivating students, and schools and districts that do not prioritize technology may not provide the necessary resources and support for successful implementation (Ahmar and Anwar, 2018)

In conclusion, the interaction between the treatment and students' social economic background can have an impact on their attitudes towards basic science, but it is not a simple or straightforward relationship. The effective use of technology to teach science requires a multi-faceted approach that takes into account factors such as access to technology, technology skills, teacher training, and school culture. The interaction effects of treatment and social economic background on students' attitude in Basic science was not significant, that is the effect of treatment was not influenced by that of SEB and the interaction effect of treatment and SEB, accounted for less than two percent of the variance experienced in students' attitude to Basic Science.

4.4.13 Collaboration Effects of Gender and Social Economic Background on Students' Attitude to Basic Science.

The interaction between gender and social and economic background can have a complex effect on students' attitudes towards basic science. Research has shown that both gender and social and economic background can independently influence

students' attitudes towards science, and that the effects of these factors can interact in complex ways. For example, girls from lower socio-economic backgrounds may face additional barriers to engagement with science, such as cultural and societal attitudes that view science as a "male" subject and limited access to resources and opportunities for learning and engagement with science. These girls may have lower levels of confidence and interest in science compared to both boys from lower socio-economic backgrounds and girls from higher socio-economic backgrounds.

On the other hand, boys from lower socio-economic backgrounds may also face challenges in engaging with science, such as a lack of positive role models in the scientific community and limited access to resources and opportunities. These boys may also be more likely to struggle with science and to have negative attitudes towards science compared to their more affluent peers.

The results revealed that there was no significant interaction effect of social Economic Background and Gender on students' attitude to Basic science. This implies that social Economic Background and gender had no interference effect on students' attitude to Basic science. The collaboration effect of these two variables had no impact on the attitude of students towards learning of Basic Science. The interaction effect account for less than one percent of the student's attitude to Basic science.

4.4.14 Collaboration Impacts of Treatment, Gender and Social Economic Background and Students' Attitudes Toward Basic Science

The interaction between treatment, gender, and social and economic background can have a complex impact on students' attitudes towards basic science. Research has shown that these factors can all independently influence students' attitudes towards science, and that the effects of these factors can interact in complex ways.

For example, girls from lower social economic backgrounds may face additional barriers to engaging with science, such as cultural and societal attitudes that view science as a "male" subject and limited access to resources and opportunities for learning and engagement with science. However, if these girls have access to technology and technology-enhanced teaching methods, they may be able to overcome some of these barriers and have more positive attitudes towards science.

On the other hand, boys from higher social economic backgrounds who have access to technology may be more likely to be engaged and motivated by technology-enhanced teaching methods, whereas boys from lower socio-economic backgrounds

who do not have access to technology may miss out on these opportunities and have more negative attitudes towards science.

In conclusion, the interaction between the use of technology to teach, gender, and social and economic background can have a complex impact on students' attitudes towards basic science, and it is important for educators to be aware of these potential disparities and to work to provide equal opportunities for learning and engagement with science for all students, regardless of their background, gender, and access to technology.

It was discovered from this study that students' attitudes towards basic science were not influenced by the joint interaction effects of treatment, gender, and social economic background. This only indicates that there was no discernible impact on students' attitudes toward basic science from the treatment, gender, or SEB. Joint interaction effect of treatment, SEB and Gender only accounted for less than one percent of the variance experienced in student's behaviour to Basic Science.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter provides an overview of the study's findings, conclusions, implications, and limitations, as well as suggestions for further research, guidance, and knowledge contributions.

5.1 Summary

This study looked at the impact of technology-enhanced assessment for learning packages on students' learning outcomes in basic science. The study used a 3x2x3 factorial design with a pre-test-post-test quasi-experimental design. 150 J.S. 2 students were chosen from six schools in zones 1 and 2 of Ibadan using a multistage sampling process. The criteria used to choose the schools was whether each one has twenty-five working computers.

Six research instruments were used in the study, and Analysis of Covariance was used to analyze the data (ANCOVA).

Seven hypotheses were assessed for significance at the 0.05 level. The quantitative findings in this study revealed that treatments (TEAPF and TEAPFR), that is, the use of computer as instructional strategy had substantial impact proceeding attainment in Basic science and perspective of the students to Basic science. The findings further reveal the use Technology – Enabled Assessment for Learning Package with Feedback and Remediation (TEAPFRP)to have great effect on the academic achievement of the learners. Self - learning by the students using technology made them learn at ease without anxiety of being beaten by the teacher or being bullied as it is in the conventional class. The study equally showed that the treatments are more effective in teaching Basic science than the control group that read textbook on their own, this implies that student’s knowledge, achievements and attitude could be improved through the use of technology for self -learning.

The study's results indicated that social economic background had no significant impact on student’s attitude towards Basic Science as a subject. However, the study found discrepancies in the predicted marginal means of the student’s Basic Science achievement, indicating that there may be other factors that are affecting their

achievement in Basic Science. These could be factors such as student's cognitive ability, teaching method, technology-enabled assessment for learning, learning at one's pace, classroom environment, and access to resources, etc.

The following is a summary of the study's main conclusions:

1) According to the students, three topics were challenging to learn, these were discovered by the use of diagnostic questionnaire, the topics are; Chemicals, Energy, Crude oil and petroleum.
2) The same three topics were also discovered by the teachers to be difficult to understand by the students using the same diagnostic questionnaire, which are; Chemicals, Energy, Crude oil and petroleum. Hence, the same topics discovered by both teachers and students to be difficult to learn, were selected to build the learning packages (TEALP).
3) There was substantial main impact of treatments (Technology – Enabled Assessment for Learning Package with Feedback (TEALPF) and Technology–Enabled Assessment for Learning Package with Feedback and Remediation (TEALPFR)) on student's achievement in Basic Science.
4) There was substantial difference in attainment assessment scores in Basic Science between the participants in Technology–Enabled Assessment for Learning Package and control group. Additionally, there is a substantial discrepancy between the mean scores of Technology–Enabled Assessment for Learning Package with Feedback (TEALPF) and Technology-Enabled Assessment for Learning Package with Feedback and Remediation (TEALPFR).
5) The treatment had a significant primary influence on students' attitudes about basic science.
6) The main effect of gender on students' performance in Basic Science was insignificant.
7) Social economic background had no discernible impact on students'' performance in basic science.
8) The social economic background of students did not significantly affect their attitudes about basic science.
9) This finding suggests that there is no significant difference in students' attitudes towards basic science based on their gender. This means that gender does not have a significant impact on students' attitudes towards basic science. It means

that Male and Female students have similar attitudes towards Basic Science.

10) No substantial collaboration impact of treatments (Technology–Enabled Assessment for Learning Package with Feedback (TEALPF) and Technology-Enabled Assessment for Learning Package with Feedback and Remediation (TEAPFR) and social economic background on student's attainment in Basic Science.

11) There is no substantial collaboration impact of treatments (Technology–Enabled Assessment for Learning Package with Feedback (TEALPF) and Technology-Enabled Assessment Learning Package with Feedback and Remediation (TEALPFR) instructional modes and gender on attainment of students in Basic Science.

12) This finding suggests that there is no significant correlation or relationship between students' social economic background and their gender on their performance in basic science. This means that social economic background and gender had no substantial impact on the performance of students in basic science, and that achievement of students in basic science is not influenced by these factors

13) There was no substantial collaboration impact of treatments (Technology–Enabled Assessment Package with Feedback (TEAPF) and Technology-Enabled Assessment Package with Feedback and Remediation (TEAPFR) instructional modes and social Economic Background on students' perspective to Basic Science.

14) There was no substantial collaboration impact of treatments (Technology–Enabled Assessment Package with Feedback (TEAPF) and Technology-Enabled Assessment Package with Feedback and Remediation (TEAPFR) instructional modes and gender on student's perspective to Basic Science.

15) This finding suggests that there is no significant correlation or relationship between students' social economic background and their gender on their performance in Basic Science. This implies that social economic background and gender did not have distinct impact on the performance of students in basic science.

16) No substantial interaction impact of treatments (Technology–Enabled Assessment Package with Feedback (TEALPF) and Technology-Enabled Assessment Package with Feedback and Remediation (TEALPFR)

instructional modes, social economic background and gender on student's attainment in foundational science.

17) No substantial interaction effect of treatments (Technology–Enabled Assessment Package with Feedback (TEALPF) and Technology-Enabled Assessment Package with Feedback and Remediation (TEALPFR) instructional modes, social economic background and gender on student's perspective to foundational science.

5.2 Study's Implication

The results of this thesis have many suggestions that will be of benefits to educational stakeholders, whose are, students or scholars, teachers, parents, school administrators and policy makers.

- **Scholars**

  Students should always be prepared to participate fully in any intervention program designed specifically for them to suit their educational needs. They should always be ready to learn, especially learning at their own pace with the use of computer to, make them 21st century relevant. They should always be ready and have willingness to learn, understand any difficult topics discovered in Basic science, without being discouraged. Rather the learners need to have a good foundation for the science subjects at senior secondary classes, and also be made to acquire skills that can help them to be self – dependent and self – reliant. They should believe in themselves, irrespective of their sex and social economic status. No gender should feel inundated by the other.

- **Teachers**

  As a result of the study's findings, teachers are advised to review their instructional strategies and make them more student-centered so that students can progress at their own rate rather than being spoon-fed at all times. Teachers need to be aware of how to utilize computers to enhance learning, not to impede it. Students should be mentored and encouraged to use computers for learning in the correct manner.

- **School Administrator**

  Moreover, findings of this study serve as an eye opener to school administrators to rise up to the use computers in schools to improve student' performance in teaching and learning especially examinations. The findings

reveal that students learn better, and develop positive attitude towards Basic science with the use of technology. They learn and understand better, and freely on their own with the help of all instructional aids embedded in the learning package, audio and video modes without any intervention of any instructors**.** Teachers should be encouraged to motivate students as regards the use of computers to learn Basic science.

- **Government and Policy Makers**

  Government and policy makers should ensure there is availability of computers in Junior secondary schools for interaction with Basic science learning package for acquisition of skills, and for having good perquisite knowledge for science subjects in senior secondary school. In order to improve students' grasp of fundamental science and foster a favorable attitude toward fundamental science, the government should finance the development of learning materials for teaching and learning basic science.

  This became necessary as a result of the study's findings, which showed that using a technology-enabled assessment for learning package in basic science had a considerable impact on students' attitudes.

5.3 Conclusion

The Technology-Enabled Assessment for Learning Packages significantly improved students' performance in basic science as well as their attitudes toward the subject, according to the study's findings.

Meaning that, students learn and perform better when good instructional strategy is used to teach. It was discovered that the students understand a concept better when they learn at their own pace using computer with inclusion of videos, pictures and charts to explain the concept better as instructional aids. The aim of developing a learning package on Basic science is to provide an appropriate teaching method that will enable the students to learn better and have good foundation of science subjects which will enable them to acquire skills and develop interest to be self -dependence and self- reliance in future. Also, it useful in eradiating or reducing inconsistence of learning during any Epidemic. The use of appropriate teaching methods like using Technology-Enabled Assessment for Learning Package may be operational in teaching and learning, because there is no abuse, scolding and anxiety in its application.

5.4 Limitation of the Study

1. The study did not consider students' attitude to and achievement in Basic Science in private schools in Ibadan city. Hence, the results cannot be extrapolated to represent all the students in Ibadan city.
2. The characteristics of the students that were considered are gender, social economic background and attitude. Variables not factored in this present study could have yielded different results.
3. The attitude of the students to the use of computers, which many of the students were not familiar with, or have not used for long time became a barrier. Students should exposed to computer practical in schools not theory
4. Computers' software not updated, created fidgeting and barrier to the access and use of the learning packages at the time allocated for the subject (Basic Science). Prompt updating of computers or virtual assessment software may have impacted on the results of this study.
5. Despite the abnormality behaviour of some of the computers and power supply, problem of the use of computers in schools was also experienced, the return rate was 98.5%. Thus, this may have affected the results or generalisation of the result of the study.

5.5 Recommendations

In light of the evaluation of this study, the following serves as advice;

1. Students should be encouraged to use modern ICT developments wisely to acquire TEALP in Basic science.
2. Based on the findings of the study, it is suggested that teachers should be encouraged to learn the use of computer-based multimedia instruction as a method of teaching and assessment. This is because the study found that students who were taught using computer-based multimedia instruction and assessed by it had high achievement in Basic Science than those taught using only textbook reading. This suggests that computer-based multimedia instruction with assessment mode may be a more effective method of teaching and assessing Basic Science. Furthermore, it is believed that computer-based multimedia instruction is a more interactive and engaging method of teaching which can lead to better student's learning outcomes. Encouraging teachers to learn this method of instruction could lead to improved achievement in basic

science among students.

3. Female students, especially at the Basic classes should be encouraged to develop interest in science and technological based subjects.
4. For students to acquire basic science and other science-related courses and to develop their skills, curriculum planners must make sure that learning packages are used in conjunction with computers in the classroom.
5. Government should allow the use of learning packages for instructions in schools, and provide adequate finance for development of learning packages.
6. There is need to provide Microsoft updated computers in schools for learning. Computers and computer labs should be available in sufficient numbers in schools to improve the efficiency of instruction.
7. Government ought to coordinate courses, gatherings and studio for instructors on the utilization of ICT for inventive and innovative educating.

5.6 Contributions to knowledge

According to the study's conclusions, the following advances in understanding were made:

1. The study demonstrates the positive effects of the technology-enabled assessment for learning package on students' performance in basic science.
2. The study identified difficult topics in Junior Secondary School 2 Basic Science.
3. The study reveals that the instructional method could be employed to improve teaching and learning Basic science.
4. The use of computers during instruction has demonstrated that when students are given the freedom to learn at their own pace, they do better on exams.
5. Also, the use of colour, videos, pictures, animations with the computer's interphase in learning packages, help to improve learning outcomes of students.
6. The study also shows that when feedback and remediation are done for students in the course of learning, it helps to improve their learning outcomes.

5.7 Suggestions for further study

Enquiry on the impacts of Technology- Enabled Assessment for learning Package on achievement of students in and attitude to fundamental science was carried out on J.S 2 students only. It was hoped that this study, will be used in the learning of other subjects in junior secondary classes and senior secondary classes, most importantly on

science -based subjects like Physics, Chemistry and Biology for acquisition of 21st century skills.

A recommendation from this study is that, it can be repeated in Federal Government Colleges. This is due to the fact that the study was conducted in a specific area and type of school, which may not be typical of the overall student population in Nigeria. Implementing the study in federal government institutions will make it possible to assess the Learning Package in Basic Science's technology-enabled assessment's worth in more detail.

The study also recommends that more investigation be done to determine the impact of technology-enabled assessment for Learning Package in Basic Science on additional factors like skill acquisition, motivation, and students' preparation. This will provide a more comprehensive understanding of how Technology-enabled assessment for Learning Package in Basic Science affects student's learning outcomes.

Lastly, it was recommended that the study should be replicated in other states in Nigeria, to allow for comparison. This is because the study was carried out in a specific location and in a specific type of school, which might not be representative of the entire population of students in Nigeria. A more thorough understanding of the efficiency of the technology-enabled assessment for the Learning Package in Basic Science will be possible with the study's replication in additional states.

It is likewise recommended that the study or experiment be carried out in both private and public schools. Additional review can be completed on the impact of technology-enabled assessment for the learning package in basic science on different factors like procurement of abilities, motivation, and students' readiness, to name a few. Further replication ought to be carried out in different states to take into account correlation.

Finally, other studies can find out the effectiveness of Technology–enabled assessment package in Basic Science; which can offer experimental indication for establishing the substantial things of this instructional strategy. It will also provide baseline for recommending Technology–Enabled Assessment Learning Package in fundamental science for use in junior secondary schools (Basic classes).

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Appendix I

Diagnostic Questionnaire on Basic Science (DQBS)

Teachers' Copy

EDUCATION INSTITUTION
INTERNATIONAL CENTRE FOR EDUCATION EVALUATION
UNIVERSITY OF IBADAN
SUBJECT MATTER DIAGNOSTIC QUESTIONAIRE (SMDQ)

SECTION A

Dear Respondent,

This questionnaire is specially designed for the purpose of basic science diagnostic matter on difficult to learn or teach topics. Kindly fill in the correct information and tick where appropriate. Responses will be used exclusively for evaluation. Thanks for your time in advance.

Key- VDL-Very difficult to Learn; **DT**-Difficult to Learn; **LDT**- Less Difficult to Learn; **NDT**-Not Difficult to Learn

Section A: Bio-Data

1. School:----------
2. Class: ----------
3. Gender: ----------
4. Age: ----------

SECTION B

S/N	TOPICS	CATEGORIES			
1	Learning about our environment i. Habitat of living things ii. Characteristics of living things iii. Chemicals –definition of chemicals iv. Classification of chemicals v. Safety of chemicals	**VDL**	**DL**	**LDL**	**NDL**
2	You and Energy i. Meaning of energy ii. Identify energy transfer when work is done iii. Types of energy iv. Calculations involved in kinetic energy and potential energy v. Thermal energy				
3	Development and Science i. Petroleum and Crude oil ii. A description of crude oil refining iii. A method of cleaning unpolished oil iv. Uses of unpolished oil v. Importance of crude oil to Nigeria				

Appendix II

Diagnostic Questionnaire on Basic Science (DQBS)

Students' Copy

EDUCATION INSTITUTION
INTERNATIONAL CENTRE FOR EDUCATION EVALUATION
UNIVERSITY OF IBADAN
SUBJECT MATTER DIAGNOSTIC QUESTIONAIRE (SMDQ)

SECTION A

Dear Respondent,

This questionnaire is specially designed for the purpose of basic science diagnostic matter on difficult to learn or teach topics. Kindly fill in the correct information and tick where appropriate. Responses will be used exclusively for evaluation. Thanks for your time in advance.

Key- **VDL**-Very difficult to Learn; **DT**-Difficult to Learn; **LDT**- Less Difficult to Learn; **NDT**-Not Difficult to Learn

Section A: Bio-Data

5. School:----------
6. Class: ----------
7. Gender: ----------
8. Age: ----------

SECTION B

S/N	TOPICS	CATEGORIES			
		VDL	DL	LDL	NDL
1	Learning about our environment i. Habitat of living things ii. Characteristics of living things iii. Chemicals –definition of chemicals iv. Classification of chemicals v. Safety of chemicals				
2	You and Energy i. Meaning of energy ii. List the energy transfers that take place when work is completed. iii. Types of energy iv. Calculations involved in kinetic energy and potential energy v. Thermal energy				
3	Science and Development i. What is crude oil and petroleum ii. Explanation of refining crude oil iii. crude oil refinery process iv. crude oil uses v. Importance of crude oil to Nigeria				

Appendix III

Result of Diagnostic Questionnaire on Basic Science (DQBS)

Table 2: Summary of Result of Diagnostic Questionnaire on Basic Science (DQBS)

THEME	TOPICS	VDL and T	DL and T	LDL and T	NDL and T
LEARNING ABOUT OUR ENVIROMENT	Chemicals -- definition of chemicals	21 16.3%	19 14.7%	46 27.1%	64 41.9%
	Classification of chemicals	13 10.1%	20 15.5%	63 40.3%	54 34.1%
	Safety of chemicals	20 15.5%	24 18.6%	38 21.7%	68 44.2%
	Meaning of energy	5 3.9%	2 1.6%	15 11.6%	107 82.9%
YOU AND ENERGY	List the energy transfers that take place when work is completed.	13 10.1%	22 17.1%	43 25.6%	72 47.3%
	Types of energy	6 4.6%	3 2.3%	29 14.7%	112 78.3%
	Calculations involve in kinetic energy and potential energy	31 24.1%	20 15.5%	37 20.9%	52 39.5%
	Thermal energy	17 13.2%	38 29.5%	39 22.5%	56 34.9%
	What is crude oil and petroleum	10 7.7%	15 11.6%	41 24.0%	84 56.6%
SCIENCE AND DEVELOPMENT	Explanation of crude oil	15 11.6%	19 14.7%	39 22.5%	77 51.2%
	Crude oil refinery process	15 11.6%	20 15.5%	44 26.4%	71 46.5%
	Crude oil uses	10 7.8%	9 7.0%	32 17.1%	99 68.2%
	Importance of crude oil to Nigeria	12 9.4%	14 10.9%	18 14.0%	85 65.9%

Key: VDL and T = Very Difficult to Learn and Teach
DL and T = Difficult to Learn and Teach
LDL and T = Low Difficult to Learn and Teach
NDL and T = Not Difficult to Learn and Teach

From table 2, the topics were selected with the VDL and T percentage, any topic having less than 10% was selected as one of the topics that were very difficult to learn and teach. The topics selected are, Chemicals, Energy and Crude oil.

Appendix IV

DATA COLLECTION FOR DIAGNOSTIC QUESTIONAIRE

S/N	NAMES OF SCHOOL	LOCAL GOVERNMENT	NO OF STUDENTS	NO OF TEACHERS
1	Basorun High School	Ibadan North East	28	2
2	BasorunOjoo High School	Ibadan North	28	2
3	Bishop Phillip Academy, Iwo road	Lagelu	28	2
4	Methodist Secondary School, Bodija	Ibadan North	28	2
5	St Patrick's Grammar School	Ibadan North	28	2
	TOTAL		140	10

TOTAL RESPONDENTS =150

Note: The selected schools used for diagnostic questionnaire were not part of thestudy sample

Appendix V

RATING SCALE FOR TECHNOLOGY-ENABLED ASSESSMENT FOR LEARNING PACKAGE VALIDATION

This questionnaire's objective is to assess the usability and friendliness of the users of this learning package (TEALP) by the educational experts for validation.

SECTION A

Please check the box that most accurately reflects your opinion.

1. Name…….
2. Sex:…….
3. Age…….

Please check the box next to your selection in Section B.

Record your response in the space provided to the left of each position using the scale.

1. Definitely Not
2. Somewhat
3. To A Great Degree
4. To A Very Great Degree

S/N	Statement	1	2	3	4
1	To what extent is the storyboard well executed in the assessment for learning package				
2	How easy is the navigation of the package?				
3	To what extent is the package friendly				
4	Is the studies 1-3 well represented in the package as it is in the storyboard?				
5	Are the diagrams said to be used as instructional aid in the storyboard is well represented in the package?				
6	Are the videos used as aids clear enough?				
7	To what extent are the steps of learning properly implemented in the package?				
8	Is the package well graphical?				

Appendix VI

Summary of Responses for Technology-Enabled Assessment for Learning Package Validation

S/N	Statements	1	2	3	4
1	To what extent is the storyboard well executed in the assessment for learning package	-	-	19(51.2)	18(48.8)
2	How easy is the navigation of the package?	-	1(2.9)	19(51.2)	17(45.9)
3	To what extent is the package friendly	-	-	10(27.0)	27(73.0)
4	Is the studies 1-3 well represented in the package as it is in the storyboard?	-	-	12(32.4)	25(67.6)
5	Are the diagrams said to be used as instructional aid in the storyboard is well represented in the package?	-	-	9 (24.3)	28(75.7)
6	Are the videos used as aids clear enough?	-	-	5(13,5)	32(86.5)
7	To what extent are the steps of learning properly implemented in the package?	-	-	2(5.4)	35(94.6)
8	Is the package well graphical?	-	1(2.9)	10(27.0)	26(70.3)

Appendix VII

EDUCATION INSTITUTION (ICEE)

UNIVERSITY OF IBADAN

FUNDAMENTAL SCIENCE ATTITUDINAL SCALE (BSAS)

(to be completed by students)

SECTION A

1.School ----------

2.Gender ----------

3.Class ----------

4.Age ----------

Instruction: Kindly use the following response format to response to the following items. MA=Most Applicable, A=Applicable, LA= Less Applicable, NA= Not Applicable. The instrument was designed to measure students' attitude towards Basic science.

ATTITUDE TO BASIC SCIENCE AS A SUBJECT

S/N		MA	A	LA	NA
1.	Basic science is an interesting subject				
2.	I hardly miss Basic science class				
3.	I prefer Basic Science to other subjects				
4.	I desire having regular assignments on Basic Science				
5.	I am proud to learn Basic Science				
6.	Basic Science is boring to me				
7.	I wish Basic Science will be removed from the list of secondary school subjects				
8.	I do not have much interest in studying Basic Science				
9.	The study of fundamental sciences does not improve my quality of life.				
10.	Basic science can be challenging.				
11.	It should no longer be listed as one of the J.S.S Basic school's courses.				
12.	I am not good at Basic Science.				
13.	The study of Basic Science makes me think right				
14.	Basic science lessons teach me how to cope with difficulties				
15.	Basic science lessons teach me how to cope with daily life activities				

Appendix VIII

EDUCATION INSTITUTION (ICEE)

UNIVERSITY OF IBADAN

SOCIAL ECONOMIC BACKGROUND SCALE (SEBS)

(to be completed by students)

SECTION A

1.School ----------

2.Gender ----------

3.Class ----------

4.Age ----------

SECTION B

5. Father's profession: Law ☐ Medicine ☐ Engineering ☐

Craftsman ☐ Teaching ☐ Business ☐

Cleric ☐ Military ☐

6. Mother's profession: Law ☐ Medicine ☐ Engineering ☐

Craftsman Teaching ☐ Business ☐

Cleric ☐ Military ☐

7. Guardian's profession:Law ☐ Medicine ☐ Engineering ☐

Craftsman Teaching ☐ Business ☐

Cleric ☐ Military ☐

8. Educational levels of parents tick( ) in the appropriate box.

- No formal education ☐
- Elementary School, Secondary school or Teacher Training ☐
- OND/ B.sc/ HND/ PHD ☐
- Professional Training- clergy, Trade ☐

9. Parents' Residence tick ( ) in the appropriate box

- Own house ☐

- Company/Government/ University Quarter ☐
- Rented House ☐

10. Do your parents have any of the following? Tick in appropriate space:

- Desktop ☐
- Laptop ☐
- I phone ☐
- Palmtop ☐
- Phone ☐
- None ☐

11. Family income: below ₦30, 000 ☐

₦30, 000 ☐

₦40, 000 ☐

₦50, 000 ☐

₦60, 000 and above

Appendix IX

ITEM ANALYSIS

S/N	ITEM	DIFFICULTY	DISCRIMINATION	DECISION
1	quest1	0.6491228	0.36842105	GOOD
2	quest2	0.2105263	0.35789474	GOOD
3	quest3	0.3684211	0.15789474	BAD
4	quest4	0.3859649	-0.21052632	BAD
5	quest5	0.6017544	0.31052632	GOOD
6	quest6	0.3508772	0.15789474	BAD
7	quest7	0.3333333	0.00000000	BAD
8	quest8	0.1403509	0.00000000	BAD
9	quest9	0.3508772	0.15789474	BAD
10	quest10	0.2982456	0.05263158	BAD
11	quest11	0.3982456	0.31052632	GOOD
12	quest12	0.4982456	0.46315789	GOOD
13	quest13	0.3280702	0.31578947	GOOD
14	quest14	0.1228070	0.05263158	BAD
15	quest15	0.1228070	0.21052632	BAD
16	quest16	0.3859649	0.32789474	GOOD
17	quest17	0.3982456	0.31578947	GOOD
18	quest18	0.1754386	0.26315789	BAD
19	quest19	0.1929825	0.21052632	BAD
20	quest20	0.5789474	0.35263158	GOOD
21	quest21	0.5263158	0.31052632	GOOD
22	quest22	0.4385965	0.68421053	GOOD
23	quest23	0.1754386	0.00000000	BAD
24	quest24	0.2982456	0.35789474	GOOD
25	quest25	0.6315789	0.31578947	GOOD
26	quest26	0.3157895	0.73684211	GOOD
27	quest27	0.3333333	0.46315789	GOOD
28	quest28	0.2456140	0.30526316	GOOD
29	quest29	0.2807018	0.68421053	GOOD
30	quest30	0.4035088	0.36315789	GOOD
31	quest31	0.3508772	0.57894737	GOOD
32	quest32	0.4210526	0.05263158	BAD
33	quest33	0.4736842	0.15789474	BAD
34	quest34	0.3859649	0.57894737	GOOD
35	quest35	0.4982456	0.36842105	GOOD
36	quest36	0.3456140	0.52631579	GOOD
37	quest37	0.3105263	0.46315789	GOOD
38	quest38	0.5438596	0.31052632	GOOD
39	quest39	0.8245614	1.30526316	BAD
40	quest40	0.4210526	0.30526316	GOOD
41	quest41	0.3280702	0.36842105	GOOD
42	quest42	0.3684211	0.36315789	GOOD
43	quest43	0.3508772	0.45789474	GOOD
44	quest44	0.4912281	0.36315789	GOOD
45	quest45	0.3631579	0.31578947	GOOD
46	quest46	0.4456140	0.36842105	GOOD
47	quest47	0.3982456	0.45789474	GOOD
48	quest48	0.4561404	0.31052632	GOOD
49	quest49	0.3456140	0.31052632	GOOD
50	quest50	0.3157895	0.42105263	GOOD
51	quest51	0.1754386	0.05263158	BAD

52	quest52	0.4561404	0.31052632	GOOD
53	quest53	0.4210526	0.42105263	GOOD
54	quest54	0.3508772	0.36315789	GOOD
55	quest55	0.3105263	0.45263158	GOOD
56	quest56	0.3333333	0.35263158	GOOD
57	quest57	0.1929825	0.15789474	BAD
58	quest58	0.3684211	0.41052632	GOOD
59	quest59	0.3807018	0.30526316	GOOD
60	quest60	0.4035088	0.30526316	GOOD

Appendix X

INSTITUTE OF EDUCATION

CENTRE FOR EDUCATIONAL EVALUATION

UNIVERSITY OF IBADAN

BASIC SCIENCE ACHIEVEMENT TESTS (BSAT)

(To be completed by students)

SECTION A

1.School ----------

2.Gender ----------

3.Class ----------

4.Age ----------

ACHIEVEMENT TESTS (TECHNOLOGY ENABLED)

1. Except for those listed below, crude oil contains...
   a. ethane b. water c. sulphur d. salt
2. The refined crude oil product used as aviation fuel is _____
   a. bitumen b. kerosene c. petroleum ether d. ethane
3. Crude oil contains a variety of _____
   a. silt b. clay c. hydrocarbons d. water
4. Any substance that is produced by a chemical process is called _____
   a. chemical b. nylon c. nuclear d. plate
5. A compound is a substance produced when two or more elements are chemically _____ together?
   a. react b. collide c. push c. combined
6. One example of an element is _____
   a. boron b. pencil c. nylon d. table
7. A chemical substance that is made up of only one type of atom is _____
   a. alum b. element c. potassium d. oxygen
8. An example of compound is _____
   a. helium b. sodium c. common salt d. hydrogen
9. Potential energy is the energy that an object has by virtue of its----------
   a. place b. principle c. power d. position
10. Which of the following is NOT a chemical substance
    a. Gold b. Salt c. Water d. Limestone
11. A chemical substance can exist in the form of:

(I) solid b (III) liquid (IIII) gas

a. I, II, and III b. I only c. III only d. I and II only

12. Which of these is an agrochemical?

a. Chalk b. Fertilizers c. Lithium paper d. Charcoal

13. Chemical formula of water is _____

a. H_20_2 b. H_2 c. H_20 d. 0H

14. Chemicals can either be an element or _____

a. Compound b. Sugar c. Liquid d. helium

15. Ability to do work is……

a. energy b. velocity c. atom d. strength

16. One of the protective kits used or worn in the laboratory is _____

a. shirt b. gloves c. short d. jewelries

17. Energy that a body has by virtue of its position is _____

a. sound energy b. heat energy c. potential energy d. light energy

18. Energy cannot be created but can be converted from one _____ to another

a. form b. water c. side d. up

19. P.E mean _____

a. Potential energy

b. Sound energy

c. Heat energy

d. production energy

20. What is the formula for calculating potential energy _____

a. P.E. = phg

b. P.E = mgh

c. P.E = mg/A

d. P.e = $I/2MV^2$

21. Potential energy is measured in _____

a. metres

b. joules

c. centimetres

d. watts

22. A stone of mass 2kg is lifted to a height of 1m. calculated its potential energy of this point (take g = $10ms^{-1}$)

a. 200 J

b. 20J

c. 10J

d. 100J

23. Doing work means _____

a. jumping up

b. transfer energy

c. Cleaning land

d. sweeping floor

24. Energy that a body has when its moving is _____

a. kinetic movement

b. chemical energy

c. kinetic energy

d. potential energy

25. Mass of a body is measured in _____

a. kilogram (kg)

b. metre (m)

c. Newton (N)

d. seconds (s)

26. Formula for calculating kinetic energy is _____

a. ut +1/2at^2

b. ½ mv^2

c. mc0

d. mgh

27. K.E means _____

a. Potential energy

b. Sound energy

c. kinetic energy

d. Heat energy

28. Kinetic energy is measured in _____

a. kilogramme

b. metre

c. joules

d. Watt

29. A bicycle of mass 10kg is moving at velocity of 2mls. Calculate its kinetic energy

a. 100J

b. 20J

c. 10J

d. 5J

30. Work is defined as the product of force and _____

a. distance

b. velocity

c. movement

d. running

31. Power is defined as the rate of doing _____

a. work

b. fulcrum

c. load

d. effort

32. Work is measured in _____

a. metres

b. kilogramme

c. joules

d. newton

33. One of the modes of heat energy transfer is _____

a. conduction

b. cooking

c. boiling

d. travelling

34. Radiation can transport heat energy through …..

a. metal

b. vacuum

c. water

d. pots

35. Which of the following materials absorbs thermal energy most rapidly

a. white can

b. black cun

c. black mat

d. red rug

36. That which follows is NOT a petrochemical.

a. nylon

b. benzene

c. plastics

d. water

37. Crude oil products include one of these _____

a. silt

b. salt

c. clay

d. ash

38. Simple gum can be produced by mixing _____ and _____

a. cushy and petrol

b petrol and alcohol

c. petrol and water

d. cushy and ash

39. Alcohol is mixed with glycerin , produce_____

a. face cream

b. heal balm

c. hand sanitizer

d. body lotion

40. In producing homemade scrubbing powder, two chemicals substances are necessary, they are _____ and_____

a. ash and oil
b. ash and flour
c. ash and eggshell
d. ash and water

Appendix XI

TABLE OF SPECIFICATION FOR ACHIEVEMENT TEST ITEMS

THEME	Knowledge	Comprehension	Application	Analysis	Evaluation	TOTAL
Learning about our Environment	5	-	1	4	-	10
You and Energy	4	5	5	-	4	18
Science and Development	9	2	1	-	-	12
Total	18	7	7	4	4	40

Appendix XII

LIST OF SCHOOLS THAT HAVE COMPUTERS IN IBADAN CITY

S/N	NAMES OF SCHOOL	LGA
1	Islamic high school	Ibadan North
2	Comprehensive college ,Oke Bola	Ibadan North West
3	Ansaru- deen High school 1, Liberty	Ibadan South West
4	Oba Abass Grammar school, Eleyele	Ibadan North West
5	St Gabriel Commercial Secondary school, Mokola	Ibadan North
6	Oba Akinyele Memorial High School	Ibadan north
7	Adifase High School, Apata	Ibadan South West
8	Anglican Grammar school, Oritamefa	Ibadan North
9	Adelegan Memorial Grammar school I,Odinjo	South East
10	Baptist Secondary School, Oke Ado	Ibadan South West
11	Ikolaba High School, Ikolaba	Ibadan North
12	IMG Grammar School. Lobuko, Molete	South west
13	Immanuel college ,UI	Ibadan North
14	CAC Grammar School, Aperin	South East
15	Community Grammar School, Osungbade	South East

SCHOOLS RANDOMLY PICKED

1. Anglican Grammar school, Oritamefa ---- TEALPFR
2. Adifase High School,Apata -----TEALPFR
3. Islamic high school ---- Assigned TEALPF
4. Ansaru- deen High school,Liberty ---- TEALPF
5. Oba Akinyele Memorial High School----TEXTBOOK READING
6. Baptist Secondary School, Oke Ado ---TEXTBOOK READING

Appendix XIII

GROUPING OF THE SAMPLE

GROUP 1 (TEALPFR)	GROUP II (TEALPF)	CONTROL GROUP (TEXTBOOK READING)
1.Anglican Grammar school, Oritamefa 2. Adifase High School,Apata	1.Islamic high school 2. Ansaru- deen High school,Liberty	1. Oba Akinyele Memorial High School 2. Baptist Secondary School, Oke Ado

Appendix XIV

PACKAGE STORYBOARD

STUDY ONE

BASIC SCIENCE

INSTRUCTIONAL CONTENTS

Slide 1 Topic: Chemicals performance objectives

Following completion of this chapter, student ought to be able to:

- Explain chemicals
- group chemicals according to the intended applications and level of danger
- List the precautions that should be taken before employing chemicals.

Slide 2: Meaning of Chemicals

A chemical is any substance that is produced by a chemical process. It can either be an element or a compound.

Picture of chemical laboratory flask

DIAGRAM

Fig 1:1

Slide 3: What is element

An element is a chemical substance that is made up of only one type of atom. It cannot be broken into simpler ones by any chemical substance.

Slide 4: Examples of elements

Elements pictures of the elements

- Boron
- Helium
- Carbon
- Copper
- Sodium

Slide 5: What is a compound?

A compound is a substance produced or formed when two or more elements are chemically combined together.

Slide 6: Examples of compound

- Water
- Common salt (sodium chlorine NaCl)
- Sugar (sucrose)
- Washing soda (NaCo3) sodium carbonate

Slide 6b: Chemicals are available in or can exist in these various forms as

1. Solid
2. Liquid
3. Gas

Slide 7: Chemicals have physical characteristics such as:

i. Colour
ii. Type of crystal
iii. Density

Slide 8: Classification of chemicals based on their intended uses:

We use various chemicals in our environment

- homes
- schools
- farms
- industries

Slide 9: Pharmaceutical chemicals

- Drugs – in form of tablets, capsules solution, drips, injections
- Pictures of these one after uses of the treatment of diseases for vaccination

Slide 10: Cosmetics chemical

Picture Perfumes, finger paints, face powder, lip stick, body creams, shampoo

Uses: To care for our bodies

Slide 11: Nuclear Chemical

Explosives chemicals such as

Pictures → nuclear bomb → Hydrogen bomb → Atomic bomb

Uses: Used in warfare

Slide 12: Agrochemicals

Pictures: Fertilizers, pesticides, herbicides of these fungicides, insecticides etc

Uses: -

- For increasing soil fertility
- Killing of pests
- Killing of weed

Slide 13: Industrial chemicals

Printing ink, textile chemicals

Uses: Industrial production of books

Industrial production of clothes

Slide 14: Laboratory chemicals

Acid, base salts

Uses: To perform experiments

Slide 15: Classification of Chemicals Based on Their Hazardous Nature

A hazardous chemical is any substance that can cause harm or damage to people.

Slide 16: highly hazardous and toxic

- Choloroform
- Hydrogen cyanide
- Benzene
- Pyridine

Moderately hazardous and toxic

- Alcoholic
- Caustic soda
- Caffeine
- Herbicides

Slide 17: Non-Hazardous and non – toxic

- Common salt (sodium chloride NaCl)
- Water
- Bakery soda

Slide 18: Chemical Danger Symbols

Symbol	**Meaning**
	Poison or danger
	Flammable chemicals e.g. petrol
	Explosive chemical e.g. Atomic bomb
	Corrosive chemical e.g. Acid
	Chemical weapons e.g. tear gas, pepper spray

Slide 19: Safety Measures to be observed when using chemicals

i. Adherence to manufacture's safety instructions

ii. Following safety guidelines for chemical storage and handling

iii. Ensure proper labeling and storage of chemicals

iv. Adherence to safety signs on chemical packages

v. Wearing of protective glasses

vi. Keeping chemicals out of the reach of children

Formative Assessment

(1) Which of the following is not a chemical substance

A. Stone X – right it is not a chemical but a matierla

B. Paint √ a chemical

C. Gold √ a chemical

D. Sugar √ a chemical

(2) A chemical substance can exist in the form of:

i. Solid

ii. Liquid

iii. Gas

A. I only x wrong (chemical exists in solid liquid and gas)

B. I &II only x Wrong

C. I, II and III √ right (Chemical exist in Solid liquid and gas)

D. IIII only X Wrong

(3) A chemical is any substance that is produced by chemical process

Yes √ correct (It is any substance that is produced by chemical process)

No √Wrong (It is any substance that is produced by chemical process)

(4) An example of a chemical compound is _____

A. Aluminum X wrong (Aluminum is an element)

B. Chlorine X wrong (chlorine is an element)

C. Gold X Wrong (Gold is an element)

D. Water √ correct (water is a compound)

(5) An example of a chemical element is _____

A. Iron - √ Correct (is a chemical element)

B. Sugar X wrong (is a compound)

C. Water X Wrong (is a compound)

D. Salt X wrong (is a compound)

(6) Which of these is an agrochemical?

A. Perfumes X wrong (this is a cosmetics, right answer is fertilizer)

B. Drugs X Wrong (this is a pharmaceutical, right answer is fertilizer)

C. Fertilizer √ correct

D. Body cream X Wrong (this is a cosmetics, right answer is fertilizer)

(7) Chemicals are classified into two major categories

A. intended uses and Hazardous uses √ correct

B. Liquid uses and solid uses

C. Solid uses and gas use

D. Liquid uses and gas uses

(8) Which of the following statements regarding chemicals is false?

A. They used to be corrosive

B. They can be flammable

C. They constant compositions

D. They are not useful to man

(9) Each class of hazardous chemical has a warning pictorial symbolwhich is ____

A. Craft mark

B. Trade symbol

C. Danger symbol

D. Chemical Symbol

10. This symbol means

A. Danger

B. Flammable

C. Friendly

D. Corrosive

STUDY TWO

CONTENTS

Slide1: Topic: energy, work and power

Instructional Objectives: By the end of this study, student should be able to:

- explains, energy, power and word
- explain potential energy and kinetic energy
- explain work done W = F x d
- apply the formular power as $\frac{\text{Workdone}}{\text{Time}}$

Slide 2:

Pictures to show Energy is the ability to do work

Pictures to show Work is said to be done when a body or an object moves in the direction of a force applied to it.

Pictures to show exhibition of power: Definition of Power?

Power is the rate of doing work

Slide 2: Potential Energy

Potential energy is the energy that a body has by the virtue of its position.

Potential Energy (PE) = Mass x acceleration due to gravity x height

P.E = mgh. Potential Energy is measured in (joules) J

Pictures to explain P.E

DIAGRAM

Examples

1. A stone of mass 20kg is lifted to a height of 3m. Take g=10mls^2 Calculate P.E at this point?

Solution

Mass of store (m) 20kg

Height = 3m

g (acceleration due to gravity) = 10mls^2

P.E (Potential Energy) = mgh

= mx g x h

20 x 3 x 10 = 600J

2. Calculate the potential energy of a rock with mass of 5kg sitting on a cliff that 7m high. (Take g = 10mls^2)

Solution

m = 5kg

g = $10mls^2$

h = 7m

P.E = mgh

= 5 x 7 10

= 450J

KINETIC ENERGY

Kinetic energy is the energy that a body has because of its motion. The kinetic energy (K.E) of an object depends on its mass and velocity.

Kinetic energy = ½ mv^2

K.E = Kinetic energy measured I Joules (J)

M = Mass of the body in kilogram

V = Velocity of the body in M/S

K.E = 1/2 MV^2

= ½ x 100 x 10^2

½ x 100 x 100

5000J

2. The K.E of a ivory is 100J with mass of 50kg what is its velocity when travelling?

K.E = 100J

M = 50Kg

V = ?

K.E = ½ MV^2

100 = 25 x V^2

$\frac{100}{25} = V^2$

$V^2 = 4$

$V = \sqrt{4} = 2$

V = 2mls

Work

Work is defined as the product of the force and the distance moved in the direction of the force.

Force is measured in Newton (N)

Distance is measured in metre (M)

Work is measured in Joule (J)

Examples:

1. How much work is done by a body who pushes a load of 50N through a distance of 2m?

Solution:

F = 50N

D = 2m

Workdone = 7

Workdone = f x d

W = 50 x 2

W = 100J

2. Calculate the workdone by a man of 60 kg in climbing a ladder of 3m high (take g = $10ms^{-1}$)

Solution

W = F x d

F = ma

M = 60kg

D = 3m

F = 60 x 10

600

g = $10ms^{-1}$

f= 600N

W = f x d

W = 600 x 3

W = 1800J

POWER

Power is defined as the rate of doing work.

$$\text{Power} = \frac{\text{Workdone}}{\text{Time}}$$

S.I unit of power is Watt (W)

Example

1. The workdone by a student is 600N in 35. Calculate the workdone?

$$\text{Power} = \frac{\text{Workdone}}{\text{Time}}$$

P = 200W

THERMAL ENERGY

Slide 1: Thermal energy or heat energy is the energy that is associated with the movement of molecules. It is a measure of the kinetic energy of the molecules of a substance due to its internal energy.

Internal energy of a substance is the sum of the kinetic energy and potential energy of the particles that make up the substance.

Heat

Picture

Heat flow

In touch, heat transfers from a heated body to a cold body which refers to as heat flow.

Picture;

Pot with hot water

Pot with water

Heat transfer from hot tocold until theboth pots are at thesame temperature.

Process of heat transfer

Process of heat transfer occur in three ways

i. Conduction
ii. Convection
iii. Radiation

Conduction

It is the process by which heat is transmitted through a medium from its hotter part to its colder part until they are both at the same temperature.

Picture

Convection

Convection is the transfer of heat by the movement of a fluid or a gas

Picture

The knowledge of convention is applied in the installation of air-conditioners in homes and in offices

Radiation

Radiation is a method of heat transfer whereby heat energy is transmitted from a hot object to another in the form of infra-red rays (Electromagnetic waves).

This process does required medium. It can take place in a vacuum (empty space)

Picture

FORMATIVE ASSESSMENT

1. Workdone is measured in _____
    a. Metres
    b. Kilogramme
    c. Joules
    d. Centimetres
2. Energy due to motion is called _____
    a. Kinetic energy
    b. Sand energy
    c. Bitumen energy
    d. Classroom energy
3. Stored energy or energy due to position is known as _____
    a. Movement energy
    b. Standing energy
    c. Potential energy
    d. Electrical energy
4. The rate at which work is done is _____
    a. Workdone
    b. Power
    c. Litter
    d. Automobile
5. The formular for calculating power is _____
    a. $\frac{\text{Joule}}{\text{Time}}$
    b. $\frac{\text{Energy}}{\text{Time}}$
    c. $\frac{\text{Work}}{\text{Time}}$
    d. $\frac{\text{Time}}{\text{Work}}$
6. The ability to do work is _____
    a. Force
    b. Power
    c. Energy

d. Length

7. Heat energy is transferred by radiation through
    a. Metal
    b. Plastics
    c. Water
    d. Vacuum
8. Conduction cannot take place in a _____
    a. Vaccum
    b. Metal spoon
    c. Metal rod
    d. Metal plate
9. When a substance is heated its particles _____
    a. Move slowly
    b. Move fast
    c. Remain stationary
    d. Lose kinetic energy
10. The mode of heat transfer that requires no medium is _____
    a. Conduction
    b. Convection
    c. Radiation
    d. Generation

STUDY THREE

PETROCHEMICALS AND CRUDE OIL

Crude Oil: Crude oil is a dark viscous liquid, fossil fuel found deposited at oil reserves. It is formed from sea plants and animals that were dead and buried over millions of years ago by sediments, sand, silt clay and mud.

Refining of Crude Oil

Crude oil is a dark oily liquid formed by remains of dead marine plants and animals buried. The crude oil (petroleum) obtained directly from the oil well is a mixture of many hydrocarbons

Pictures

After loading the crude oil into the fractionating column. It is first pre-heated to a temperature to about 500^0C – 600^0C in an electric furnace to vaporized the crude oil. The mixture of vapourised crude oil and liquid crude oil flows into the bottom of the column. The condensed liquids are collected through the side steam pipes in fractions at different boiling points.

Further re-distillation of various fractions obtained from the fractionating column produces different types of solvent, grease and fuels such as kerosene, engine oil, machine oil, etc. These petroleum fractions are used to produce petrochemicals such as nylon, plastics, synthetic rubber, paints etc.

Pictures

Uses of crude oil (Petroleum product) crude oil

	Product	Uses
1.	Liquefied petroleum gas	Used in homes as fuel for cooking Used in manufacturing of hydrogen and other compounds
2.	Gasoline (Petrol)	Fuel for cars, generators etc
3.	Kerosene	Fuel for cooking For lightning For aviation (jet) engines
4.	Petroleum ether	Used as organic solvents
5.	Lubricating oil (Grease)	Used as lubricant for machine parts, fro making candles hair and body creams
6.	Diesel oil	Fuel for generators and diesel engines (automobiles)
7.	Bitumen (asphalt)	Used for coating of road surfaces, building roofs and water pipes

Importance of crude oil to Nigeria

1. It provides huge foreign exchange for Nigeria and serves as her major source of income
2. It provides job opportunities through activities such as oil drilling, refining transportation, manufacturing (petrochemicals) and marketing.
3. It is the major source of raw materials for the manufacturing of petrochemicals

Petrochemicals

Petrochemicals are useful substances produced from chemicals obtained from crude oil and natural gas.

Examples of Petrochemicals

1. Rubber
2. Synthetic
3. Nylon
4. Plastics
5. Benzene

User of Petrochemicals

	Petrochemicals	Uses
1.	Ethane	For making plastics, polythene
2.	Butadiene	For making synthetic rubber which is used to make tyres
3.	Vinyl chloride	For making poly vinyl chloride (PUC)
4.	Isopropanol	For making paint solvent
5.	Stryrene	For making rubber and plastics
6.	Ethylene glycol	For making textile fibres
7.	Vinyl acetate	For making paper, textile coatings and paints
8.	Insecticides	For controlling (killing) invest, pests
9.	Drugs	For curing of ailments in human beings and animals

Importance of Petrochemicals

1. They serve as major sources of raw materials for manufacturing industries
2. They provide sources of income to people
3. They are used for as laboratory reagents for science practicals

ASSESSMENT

1. Among these, which is not a petrochemical
    a. Nylon
    b. Benzene

c. Plastics
d. Water

2. The refined crude oil products used as aviation fuel is _____
    a. Bitumen
    b. Palm oil
    c. Kerosene
    d. Ethane
3. Crude oil is a mixture of _____
    a. Silt
    b. Clay
    c. Hydrocarbons
    d. Dead animals
4. The following are importance of crude oil except _____
    a. Provision of employment
    b. Industrialization
    c. Distillation
    d. Provision of energy
5. Among the following, which is not a petrochemical fraction
    a. Engine oil
    b. Cars
    c. Petroleum ether
    d. Ethane
6. Major source of hydrocarbons is _____
    a. Crude oil
    b. Yam flour
    c. Kerosene
    d. Pencils
7. Pencils of examples of petrochemical s _____
    a. Ethene
    b. Water
    c. Sand
    d. Chairs
8. Making uses vinyl chloride for……
    a. PVC

b. PPC
c. AAP
d. PDP

9. One of the uses of kerosene as crude oil product is _____
    a. Cooking
    b. Bathing
    c. Farming
    d. Raining
10. One of the importance of crude oil to Nigeria is _____
    a. It provides huge foreign exchange
    b. It provides wood cooking
    c. It provides water for farming
    d. It gives food

Appendix XV

KEYS TO ACHIEVEMENT TEST

1) D	21) B
2) B	22) B
3) C	23) B
4) A	24) C
5) C	25) A
6) A	26) B
7) B	27) C
8) C	28) C
9) D	29) B
10) A	30) A
11)A	31) A
12) B	32) C
13) C	33) A
14)A	34) B
15) A	35) B
16) B	36) D
17) C	37) C
18) A	38) C
19) A	39) C
20) B	40) C

Appendix XVI

KEYS TO STUDY 1 -3

STUDY I

1) A

2) C

3) YES

4) D

5) A

6) C

7) A

8) D

9) D

10) B

STUDY 2

1) B

2) A

3) C

4) B

5) C

6) C

7) A

8) A

9) B

10) C

STUDY 3

1) D

2) C

3) C

4) B

5) B

6) A

7) A

8) A

9) A

10) A