EFFECT OF SEEK APP ON SECONDARY SCHOOL STUDENTS' INTEREST AND ACHIEVEMENT IN ECOLOGY IN OVIA NORTH EAST LOCAL GOVERNMENT AREA

Eseosa Ehidiamen OAMEN
PG/EDU 1708750
B.Sc.Ed, (UNIBEN)

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CERTIFICATION

We, the undersigned, certify that this research was carried out by **Eseosa Ehidiamen OAMEN**, in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Nigeria.

_____ _____

HRH Prof. S.E.O. Aduwa-Ogiegbaen **Date**

(Supervisor)

_____ _____

Prof. F. O. Idehen **Date**

(Head of Department)

DEDICATION

I dedicate this work to God Almighty (Sweet Jesus). My creator and my pillar of hope for seeing me through this degree.

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ABSTRACT

This study investigated the effect of the Seek App on students' interest and achievement in Ecology among senior secondary school students in Ovia North East Local Government Area. The study was prompted by the need to enhance students' engagement and performance in Ecology, a subject often regarded as abstract and challenging to relate to real-life environmental issues.

Anchored on Constructivist learning theory, the research adopted a quasi-experimental design involving 68 SS I students drawn from two intact classes in co-educational schools. The experimental group received instruction through the Seek App, while the control group was taught using the conventional lecture method. Data were collected using the validated Ecology Achievement Test (EAT) and Ecology Interest Inventory (EII), with reliability established through internal consistency and Cronbach's Alpha values of 0.74 and 0.81 respectively. Descriptive and inferential statistics, including mean, standard deviation, independent t-test, and Analysis of Covariance (ANCOVA), were used for data analysis at a 0.05 level of significance.

The findings revealed no significant difference in pretest mean scores between the experimental and control groups, indicating similar entry behavior prior to treatment. Posttest results showed that students taught using the Seek App had higher mean achievement scores compared to those taught conventionally, although the difference was not statistically significant. A significant difference was, however, observed in students' interest levels, favoring the experimental group, thereby confirming the positive influence of the Seek App on learners' motivation and engagement. Furthermore, no significant difference was found between male and female students in both achievement and interest, and no interaction effect was observed between gender and instructional method. The study concluded that mobile-assisted instruction through the Seek App enhances students' interest and supports learning outcomes in Ecology irrespective of sex. It recommended the integration of mobile learning tools into the Biology curriculum, the provision of adequate technological infrastructure by schools and educational authorities, and regular teacher training on the use of mobile learning technologies. The research contributes to knowledge by providing empirical evidence of the effectiveness of mobile-assisted learning in improving interest and learning experiences in Ecology. It also emphasizes the inclusive nature of such technologies, as sex had no moderating effect on outcomes. Future research should replicate the study in other geographical locations to validate the findings, investigate the long-term effects of the Seek App on knowledge retention, compare different mobile learning applications, examine the influence of teacher technological competence on learning outcomes, and explore the broader impact of mobile learning on students' environmental attitudes and behaviors.

CHAPTER ONE

INTRODUCTION

Background to the Study

In recent decades, many developing countries, including Nigeria, have made significant efforts to embrace technological innovation in education. As the world continues to evolve digitally, mobile devices such as smartphones and tablets have emerged as essential tools for communication, information access, and most importantly, learning (Asadullah, Faik & Lim, 2023). These technological transformations have brought about a paradigm shift in the delivery of education from the conventional teacher-centered, classroom-based instruction to more dynamic, flexible, and learner-centered methods such as e-learning and its more portable variant, mobile learning (m-learning). This shift is a major concern of Instructional Technology, a field that focuses on designing, implementing, and evaluating technology-based teaching and learning processes to enhance educational effectiveness. Among the disciplines affected by this transformation is Biology, a science subject that plays a critical role in understanding the natural world and preparing students for careers in the health sciences, agriculture, biotechnology, and environmental management. Instructional technology offers solutions to the persistent instructional challenges in science education by integrating digital tools that promote active learning, engagement, and accessibility.

According to Balasubramanian (2019), Biology is the science of life. Ecology is a sub-theme of Biology. It deals with the study of interactions among organisms and their biophysical environment. This biophysical environment includes both biotic and abiotic components. The

word "ecology" ("Ökologie") was coined in 1866 by the German scientist Ernst Haeckel. It is derived from the Greek words *Oikos* – home + *logos* – study. The biophysical environment in which all interactive mechanisms happen is called an ecosystem. Since the ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscapes, work together to form a bubble of life, Earth science becomes the backbone of ecology (Balasubramanian, 2019). Musa (2025) defined Ecology as the interconnectedness of all living organisms and their environment, underscoring the importance of understanding these relationships for the conservation and management of ecosystems.

According to Adodo (2013), in Nigeria, the challenges of Science Education, particularly Biology, are well documented. Despite Biology's central role in understanding life and its interconnected systems, which makes it foundational to careers in health sciences, agriculture, and environmental management, student achievement trends in the subject remain persistently low (Eromosele, 2017). Biology is a broad field with numerous abstract topics, with Ecology, in particular, posing notable challenges to both students and teachers. According to studies by Anidu and Pius (2022), various science educators have expressed concern over the poor academic achievement of students in this topic in senior secondary schools for the past decades. Many factors have been attributed to the poor achievement and lack of interest in Ecology. Anidu and Pius (2022) presented the following as prominent factors contributing to the noticed poor achievement and interest in Biology: the teaching methods used by Biology teachers; learning methods adopted by students; the difficult nature of the topics/concepts; lack of equipment and instructional materials.

These challenges point to a need for more effective instructional strategies and technologies that can support better learning outcomes. The continued reliance on traditional lecture methods, typically marked by passive learning, rote memorization, and minimal interaction, limits students' ability to fully grasp and retain complex scientific ideas (Toh & Tasir, 2024; Sung et al., 2016). Similarly, Wakhidah (2017) reported that learning about ecological concepts such as environmental pollution through lecture-based methods is less effective and makes students less interested. Despite the limitations of these approaches, many teachers believe they are their only options. This reflects a gap in the adoption and integration of instructional technology tools that can enhance student engagement and conceptual understanding. Importantly, these methods often ignore the affective domain of learning, particularly the role of student interest, which is a critical determinant of motivation, engagement, and academic achievement.

Teaching methods play a vital role in increasing interest and improving academic achievement. According to Harackiewicz, Smith and Priniski (2016), interest is both a psychological state of focused attention and a predisposition toward particular subject matter. It serves not only as a catalyst for initial engagement but also reinforces deeper learning and long-term retention. In the context of Science Education, and especially from an instructional technology perspective, fostering interest is crucial as it helps students overcome anxiety and cognitive resistance to abstract scientific topics. Instructional technologies such as interactive apps, simulations and mobile learning platforms have been shown to stimulate this interest and improve learning outcomes.

Musa (2025) and Usman (2022) found that in Nigeria, national examination reports such as those from the West African Examinations Council (WAEC) and National Examinations Council

(NECO) (2015–2021) have consistently highlighted poor student achievement in Ecology and other complex Biology topics. These results reflect not only inadequate comprehension but also a deeper lack of interest and engagement with scientific content. The low achievement may also be traced to factors like a shortage of qualified Biology teachers, inadequate instructional materials, and limited access to effective instructional technologies and pedagogical tools (Adodo, 2013). Recent studies have also shown that students struggle to apply ecological concepts to real-life situations, leading to low interest and poor learning outcomes. For example, Nwachukwu, Onyebuchi, Agbo et al. (2024) identified challenges such as inadequate instructional materials, insufficient practical experiences, and limited teacher competence as significant barriers to effective Ecology Education. These issues prevent students from relating what they learn in the classroom to real-world ecological systems. Likewise, Eromosele (2023) found that conventional lecture-based approaches were ineffective for teaching Ecology, while students exposed to field-based instruction demonstrated significantly better conceptual understanding. A study by Abimbola and Abidoye (2013) revealed that many Biology teachers in Kwara State either skipped or inadequately covered difficult ecological topics due to perceived instructional challenges, further compounding students' difficulties in grasping key ecological concepts.

Against this backdrop, the integration of mobile learning has been proposed as a viable solution to these pedagogical shortcomings. Mobile learning is defined as the use of mobile digital devices for educational purposes and is a growing area within Instructional Technology. Mobile learning facilitates flexible, contextual, and interactive learning experiences. According to McQuiggan, McQuiggan, Sabourin and Kosturko (2015), mobile learning tools such as smartphones and tablets have transformed everyday life and can similarly revolutionize educational practices by promoting collaboration, communication, and critical thinking.

Applications like Seek by iNaturalist, which run on mobile devices and use image recognition to identify species and provide ecological information, have the potential to bridge the gap between theoretical learning and real-world observation.

Interest and academic achievement, the two core variables of this study are closely linked to the effective integration of instructional technology, particularly mobile learning tools, in Biology education. Research indicates that mobile learning enhances student interest by increasing interactivity, fostering autonomy, and making learning experiences more personally meaningful (Bone, Cochrane, Narayan et al., 2022; Diacopoulos & Crompton, 2020). When students are actively engaged through technology, they are more likely to express curiosity, pose questions, and pursue deeper understanding. This heightened interest positively influences academic achievement, as interested students tend to invest greater effort, dedicate more time to learning tasks, and achieve higher assessment outcomes (Chee, Yahaya, Ibrahim & Hasan, 2017).

Student interest itself is shaped by an interplay of internal and external factors. Internally, curiosity, intrinsic motivation, prior knowledge, and individual learning styles all contribute to a student's disposition toward interest in a subject. Prior knowledge helps anchor new information, making it more relatable and easier to integrate, while learning styles influence how students best absorb and process information, whether through visual, auditory, or hands-on activities. These factors can be addressed and enhanced through the thoughtful application of instructional technologies tailored to diverse learning needs.

Externally, the learning environment plays a significant role in stimulating interest. Classrooms that promote exploration, encourage questions, and provide emotional and cognitive support are more likely to engage students. Social interactions such as collaboration with peers and feedback

from teachers further enhance interest by creating a sense of community and shared purpose. Additionally, the use of relevant and well-designed instructional technology tools, such as mobile applications tailored to ecological content, can capture attention, cater to diverse preferences, and provide real-time engagement opportunities.

Beyond interest and achievement, other variables may influence the effectiveness of mobile learning in Ecology. Student motivation which could be defined as the internal drive to learn and achieve, can either reinforce or inhibit engagement with digital tools. Similarly, technological self-efficacy, or students' confidence in using mobile learning tools, may determine how effectively they utilize applications like Seek. Digital literacy, the ability to navigate and meaningfully engage with digital platforms, is also a key determinant of successful learning outcomes. From the educator's side, teacher competence in integrating instructional technology is critical, as it shapes how mobile learning is delivered and managed. Moreover, demographic factors such as gender may serve as moderating or mediating variables that influence how students benefit from technology-enhanced learning environments.

Furthermore, mobile learning promotes constructivist learning environments, where students build knowledge through exploration, collaboration, and real-time feedback (Nguyen, Barton & Nguyen, 2015). For a topic like Ecology, which benefits from outdoor and experiential learning, mobile learning can allow students to connect classroom knowledge with environmental observations, thereby reinforcing conceptual understanding and retention. The ability to instantly identify organisms in the field using Seek, for instance, can help demystify scientific nomenclature and taxonomy, making learning more interesting and less intimidating.

Additionally, issues of gender disparity have also surfaced in science education. A study by (Tandi & Njigwum, 2022) suggest that boys tend to outperform girls in science-related subjects, others, such as the United Nations Educational Scientific and Cultural Organization, UNESCO (2017) report, argue that gender achievement gaps are narrowing and often influenced more by socio-cultural factors than innate ability. Integrating mobile learning may offer a more equitable platform for learning by accommodating diverse learning styles and promoting inclusion, especially for students with disabilities or those in marginalized communities (Cárdenas & Inga, 2020).

Based on the above, the low interest and poor academic achievement in Biology, especially in topics like Ecology indicates a need for pedagogical reform in Nigerian secondary schools. Conventional teaching methods often fail to stimulate interest or connect scientific content to students' lived experiences. In response, mobile learning presents a promising pedagogical approach capable of transforming science education by making it more interactive, accessible, and personally relevant. Leveraging digital learning tools allows students to engage with biological concepts through real-time observation, gamification and contextualized learning, which may bring about understanding and sustained interest.

One of such mobile learning tool is Seek by iNaturalist, a free mobile application developed by the iNaturalist team in collaboration with the California Academy of Sciences and National Geographic. Seek uses image recognition technology to help users identify plants, animals, fungi, and other organisms in their immediate environment through their smartphone camera. It encourages active learning by prompting students to observe and document real-world ecological phenomena, earn achievement badges, and explore local biodiversity. The mobile app supports experiential learning, stimulates curiosity and bridges the gap between theoretical knowledge and

environmental observation making it highly suitable for teaching Ecology. Seek is freely available for download on both Android (via Google Play Store) and iOS (via Apple App Store), making it widely accessible to students and educators.

This study, therefore, seeks to examine the effect of using the Seek app on student interest and academic achievement in Ecology among senior secondary school students in Ovia North East Local Government Area.

Statement of Problem

Biology is a science subject in Nigeria's Senior Secondary School curriculum and serves as a gateway to numerous science-related disciplines, including medicine, agriculture, environmental science, and biotechnology. Among its various sub-themes, Ecology is particularly significant in light of contemporary global concerns such as climate change, environmental degradation, biodiversity loss, and sustainability. However, despite the importance and growing relevance of Ecology, students' achievement in Biology at the Senior Secondary School level in Nigeria has remained consistently poor over the years.

According to Piwuna and Mankilik (2023), external examination bodies such as the West African Examinations Council (WAEC) and the National Examinations Council (NECO) have repeatedly reported students' weak achievement in Biology for more than 20 years, using phrases like "not satisfactory," "downward trend," "abysmal/dismal achievement," "decline in pass rate," "fluctuating achievement," and "persistent failure" (Chief Examiners' Reports, 2016, 2017, 2018), especially in complex topics like Ecology. These reports suggest that many students find the concept difficult to grasp, contributing to widespread failure and declining interest in the subject.

Several studies have attempted to identify the root causes of this poor achievement. A growing body of research highlights the lack of engaging instructional methods as a significant factor. For example, Ndayambaje, Bikorimana and Nsanganwimana (2021) noted that Biology lessons are often delivered in a non-interactive, teacher-centered manner, limiting students' active participation, interest, and deep understanding. Supporting this, Abiodun, Daodu and Eniolorunda (2024), in a study conducted in Kabba Metropolis, Kogi State, Nigeria, found that Biology instruction in many schools fails to incorporate student-centered strategies, particularly when dealing with abstract topics like Ecology. Consequently, students often struggle to connect theoretical knowledge with real-world applications, leading to low academic achievement and reduced interest.

Despite various efforts by educators, policymakers, and curriculum developers to improve science teaching and learning outcomes, progress has been minimal. Interventions such as curriculum revisions and teacher workshops have had limited impact on transforming classroom practice. One critical gap that persists is the under-utilization of instructional technologies, especially mobile learning tools, which have the potential to enhance classroom interactivity**,** support differentiated instruction, and bridge the gap between teacher delivery and student engagement.

Instructional Technology as a field focused on the design, development, and integration of technology to improve teaching and learning, offers valuable frameworks for addressing these issues. In particular, mobile learning provides a promising avenue for improving Biology instruction, especially in resource-constrained settings. The increasing availability of smartphones and mobile applications among Nigerian youth presents an opportunity to transform

Biology education through interactive, multimedia-based learning that is learner-centered, contextual, and engaging.

However, while mobile technologies have been successfully integrated into educational systems in many parts of the world, there is limited empirical evidence on their effectiveness in improving students' interest and achievement in Ecology instruction within in Nigeria.

Therefore, this study seeks to fill this critical gap by investigating the effect of Seek app on the interest and academic achievement of Senior Secondary School students in Ecology. By evaluating how mobile-assisted instruction can enhance student engagement and learning outcomes in a traditionally challenging topic, this research aims to contribute to the development of more effective, technology-driven instructional strategies for Biology education.

Research Question

The following research questions are raised to guide the study:

1. Is there a difference in mean interest scores of students taught ecology using seek app and those taught using conventional teaching methods?
2. Is there a difference in mean achievement scores between students taught ecology using seek app and those taught using conventional teaching methods?
3. Is there difference in mean interest scores of students' taught ecology using seek app based on sex?
4. Is there difference in mean achievement scores between students' taught ecology using seek app based on sex?

5. Is there a difference in the pretest and posttest mean achievement scores of students taught with seek app?
6. What is the interaction of seek app and sex on interest scores of students?
7. What is the interaction of seek app and sex on achievement scores of students?

Hypotheses

The following hypotheses will be tested in the study:

1. There is no significant difference in mean interest scores between students taught ecology using seek app and those taught using conventional teaching methods.
2. There is no significant difference in mean achievement scores between students taught ecology using seek app and those taught using conventional teaching methods.
3. There is no significant difference in mean interest scores between students' taught ecology using seek app based on sex.
4. There is no significant difference in mean achievement scores between students' taught ecology using seek app based on sex.
5. There is no significant difference in the pretest and posttest mean achievement scores of students taught with seek app.
6. There is no significant difference in the interaction of seek app and sex on interest scores of students.
7. There is no significant difference in the interaction of seek app and sex on achievement scores of students.

Purpose of the Study

The main purpose of this study is to examine the effect of seek app on interest and achievement of secondary school students.

Specifically, the study aims to;

1. Examine the mean interest scores between students taught ecology using seek app and those taught using conventional teaching methods.
2. Examine the mean achievement scores between students taught ecology using seek app and those taught using conventional teaching methods.
3. Compare the mean interest between students taught ecology using seek app based on sex.
4. Compare the mean achievement scores between students taught ecology using seek app based on sex.
5. Determine whether there is a difference in the pretest and posttest mean achievement scores of students taught seek app.
6. Determine whether there is a difference in the interaction of seek app and sex on interest scores of students.
7. Determine whether there is a difference in the interaction of seek app and sex on achievement scores of students.

Significance of the Study

The results of this study on the effectiveness of mobile learning tool in enhancing students' interest and academic achievement in Ecology will be of great benefit to curriculum developers, school administrators, teachers, researchers, students and parents.

Curriculum developers will gain valuable insights into the role of mobile learning technologies in teaching abstract biological concepts such as Ecology. Findings from this study will guide them in reviewing and updating the Biology curriculum to integrate mobile-based instructional strategies. By incorporating Seek into the curriculum, developers can design more interactive, inquiry-based, and learner-centered content that supports 21st-century education goals. This integration has the potential to transform the teaching of Ecology from a textbook-dominated process into a dynamic, technology-supported learning experience that fosters deeper understanding.

School administrators will benefit from the study by gaining a clearer understanding of the positive impact of mobile teaching on students' interest and academic achievement. This evidence may influence decisions to invest in mobile learning infrastructure, such as mobile devices, educational apps and teacher training programs. Administrators can also use the results to advocate for institutional and policy-level support for integrating mobile technology into science instruction, especially in public secondary schools where traditional resources may be insufficient.

Biology teachers stand to benefit directly from the study as it will reveal best practices for integrating mobile tools into ecology instruction. The findings will provide evidence on how mobile teaching enhances classroom interactivity, supports outdoor and experiential learning, and promotes self-paced inquiry. Teachers will be empowered to adopt innovative strategies that increase student participation and make abstract ecological concepts more tangible and relatable through visual and real-time applications.

Researchers in science education and instructional technology will find this study valuable for expanding the literature on mobile-assisted teaching and learning. It will contribute to ongoing

discourse on technology integration in science subjects and open up new areas for future investigation, such as the long-term effects of mobile learning, the effectiveness of specific applications, or comparative studies across different scientific topics and educational settings.

Students are the ultimate beneficiaries of the study. If mobile teaching is shown to be effective, students will experience a more engaging, personalized, and interactive learning environment. This could lead to improved academic achievement, stronger conceptual understanding of ecology, and enhanced critical thinking skills. Additionally, mobile learning promotes learner autonomy, collaboration, and digital literacy skills that are essential for success in the contemporary world.

Parents will also benefit from this study as it highlights how mobile technologies can be used for educational purposes beyond entertainment or social interaction. By understanding the academic value of mobile learning, parents may become more supportive of its use at home, fostering a collaborative environment where learning continues outside the classroom.

This study underscores the transformative potential of Seek app in Ecology. It offers practical implications for improving teaching strategies, curriculum design and educational policy, while ultimately contributing to better learning outcomes for students.

Scope and Delimitation of the Study

The study examines the effect of a mobile learning tool, Seek app by iNaturalist on secondary school students' interest and achievement in Ecology in Ovia North East Local Government Area. This study will make use of seek app that uses image recognition to help identify organisms, to find out the interest and achievement of students in Ecology. This study will be

delimited to Biology students in secondary schools in Ovia North East Local Government in Benin City, Edo State.

Definition of Terms

The following terms were operationally defined as used in the study:

1. **Mobile learning**: This refers to the instructional delivery method that involves the use of mobile devices (such as smartphones or tablets) and mobile applications to facilitate the teaching and learning of ecology.
2. **Interest**: This refers to students' level of attention, curiosity and motivation to learn ecological concepts.
3. **Academic Achievement**: This represents the students' measurable results or outcomes on a given task.
4. **Sex:** this refers to the biological classification of participants as male or female.
5. **Seek by iNaturalist**: In this study, Seek by iNaturalist is a free mobile application used to enhance the teaching of Ecology by allowing students to identify and learn about living organisms through their smartphone camera. It supports interactive, real-time exploration and is available on both Android and iOS platforms.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter is about the review of related literature on the effect of Seek on secondary school students' interest and achievement in Ecology in Ovia North East Local Government Area. The review of related literature is organized under the following sub-headings:

- Theoretical Framework
- Concept of Seek App
- Concept of Ecology
- Achievement in Ecology among Students
- Interest in Learning Ecology
- Effect of Mobile Learning App on Interest in Ecology
- Effect of Mobile Learning App on Achievement in Ecology
- Achievement and Interest of Students Taught with Mobile Learning App based on Gender
- Summary of Review of Related Literature

Theoretical Framework

The theoretical framework of this study is on Constructivism Learning Theory developed by a Swiss Psychologist, Jean Piaget (1980).

The use of mobile learning tool such as Seek by iNaturalist is well hinged on educational theories that inform their pedagogical effectiveness. One of the primary theories underpinning mobile learning is Constructivism, which posits that learners build knowledge through active engagement with their environment (Sharples et al., 2016). The Seek app facilitates this process by allowing students to explore and identify real-world organisms using image recognition technology. This hands-on experience encourages experiential learning, as students are not merely receiving content passively but actively constructing their understanding of biological concepts through direct interaction with their surroundings.

With roots in Piaget, Kant, Dewey, Freire and others, constructivism has had a large influence on teaching and learning design over the past three decades. Broadly defined, constructivism is the idea that learners make meaning and construct knowledge by reflecting on and interpreting their own and others' experiences. In contrast to constructivism, transmissive or traditional learning is one in which a teacher transmits facts to passive students who are later asked to recall the information through quizzes and tests. On the other hand, constructivism leads to transformative learning. Knowledge is not received but created by the learners, as they continually interpret and act on their experiences. Constructivism emerged in part from the belief that education cannot be separated from the realities of society and that learners are only transformed when active assimilation is embedded in the learning process.

According to Krahenbuhl (2016), constructivism "is an epistemological view of knowledge, arguing that knowledge is derived in a meaning-making process through which learners construct individual interpretations of their experiences and thus, construct meaning in their minds". While,

Tomljenovic &Tatalovic Vorkapic (2020) refer to constructivist theory as contemporary, elements of this theory are found in the work of psychologists and researchers from the early, mid and late 20th century.

While existing literature reveals different positions on constructivist theory, Allen (2022) summarizes the general idea of constructivism with this explanation: “Constructivism is based on the idea that people actively construct or make their own knowledge, and that reality is determined by your experiences as a learner. Basically, learners use their previous knowledge as a foundation and build on it with new things that they learn. So everyone's individual experiences make their learning unique to them”. According to Krahenbuhl (2016), Constructivism is the dominant pedagogical theory in contemporary educational circles. Similarly, Lombardi and Shipley (2021) state, that the construct of active learning permeates education in Science, Technology, Engineering and Mathematics.

Related to teaching practice, is the physical structure of classrooms and learning spaces. Jones and Brader-Araje (2002) report that social constructivism has led to the change in classroom layout, from the individual study carried to group learning spaces, flexible seating arrangements, science stations and mathematics centers. Some time ago, Rands and Gansemer-Topf (2017) connected the concept of classroom design with student engagement. In their study, they found that the active learning classroom (ALC), featuring a more flexible, open classroom design where seating is not fixed and tables and workspaces are not stationary, led to increased student engagement (Rands & Gansemer-Topf, 2017). Specifically, they found that with this design, students felt more connected with their instructor and peers and experienced a greater feeling of community. This design “made students feel valued as co constructors of knowledge” and they saw the teacher as a facilitator of learning (Rands & Gansemer Topf, 2017). As highlighted

above, co-construction of knowledge and the teacher as a facilitator are both key tenets of constructivism. The availability and usage of educational technologies has grown significantly over the past several years. According to Fortune Business Insights, the edtech market has grown and is projected to continue to grow tremendously (Global Newswire, 2022).

Even more relevant for this literature review than the growth of the edtech market is the nature of these new technologies and their purpose in the classroom. Education technologies today have the potential to improve student engagement and learning by enabling constructivist pedagogy, particularly in the areas of active learning, social learning, knowledge creation and student meaning-making. Zhai et al. (2019) examined the application of a constructivist learning solution leveraging mobile technology. This study aimed to determine the frequency of and functions accessed on the mobile devices of physics students. It was found that a positive correlation between using technology that promoted constructivist pedagogy and student achievement. Student achievement increased as students used technologies that promoted student agency in initiating and leading learning.

As revealed by the literature reviewed, examples of educational technologies that promote constructivist pedagogy include Google Jamboard (Ahshan, 2022), Yellowdig (Martin et al., 2017) and Kahoot! (Wang & Tahir, 2020).

Furthermore, the use of Seek would support Inquiry-Based Learning, a key element of Constructivist pedagogy, by prompting users to investigate, ask questions and draw conclusions based on immediate feedback provided by the app. For example, when a student photographs a plant or insect and receives its classification, they are encouraged to explore further, linking the identification to broader ecological or scientific contexts which helps to deepen their understanding.

Thus, the integration of Seek in educational settings is not only technologically innovative but also pedagogically sound. By aligning with constructivist and socio-cultural principles, it enables learners to engage with content in an active, contextualized, and socially relevant manner. Educators who design mobile learning experiences with these theoretical underpinnings are more likely to foster deeper engagement, critical thinking, and meaningful learning outcomes.

Concept of Seek App

Mobile learning, often referred to as M-learning, represents a modern approach to education that enables learning across diverse contexts through the use of portable electronic devices such as smartphones and tablets. It extends the traditional boundaries of e-learning and distance education by emphasizing flexibility, accessibility, and learner-centered engagement. Scholars such as Mehdipour & Zerehkafi (2017) and Spencer-Smith & Roberts (2019) describe mobile learning as a dynamic form of education that supports continuous interaction between learners, content, and real-world environments. Similarly, Crompton, Muilenburg, and Berge (2013) defined it as "learning that occurs across multiple contexts, facilitated by social and content interaction through personal electronic devices". Through such affordances, mobile learning fosters autonomy, motivation, and experiential learning by enabling students to access educational content, collaborate, and engage with their surroundings in authentic and meaningful ways.

Within this broader framework of mobile learning, the Seek app, developed by iNaturalist in collaboration with the California Academy of Sciences and the National Geographic Society, stands out as an innovative tool that connects people with nature through the use of artificial

intelligence and image recognition technology (iNaturalist, n.d.-b). The central goal of the Seek app is to cultivate environmental curiosity and awareness by providing users with instant information about living organisms in their immediate surroundings. It achieves this through a seamless blend of image recognition, gamification, real-time feedback, and offline functionality, all of which make it a student-friendly and highly engaging learning tool. The app is designed to inspire users to explore their natural environment, observe biodiversity firsthand, and deepen their understanding of ecological systems.

The Seek app operates through advanced image recognition technology that allows users to identify plants, animals, and fungi using the camera on their mobile devices. Once the app is launched, the user points their smartphone camera toward an organism of interest, and the app's built-in artificial intelligence system analyzes its visual features such as shape, color, and texture. These features are compared to a vast database of previously identified organisms, and the app progressively classifies the organism through the seven Linnaean taxonomic ranks: kingdom, phylum, class, order, family, genus, and species. When all taxonomic levels are matched, the complete scientific identification of the organism appears on the screen. The user can then capture the image, save it under their "My Observations" collection, and access detailed information about the species, including its ecological role, distribution, and conservation status (Irwin, 2018). This process, which combines observation, analysis, and feedback, aligns directly with the core principles of ecological learning by transforming ordinary encounters with nature into structured opportunities for inquiry-based exploration.

In ecological learning, students are encouraged to observe, classify, and interpret natural phenomena, and the Seek app effectively facilitates these activities. By engaging learners in the process of identifying and documenting local species, the app promotes direct interaction with the natural environment, thereby strengthening their understanding of biodiversity and ecosystem interdependence (Boone & Basille, 2019). The immediate feedback provided by the app allows learners to connect observed characteristics to scientific concepts in taxonomy and ecology, helping them develop key observational and analytical skills. In field-based learning contexts, Seek supports experiential learning by allowing students to investigate questions such as the distribution of particular species, seasonal variations, or the effects of human activity on local habitats. As learners record their findings, they construct a personal digital database of species observations that not only enhances reflection but also encourages long-term engagement with the natural world.

The app's gamified elements further reinforce learning and motivation. Seek awards badges and milestones as users identify specific groups of organisms or complete discovery challenges, turning the learning process into an enjoyable and rewarding experience (iNaturalist, n.d.-b). This integration of play and learning supports intrinsic motivation and sustained participation, which are essential for ecological literacy development. The app's ability to function offline also makes it highly effective in outdoor environments, especially in rural or remote areas where internet connectivity is unreliable. Its intuitive interface and privacy-conscious design requiring no user account or personal data makes it accessible to learners of different ages and technological competencies, thereby promoting inclusive participation in environmental education.

Seek app's relationship with ecological learning extends beyond individual exploration. It also connects users to a global community of citizen scientists through its companion platform, iNaturalist. Learners who wish to deepen their engagement can create an iNaturalist account to share their observations with experts and enthusiasts around the world. This networked system contributes to global biodiversity databases, some of which are used in academic research and environmental monitoring. As of 2022, iNaturalist had recorded more than 129 million observations, with over half being research-grade entries that have informed numerous scientific studies (Irwin, 2018; iNaturalist, n.d.-b). Through this integration, students are not only passive learners but active contributors to real-world ecological knowledge, embodying the principles of participatory and inquiry-driven education.

The use of the Seek app in ecological learning settings also helps address what Boone and Basille (2019) describe as "biodiversity blindness," a growing disconnection between humans and their natural environment due to urbanization and technological dependence. By encouraging learners to interact directly with nature through technology, the app reawakens interest and nurtures a sense of environmental stewardship. Students begin to notice patterns in local biodiversity, understand species' ecological roles, and appreciate the delicate balance of ecosystems. This experiential approach complements classroom instruction, bridging theoretical knowledge and practical understanding of ecological concepts such as adaptation, interdependence, and conservation.

Despite its many advantages, the Seek app is not without limitations. Its accuracy in species identification may be affected by environmental factors such as poor lighting or limited image clarity. Additionally, some species, particularly rare or region-specific ones, may not yet be well represented in its database. The effectiveness of the app in educational contexts also depends on the availability of compatible mobile devices, the digital literacy of students and teachers, and the integration of mobile learning strategies within the curriculum. However, these challenges do not diminish its potential as a transformative educational tool. When thoughtfully implemented, Seek serves as a bridge between technology and nature, offering learners authentic experiences that reinforce ecological concepts and encourage lifelong engagement with environmental issues.

In conclusion, the Seek app represents a powerful application of mobile learning principles to ecological education. Its goal of connecting people with nature through image recognition, gamified interaction, and instant feedback captures the essence of experiential, learner-centered learning. By enabling students to explore, identify, and document biodiversity in their surroundings, Seek transforms abstract ecological theory into tangible experience. The app's combination of artificial intelligence, offline usability, and global collaboration through iNaturalist provides a holistic platform for scientific discovery and environmental awareness. Ultimately, Seek not only enriches ecological learning but also cultivates in learners a deeper appreciation for the natural world and a commitment to its preservation.

Concepts of Ecology

Biology is the natural science that studies life and living organisms, including their physical structure, chemical processes, molecular interactions, physiological mechanisms, development

and evolution. According to the national policy on education (Federal Republic of Nigerian, 2013), learning of biology will provide the students with suitable laboratory and field skills in biology. Biology as a branch of life describes the characteristics and behavior of an organism; how the organism comes into existence and interaction it has with others and with the environment. The word “bio” which means ‘life and “logy” which means “study”. Thus biology is the study of life. Biology is the scientific study of life, encompassing organisms from the molecular level to entire ecosystems. It seeks to understand the diverse forms and functions of living organisms, as well as the underlying mechanisms that govern their behavior (Campbell et al., 2017). The evolution of ecological definitions has undergone a significant transformation from its roots in natural history to its current state as a rigorous scientific discipline. One of the seminal works that contributed to this evolution was Charles Darwin's "On the Origin of Species" published in 1859. In this influential book, according to Darwin as cited by Musa, Duwan & Tsauri (2025) proposed the theory of evolution and introduced the idea of natural selection as the driving force behind it. While Darwin's focus was primarily on the evolutionary aspects of Ecology, his work laid the foundation for a broader understanding of the interconnectedness of organisms and their environment. This marked a critical turning point in the development of ecological thought, shifting the discipline from a descriptive nature to a more analytical and quantitative approach. Ecology as defined by Odum (2017) encompasses the study of relationships and interactions between organisms and their environment. It recognizes the intricate web of interdependencies that exist within ecosystems. These interdependencies involve not only the interactions between organisms themselves but also their interactions with the physical and chemical factors of the environment. Odum et al. (2019) defined ecology as the

interconnectedness of all living organisms and their environment, underscoring the importance of understanding these relationships for the conservation and management of ecosystems.

Ecology is a branch of Biology, dealing with the scientific analysis and study of interactions among organisms and the environment. The teaching of the ecology concept at secondary school level improves students' understanding of the ecosystem. It also enables students to understand how biodiversity (a variety of species of organisms) affects ecological function. Furthermore, ecology concepts seek to explain: life processes, interactions and adaptations; the movement of materials and energy through living communities; the successional development of ecosystems and the abundance and distribution of organisms and biodiversity in the context of the environment. Anchor and Amadu (2015), however said that teaching ecology at the secondary school level seems to face more challenges than other concepts in Biology which could be attributed to ecology being an outdoor study that requires taking the students outside the normal classroom to the field.

Human activities have reshaped the planet, with profound effects on the ecology of many species. Humans are responsible for massive changes to biodiversity, community composition, and ecosystem functioning across the globe (Boivin et al. 2016). Human practices such as hunting, harvesting, and domestication have altered ecological and evolutionary processes (Bird, 2015), leading to simplified food web structures, range expansions, selection for human-adapted phenotypes, and even the origin of new species (reviewed in Sullivan et al. 2017). These practices have put enormous environmental strain on the planet and have likely resulted in a new geological epoch: The Anthropocene (Lewis and Maslin 2015). The Anthropocene is characterized by elevated temperatures and atmospheric CO2 concentrations, a drop in biodiversity due to mass extinction of species, and an exponential increase in the abundance of

humans on the planet (Waters et al. 2016). The arrival of this new epoch has demonstrated the incredible power of humans to redefine the globe.

Over the course of human history, humans have drastically modified the landscape. Human-altered habitats are often less complex, more fragmented, and contain more barriers to dispersal than the natural habitats they have replaced (Vitousek et al. 1997, McKinney 2006, Vallejos et al. 2016). These environmental changes can lead to reduced population sizes, less connectivity between populations, and modified patterns of interactions among species. In turn, these ecological processes can lead to altered patterns of both adaptive (i.e., natural selection) and non-adaptive (i.e., gene flow, genetic drift, and mutation) evolutionary processes in human-modified environments (Sullivan et al. 2017).

Achievement in Ecology among Students

Man and environment are the bonded entity of the universe. The survival of man in the environment depends on his understanding of the natural factors (biotic and abiotic) surrounding him. The Agricultural experiences and development of science, especially Biological science provides man with knowledge and skills to alter and take full control of his surroundings. However, this human ability to understand, manipulate, and control his environment lead to possible damage of the natural ecosystems, resulting in many environmental issues and challenges like; Climate change, Global warming, Loss of biodiversity, Pollution erosion etc., hence the need for environmentally literate society. Consequently, the Nigeria Educational Research and Development Council (NERDC, 2009), included Ecology as part of the experiences a learner should acquire in the Nigeria secondary school Biology curriculum. The objective of the curriculum among others is to provide every person with opportunities to acquire knowledge, values, attitudes, commitment, and skills needed to protect and improve the

environment. Furthermore, the council recommends the use of field study in teaching the content of senior secondary school Biology curriculum, including Ecology. However, the Lecture method is the most widely used method of teaching in the Nigerian schools (Usman, 2008).

Similarly, Wakhidah (2017), reported that learning about ecological concepts such as environmental pollution with the lecture method is less effective and makes students' achievement low. Despite the limitations of this method, many teachers believed it is their only option.

However, a study by Haruna and Lawan (2025), investigated the effectiveness of media animation on the academic achievement of secondary school students in Biology within the Kano Municipal Education Zone, Nigeria. The research provided a focused examination of animated media's impact on Ecology instruction and its differential effects on male and female students. A quasi-experimental pre-test post-test design was adopted, involving 127 SSII students selected from four purposively sampled public secondary schools. Participants were assigned to either an experimental group (taught using media animation) or a control group (taught using conventional methods). The Ecology Achievement Test (EAT) was developed using past WASCCE biology questions (2016–2020) and validated by four experts. Reliability was established using Pearson Product Moment Correlation Coefficient (PPMC) and Cronbach's Alpha, yielding a coefficient of $r = 0.715$, ensuring the test's internal consistency. The findings revealed that students exposed to media animation significantly outperformed their counterparts in the control group, demonstrating higher comprehension and retention of ecological concepts. Notably, female students in the experimental group achieved higher mean scores than their male counterparts, suggesting that media animation may be particularly beneficial for female learners in biology. ANCOVA results confirmed the statistical significance of these findings ($p < 0.05$).

The study's novel contribution lies in its empirical validation of media animation as an effective pedagogical tool for Ecology instruction in Nigerian secondary schools. Its practical implications suggest that Biology educators should integrate media animation into their teaching strategies to enhance student engagement, improve academic achievement, and bridge gender gaps in science education.

Another study by Nwenyi and Okoli (2025) examined the effect of virtual field trip method on the academic achievement of college of education students in ecological concept in Anambra State. Three research questions and three null hypotheses guided the study. The researcher adopted the quasi- experimental design (using the pre-test, post-test non-randomized control group design.). The population for the study comprises all the 82 NCE year I students in government owned colleges of education in Anambra state. No sample was selected and the entire population for this study was used for the experiment. The instrument for the study is the Ecology Achievement Test (EAT). The instrument was validated by three experts, with reliability coefficient of 0.83 established using KR-20. Data collected was analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The findings of the study revealed that students taught ecological concepts using virtual field trip method (VFTM) achieved higher than their counterparts taught with the conventional lecture method, which proved statistically significant when tested. On gender, the study also revealed that VFTM favoured males more than the females, although the difference was not statistically significant. Based on the findings, the study concluded that VFTM is an innovative approach that can enhance students' academic achievement in ecological concepts, irrespective of gender and recommended among others that ecology lecturers should adopt VFTM while planning their lessons to enhance students' interaction with each other and the learning materials to facilitate effective learning.

Another study conducted by Musa et al. (2025) using a population of four thousand and seven (4,007) senior secondary students (SSII) was used for a study. 72 students were randomly selected as the sample size of the study, EPT was the instrument for data collection. The instrument was pilot tested and reliability co-efficient of 0.68 was obtained, two groups were used, one experimental and one control group. The experimental group was taught using laboratory strategy while the control group was taught using conventional lecture method. All the groups received treatment for a period of six (6) weeks. At completion of the instruction a pre-test, and post-test of (EPT) was administered respectively to collect the data on students' achievement. The result of the pretest indicated that there is no significant difference between the achievement scores of the students in the control group and the experimental group while the result of the post-test indicated that there exists a significant difference between the achievement scores of students in the experimental and control group. Thus, laboratory strategy enhances students' achievement.

Similarly, on achievement, a study done by Yahaya (2023) investigated the effect of problem-based learning on academic achievement in Ecology Concepts among Science Education Students in Gusau. Quasi-experimental pretest, posttest control group design. The population comprised of one thousand two hundred and twenty-five Biology SS11 students from 11 public Senior Secondary Schools in Zaria metropolis. A sample of 137 students from two schools was randomly selected. The study involved two groups- experimental and a control group. The experimental group was taught Ecology concept using Problem-based learning while the control group was exposed to the same concept using Conventional Method. One instrument was used for data collection Namely Ecology Achievement Test. The instrument was duly validated and have reliability coefficient of 0.87, using Pearson Product Moment Correlation statistic. Two

research questions and two null hypotheses were formulated and answered using Mean and Standard deviation statistics and Independent Samples t-test at alpha 0.05 level of significance. The major findings reveal a significant difference between mean academic achievement scores in favor of the experimental group. Based on the findings, it was recommended among others, that workshops, seminars and conferences should be organized for Biology teachers on the use of Problem-Based learning among science education students in Gusau.

Another study by Dangana and Mohammed (2021) investigated the influence of advance organizers on the students' academic achievement and retention of ecology concepts in public senior secondary schools in Edu Educational Zone, Kwara State. Two schools were sampled out of thirteen public senior secondary schools in the zone. From each of the two schools sampled seventy (n – 70) students were selected using stratified sampling which amounted to a total of one hundred and forty students as sample size of the study. Ecology topics like; basic ecological concepts, functioning ecosystem and components of ecosystem were assigned to experimental and control groups. Quasi-experimental of non-equivalent control group of pretest, posttest and post posttest design was used. Experimental group were taught using advance organizers method while control group were taught using lecture method for duration of 40 minutes of classroom teaching for 6 weeks. For the pretest, posttest and post post-test, an Ecology Concept Achievement Test (ECAT) was administered to find out the amount of knowledge acquired and retained after treatments. The reliability coefficient of ECAT was found to be $r = 0.75$. Four research questions were answered and the four null hypotheses were tested using t-test statistics to determine the level of significance of the two groups at $p < 0.05$. One of the major findings from the study indicated that there is a significant difference between mean academic achievement scores of the experimental and control groups.

Teaching ecology at the secondary school level seems to face more challenges than other concepts in Biology according to Achor and Amadu (2015) which could be attributed to ecology being an outdoor study that requires taking the students outside the normal classroom to the field. On this basis, a study was investigated by Gwamna et al. (2021) on the effects of class size on achievement in ecology among secondary schools' students in Sabon-Tasha Education Zone, Kaduna State, Nigeria. The targeted populations were all the 1,183 second-year senior secondary Biology students. The sample size was 101 SS II students selected from the population using the purposive sampling technique. The research design was a descriptive survey design of the ex-post facto type. The instrument used was; Ecology Achievement Test (EPT). The reliability coefficient of the instruments was EPT = 0.78. Two research questions (RQ) were raised to guide the study, one of which was "Is there any difference between the mean scores of students in large class size and those in small class size?" two hypotheses (Ho) were postulated to guide the study and tested at 0.05 level of significance. One of the hypotheses was as follows: "There is no significant difference between the mean scores of students in large class size and those in small class size in ecology concepts" descriptive statistics of mean and standard deviation were used to answer research questions while Independent sampled t-test and Mann-Witney test was used to test the hypotheses. The major findings showed that; significant difference exists between the academic achievement of students in large class size and small class size.

Interest in Learning Ecology

Every individual has a tendency toward something in their environment, such as an object, topic, or activity. If it gives them something good, possibly, they may be interested. Being interested in something can mean that we care about it, that it is important to us, and that we have positive feelings about it.

Someone who has specific needs or interests for something is more likely to be enthusiastic about achieving their goals. According to the American Psychological Association Dictionary of Psychology, “interest is an attitude characterized by a need or desire to give selective attention to something significant to the individual, such as an activity, goal, or research area” (VandenBos, 2015). Meanwhile, John Dewey defined interest as “being engaged, engrossed, or entirely taken up with some activity because of its recognized worth” (John Dewey, 1913). It means that someone will devote their time to doing things that they are passionate about. For example, when students are interested in learning an Ecological concept, they will explore and seek material about that concept whenever possible, take courses to help them understand the topic better, and work hard to gain something of value.

Interest in education and learning has been identified as a strong motivational component associated with the formation and regulation of goal-oriented behavior. This is recognized as a motivational factor that can affect learning and achievement. However, previous studies have identified some issues that can be categorized as factors that influence student interest in learning Ecology. According to Todd (2020), who investigated “What shapes students’ interest in engaging in science curriculum?” To help define and investigate the main research question, the following sub questions guided the inquiry: In what ways, if at all, do the students ascribe importance to science phenomena? How does the learning structure and pedagogical approaches used in the classroom shape students’ interest in science, if at all? There were two major findings revealed through the study: Students find science important when they feel a connection to the topics. Students feel more interest towards science when they have hands on activities to explore science phenomena and their teachers show interest in the material and students. The research study showed understanding students’ interests and demonstrating how science can directly

impact students' lives and future will increase their inquisitiveness and thereby engagement with science curriculum.

A study by Salleh, Desa & Tuit (2013) demonstrated that the concept of interest is useful in predicting students' academic achievement. The study was conducted to examine Malaysian students' school engagement status and to understand the factors that influenced their engagement. The survey method was used to collect data with a questionnaire measuring the level of students' engagement in three psychological domains (cognitive, affective, and behavior). The influential factors were measured by learning about the ecological factors affecting the students' academic engagement, including their teachers' teaching practice and the support they received from teachers, peers, and parents. A total of 311 (male and female) participants between the ages of 12 -16 years from form one, form two, form three, and form four in a school in Selangor were selected using a random sampling procedure. Data was analyzed using descriptive and correlational analyses. The results showed that male and female students exhibit significantly different levels of engagement. Female students have a higher level of engagement than males. Teachers' teaching practices and the support students received from peers, parents, and teachers were positively correlated with students' engagement level.

Similarly, Uitto et al. (2014) conducted a research on the interest in biology and the out-of-school experiences of Finnish secondary school pupils (n=3626, median age 15) were surveyed in the spring of 2003 using the international ROSE questionnaire. Likert-scaled items were categorized with an explorative factor analysis. The scores of eight interest-context factors and seven out-of-school experience factors were studied. More boys than girls were interested in basic processes in biology, whilst more girls than boys found human biology and health education interesting. Out-of-school nature experiences were the most important factor

correlating with interest in biology. Out-of-school experiences in science and technology-related activities, such as using science kits and constructing models, had the highest correlation with an interest in basic processes in biology, such as ecology, cell biology and genetics. Out-of-school experiences of caring for farm animals correlated with an interest in applied biology, such as agriculture. Experiences linked to design and technology, or information technology, were the least important factors to correlate with any studied interest contexts. Thus to enhance pupils' interest in learning more about biology and the living environment in general, it is important to put more emphasis on pupils' out-of-school nature experience and their engagement in informal learning in contextual outdoor environments.

A study by Nnanna, Agwu and Mbamalu (2024) investigated interest as correlate of academic achievement of Biology students in senior secondary schools in Ebonyi State. The study adopted the correlational research design, with one Research Question and a corresponding null hypothesis that guided the study. The total population of SS3 students was 4,512. The sample size was 360 SS3 students obtained through a random sampling technique. The instruments for the study were the biology interest scale and students' termly results. The reliability of the BIS was conducted through a pilot study on 30 students with a Cronbach Alpha reliability estimate of 0.97. The data obtained were analyzed using Pearson's Product-Moment Correlation Statistics and paired sample t-test for the research question and hypothesis, respectively. Results showed "a low positive relationship between students' interest and academic achievement in Biology", which was significant. The study recommended that students should be encouraged through motivational strategies to arouse their interest in biology.

Still on interest, a study by Toli and Kallery (2021) presented an intervention aiming to promote students' learning by enhancing their interest in the concept of energy. Junior high school

students' learning and interest was evaluated after engaging in activities on work and energy. The intervention integrated hands-on and simulated experiments including a structured series of guided investigative tasks and whole-class discussions. The intervention was delivered to an experimental group consisting of 110 junior high school students. The control group consisted of 96 students of the same grade level, where students were taught about energy in the traditional sense, i.e., via the standard textbook. Written tests were then handed to all students to assess their learning outcomes. The results showed that the learning outcomes of students in the experimental group were significantly better than those of students in the control group. A notable increase in interest from students in the experimental group compared to that of the control group was also observed. Findings also showed a significant positive correlation between interest and academic achievement. This study reconfirms that enhancing interest could lead to better learning outcomes.

Ibenegbu et al. (2020) had a study that determines some aspects of students' Interest as an educational concept that determines some aspects of students' affective domain which is very important in the teaching and learning process. It has been hypothesized that the use of child-centered approach will stimulate students' interest in any learning situation. Blended teaching approach is one of such child-centered approaches. This study was therefore undertaken to explore the use of blended Teaching Approach in stimulating the interest of students to learn Biology. Two research questions and two null hypotheses guided the study. The design of the study is Quasi-Experimental design, specifically, pretest-posttest non- equivalent control group design. The sample for this study consists of 82 Biology students in four intact classes in secondary schools in Nsukka Local Government Area of Enugu State, Nigeria. Biology Interest Inventory (BII) was used as instrument for data collection. Two experts from Biology unit and

one from measurement and Evaluation unit, Department of Science Education University of Nigeria Nsukka validated the instrument. The Interest inventory has an internal consistency reliability of 0.96 established using Cronbach alpha. Mean and standard deviations were used to analyze the data to provide answers for the research questions. The hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Result of the study showed that the students learning biology using the Blended Teaching Approach had a significant increase in their interest scores. The increase in interest score was not gender dependent as both boys and girls had enhanced interest score.

Effect of Mobile Learning App on Interest in Ecology

The rapid development of technology is making a lot of changes. The experimental use of technology for teaching and learning in schools, colleges and universities became popular in the 1980s (Haßler, Major & Hennessy, 2016). Different mobile devices such as smartphones and tablets, are being used in educational circles to enhance interest (Traxler, 2010), which can now run feature-rich apps provided by Apple, Google, and Research in Motion, the three leading app stores. Apple reported an estimated 140 billion apps as being downloaded from its store from July 2008 to September 2016, and from Google's Play store, an estimated 65 billion as at May 2016 (Statista, 2016). The recent paroxysms of mobile apps have created a new market for academic apps that focus specifically on enhancing teaching and learning experience. Educational apps were among the most popular type of downloads, after gaming, books and entertainment (Walker, 2011) but by the end of 2014, Educational apps consistently rank as the second most popular category on the Google Play Store, and third on Apple's App Store (Shrestha, 2023). The use of smartphones, tablets and other technologies are abating the concept that knowledge ends with the individual and dwells within specific physical spaces (brick and mortar system of

education), driving home the mobile and ubiquitous nature of education (Sevillano-Garcí & Vázquez-Cano, 2015). Despite the wider benefits associated with the use of mobile learning tool necessitating their adaptation in many educational environments (Haßler et al., 2016), most institutions tend to flinch at the cost of providing mobile hardware for their students (Farley et al., 2015; Crompton, 2013), leading to the consideration of the practice of 'bring your own device' (BYOD), where students bring their own digital devices, leaning towards small and portable ones such as smartphones and tablets. In the opinion of Percival and Claydon (2015), the use of tablets for teaching and learning should be encouraged, to equip students for the work environment in the 21st century. They argued that for that to be successful, "both students and school need additional training and support." In spite of the advantages with the use of mobile learning tools, they acknowledged that the state of tools like tablet devices in present times could not handle all the complex computation needs of word processing, data analysis and presentational tools of users, but could serve as an augmentation and expansion to connectivity and computing choices aimed at increasing connectivity and social interaction, through improved applications and interface.

The digital age as part of the change that makes everything digital. One of the impacts of change on learning is digital media based learning. Low interest in learning becomes one of the problems in learning. Learning that tends to be monotonous makes students less enthusiastic in learning. The number of students who have gadgets provides opportunities for the use of gadgets as a learning medium referred to as mobile learning. Interactive mobile learning can attract students' learning interests. With the existence of mobile learning as a learning medium, it can be known that the interest of learning increases and learning is increasingly enjoyable (Pritandhari & Rosa, 2022).

Researchers have reported a continuous worldwide decline in student interest in science learning over the last two decades (e.g. Rocard et al., 2007). Among others, large-scale quantitative studies by the Global Science Forum (Organization for Economic Co-operation and Development, 2006) and the International Study Center (Mullis et al., 2016) indicate a declining trend in adolescents' interest in science learning and attitudes to science-related careers. While the general trend suggests that students start to lose interest in science-related subjects in upper secondary school, there is considerable variation across science domains. Reasons for the observed decline also appear diverse, for example, students' interest may depend on the quality and type of instruction offered in schools; the psychological demands of adolescent life may take priority; or the student's ideal self-concept may be at odds with their perception of science learning (Krapp & Prenzel, 2011). Also students' individual characteristics, such as self-efficacy and goal orientation, have been found to influence interest (Glynn, Bryan & Brickman, 2015). It has been suggested that one factor in the decline in interest in science, technology, engineering, and mathematics (STEM) is that these subjects still tend to be taught using traditional teacher-led pedagogies (Rocard et al, 2007).

Studying interest development in an ecologically valid setting over an extended time frame would allow the examination of the benefits and possible disadvantages of these types of pedagogical approaches as they unfold in real life classroom situations (e.g., Glynn et al., 2015).

Interest can also be viewed from the perspective of classroom learning, and especially the various domains of different school subjects. According to Fryer, Ainley and Thompson (2017), domain interest can be defined as students' interest to a certain body of knowledge, such as interest in ecology, and it resembles conceptually individual interest because of its connection to knowledge and value components of interest. Contrary to the university students that Fryer et al.

(2016) were studying, primary and secondary school children usually have less freedom to choose what domains to study. This poses challenges to teachers because of the various phases of interest development that the students are in. In order for students' interest to develop towards a particular domain, the activities and tasks used in the teaching should help to trigger interest in the more novice students and offer enough challenge and autonomy for the more advanced ones. Previous research literature has found interest to have several positive outcomes in learning, such as increased attention, use of learning strategies, and goal setting (Potvin & Hasni, 2014).

The ability to correctly identify a particular plant or animal species is the foundation of ecological science. Biodiversity research is increasingly critical in a world subject to unprecedented rates of climate change, habitat loss, and other environmental pressures (Rockstrom et al., 2009), as we urgently need to understand the impact of these drivers on our biodiversity and ecosystems. Providing the future workforce with the skills and competences necessary to meet society's needs in this area is a key deliverable of the educational system, and it is therefore a paradox that there is now a decreasing focus on learning plant and animal taxonomy at all educational levels (Parkin, 2016). This declining interest in species knowledge and its underlying skills is, in part, a result from a shift towards an increased focus on what is seen as 'higher-order cognition' throughout the educational system (Bloom, 1956), reflecting the view that ecology knowledge and especially species identification skills are based on rote learning and rather simple cognitive processes. Investigating factors that increase species identification knowledge in general, the interest for identifying plant and animal species, and the importance of knowing species is thus necessary.

Thus an experimental study to test the effect of the mobile-application, relative to the traditional textbook, on students' interest, perceived competence, and achievement was conducted by (Jeno

et al. 2016). Seventy-one students were randomly assigned to either an experimental condition (mobile application- ArtsApp) or control condition (textbook- Lids flora). As hypothesized, the students using ArtsApp had higher interest, perceived competence, and achievement, compared to the textbook control group, with medium to large effect sizes. Furthermore, using the mobile application, relative to the textbook, predicted interest, which in turn, predicted higher achievement scores in a path analysis. Lastly in a hierarchical regression analysis, intrinsic motivation and autonomous motivation accounted over and above in students' interest for species identification, and importance of knowing species. These results are in line with SDT's theorizing: emphasizing that when students act out of interest, choice, and have an internal locus of causality, they achieve better outcomes, presumably because these satisfy students' psychological needs for autonomy, competence, and relatedness. Factors facilitating this are interest, choice, and feedback, which was argued are in-built functions in the mobile application as opposed to the textbook, and which might account for the positive results.

Further studies by Sarifah et al. (2025), studied the use of a mobile game, QuizWhizzer application to improve fifth graders' learning interest in mathematics at Kalibata 04 Elementary School, South Jakarta, Indonesia. The contribution of the study is to enhance the interest in mathematics learning for students in all elementary schools in South Jakarta, Indonesia. This research used the analysis, design, development, implementation, and evaluation (ADDIE) model to develop the product as a systematic approach to instructional development. The experimental design, which helps collect data needed for better decision-making, was utilized for the effectiveness test for fifth graders at Kalibata 04 Elementary School, Jakarta, Indonesia. The results showed that sig (2-tailed) reached 0.000, less than 0.05, meaning there was a significant difference between schooling results in the pretest and posttest data. The N-Gain score obtained

in this study was 0.49, so the media developed in this research is compelling enough to increase learning interest in mathematics for fifth-grade elementary school students.

Similiarly, a study by Cederqvist and Williams (2023) aimed at investigating student teachers' experiences of using the AR app Seek by iNaturalist during an excursion to identify and learn about plants, as well as discuss the pedagogical implications of integrating the app into a biology course module. The student teachers took part in the excursion using the app to practice plant identification. Afterwards, semi-structured interviews were conducted with three student teachers. A thematic analysis approach was used to explore the student teachers' experiences when using Seek. The findings indicated that Seek increases student teachers' awareness of plants, which promotes their interest and engagement in plants. The easy accessibility in their phone makes them use Seek in their spare time. The increased interest and easy access support learning. By knowing the name of plants, the student teachers establish relationships with plants, which increases awareness of the importance of caring for nature. Hence, Seek app could be seen as a pedagogical tool that promotes student teachers' learning and interest about ecology.

A study by Coşkunserçe (2024) also investigated how the integration of the PlantNet mobile application and out-of-school learning experiences can increase 5th-grade students' knowledge of local plant species, their interest in biodiversity, and their pro-environmental behaviors. The study addresses the issue of "plant blindness," which refers to the widespread lack of attention to and knowledge about plant life. As prior research suggests, students' interest in nature and the environment is closely linked to their familiarity with plant species, which supports broader goals in environmental education and sustainability. Using a pre-test/post-test design, students first completed a plant species identification questionnaire and a biodiversity behavior questionnaire. They then used the PlantNet app to explore and identify herb and tree species in

their local environment during out-of-school activities. Post-intervention results indicated that students not only improved their plant identification skills but also showed increased interest in their natural surroundings, as reflected in their biodiversity-related behaviors. A strong positive correlation was found between plant knowledge and environmental behaviors, suggesting that mobile-assisted outdoor learning can play a critical role in fostering students' interest in biodiversity and promoting sustainable habits.

Effect of Mobile Learning App on Achievement in Ecology

Mobile learning applications have become integral tools in the realm of education, promising enhanced accessibility and flexibility for learners worldwide.

A study by Alsalhi (2025) determined the impact of mobile learning on the achievement of students' science topics at an intermediate stage in Jordan. The study was based on a quasi-empirical design. A total of 186 students participated in this study after being recruited into an empirical group of n = 92 and a control group containing n = 94 participants. The data were collected using the Achievement test and questionnaire and analyzed using SPSS. The results demonstrated that the two groups differed significantly and that the empirical group performed better on the test in terms of education; it also emerged that female students outperformed the male students in the Achievement Test. The study suggested more research on the use of m-learning in schools, higher educational institutions and that mobile learning should be considered when teaching science curricula and other textbooks.

Similarly, a study by ALAli (2024) examined the impact of mobile learning applications on the academic achievement of gifted students and their attitudes toward mobile learning. A quasi-experimental research design was employed. The study population consisted of all gifted eleventh-grade students in the Al-Ahsa region during the first semester of the 2023-2024

academic year. The study sample included 81 gifted male and female students. The experimental group received instruction based on a mobile learning strategy, while the control group participated in traditional classroom settings. Two instruments were developed to evaluate different aspects. The first tool aimed to examine the impact of mobile learning applications on student achievement and was designed based on the course content, while the second tool was a questionnaire to measure participants' attitudes towards mobile learning. The results revealed statistically significant differences between the average academic achievement of gifted students in the experimental group, who learned using mobile learning, and the average achievement of gifted students in the control group, who learned in the usual way. The difference was in favor of the experimental group. Additionally, there were statistically significant differences between the average level of attitudes toward mobile learning (including dimensions such as satisfaction, impact on learning, motivation, and ease of use) among gifted students in the experimental group and the average level of attitudes toward mobile learning among students in the control group. The difference was also in favor of the experimental group. These findings suggested that the integration of mobile learning applications can have a positive impact on the academic achievement of gifted students and their attitudes towards this learning approach. The study highlighted the potential of mobile learning technologies to enhance the educational experiences and outcomes of gifted learners.

A study by Orikoha (2024) examined the effect of mobile learning apps on students' academic achievement in mechanical engineering craft practice in technical colleges in Rivers State. Specifically, the study determined the mobile learning apps on students' academic achievement in grinding skills, shaping skills and Planning skills in technical colleges. Three research questions guided the study and three null hypotheses were tested. Quasi-experimental research

design was adopted for the study. The population for the study comprised of all the 132 NTC II students offering mechanical engineering craft practice in two out of the four Technical Colleges in Rivers State. Two technical colleges were used and two intact classes in each college, one as experimental group and the other as control group were used. A test instrument titled: Mobile Learning Apps Academic Achievement Test were developed and validated by two experts. The reliability coefficient of the test instrument was conducted using Kuder-Richardson 20 (KR-20) which yielded reliability coefficient of.80. Data collected from the research questions were analyzed using mean and standard deviation. Analysis of Covariance was used to test the hypotheses at the .05 level of significance. The finding of the study revealed that there is a significant difference in the mean achievement scores of students taught grinding skills, shaping skills, and Planning skills using mobile learning apps and those taught using demonstration teaching method in Technical Colleges in Rivers State. In line with these findings recommendations were made.

Similarly, Toh and Tasir (2024) did a study which aimed to analyze the cognitive load experienced by secondary school students in Biology within m-learning environments and its impact on learning achievement. A quantitative approach using a randomized pre-test/posttest quasi-experimental design was employed. Students were randomly assigned to either an intervention group (20 students) or a control group (18 students). The study was conducted over four weeks, comprising a three-week intervention period with a one-week interval. Statistical analyses, including independent t-tests, Mann Whitney U tests, Quade ANCOVA, and Pearson correlation, were used to analyze the quantitative data. Qualitative feedback was analyzed using thematic analysis. The study indicated that the adoption of mobile learning tasks not only significantly reduced cognitive load but also corresponded to enhanced learning achievement.

Participants engaging in m-learning experienced lower cognitive load, which was positively associated with superior achievement in learning tasks, emphasizing the beneficial impact of mobile learning on cognitive load management and academic achievement.

Due to the significance of mobile technology in the educational process, it has drawn the attention of numerous scholars to this topic, resulting in diverse views in academic research. Based on this, a study by Sriwas and Sharma (2022) also investigated the impact of mobile learning on student learning achievement. In his research, 600 students from Delhi/NCR were selected as a sample by simple random method. The survey method was used for this study; the researcher collected the data using a self-developed questionnaire. Data were analyzed by mean, standard deviation and t-test. The obtained results showed that there was no significant difference in the effect of mobile learning on the students' learning achievement in context to their locale and type of school.

A research by Itedjere (2025) which was on the impact of mobile learning on students' instructional achievement in Nigeria, relying on empirical research to discuss both their pros and cons. The survey enumerates the potential benefits of mobile learning, among them are the improved access to resources, better engagement, learning flexibility, joint possibilities, and real-time feedback, leading to better academic achievements. Nevertheless, obstacles such as distractions, limited access to devices and information, inadequate digital literacy, and inadequate teacher education can diminish the feasibility of mobile learning. The research results suggest that by solving the aforementioned problems through the improved infrastructure, teacher training as well as the access to the digital resources we can most effectively boost the positive effects of mobile learning. The research also stresses the importance of customized content for students to support the learning process.

Also a paper by Pedraja-Rejas et al. (2024) explored the relationships between m-learning, learning outcome and developing critical thinking in university students. A systematic review of empirical articles in English published in journals indexed in the Web of Science from 2015-May 2024 was carried out. A sample of 50 articles was obtained. The results showed that, in most of the analyzed articles, integrating m-learning tools can potentially improve students' achievement and critical thinking skills. Considering the above, it was recommended that educators and university managers integrate and promote the adoption of mobile learning technologies in teaching methods.

Due to rapid developments, mobile technologies have started to play an essential role in designing seamless learning environments. Due to the availability of mobile technologies, students can access learning materials without being bound by time and place. On the grounds that these applications allow information exchange.

A study by Herodotu et al. (2024) explored how participation in Community and Citizen Science (CCS) using the Seek by *iNaturalist* platform supports science learning and achievement among young people aged 7 to 20. Through semi-structured interviews with 31 participants who engaged with *iNaturalist* both in the field and online, the study investigates how different modes of participation facilitate learning outcomes aligned with the Environmental Science Agency (ESA) framework. The findings demonstrate that *iNaturalist* not only enabled inclusive participation, including for those with limited prior exposure to science but also significantly contributed to the development of scientific competence, environmental understanding, and personal engagement with biodiversity. Participants showed an increased ability to identify species, use scientific terminology, and demonstrated awareness of ecological systems key indicators of academic achievement in environmental science. These results highlight the

educational potential of Seek app in supporting formal and informal science learning, and propose a blended learning framework to foster deeper engagement and achievement in ecological education among diverse youth populations.

Mobile technologies, characterized by their portability and accessibility, have revolutionized user interactions and opened new learning opportunities beyond traditional classrooms (Criollo-C et al., 2021). These applications, offering multimedia features and communication tools, are integral to mobile learning (m-learning), which utilizes smartphones and tablets as educational aids (Criollo-C et al., 2021). The flexibility of m-learning allows learning to occur anytime, anywhere (Faudzi et al., 2023), highlighting the need for further development in pedagogy and instructional design.

Research shows that between 2019 and 2023, mobile learning saw a significant rise in adoption across different educational settings, with increasing numbers of educational institutions implementing mobile technologies to facilitate learning (Lan, 2022). Studies by Neffati et al. (2021) and Sofia and Mar (2024) emphasize that mobile learning initiatives, particularly those tailored for secondary education, have contributed to better academic achievement , particularly in STEM subjects, by providing students with immediate access to resources and allowing for varied learning experiences through videos, quizzes, and interactive simulations. This immediate access helps to meet students where they are, accommodating diverse learning styles and preferences, which is crucial in a globally diverse educational landscape (Itedjere, 2025). Moreover, the COVID-19 pandemic accelerated the global shift towards mobile and remote learning, spotlighting challenges but also opportunities in educational delivery (Kearney et al., 2022). The sudden necessity for online education revealed how mobile technologies could serve as a vital tool for continuity in learning even in the face of disruption. The effectiveness of

mobile learning is thus not only contingent on access to technology but also on the strategic implementation of pedagogical practices that leverage its unique characteristics.

Mobile learning applications have become integral tools in the realm of online education, promising enhanced accessibility and flexibility for learners worldwide. Academic achievement in developed economies such as the USA and Japan is often measured by grades, test scores, and completion rates. In the USA, the National Center for Education Statistics (NCES) reported that the high school graduation rate reached an all-time high of 85% in the 2017-2018 school year, with average SAT scores stabilizing around 1050 out of 1600 in 2021. Similarly, Japan has consistently high educational outcomes, with the OECD's PISA 2018 results showing that Japanese students scored above the OECD average in reading, mathematics, and science, with mean scores of 504, 527, and 529 respectively. These metrics indicate strong academic achievement in both countries, driven by well-established education systems and significant investment in educational resources. A study by Johnson (2019) highlights that rigorous academic standards and comprehensive support systems are critical factors contributing to these outcomes in developed economies (Johnson, 2019). In developing economies, academic achievement varies significantly but generally lags behind developed nations. For instance, in India, the Annual Status of Education Report (ASER) 2020 revealed that only 73% of students in grade five could read a grade two level text, showing challenges in foundational literacy skills. In Brazil, the National Institute of Educational Studies and Research (INEP) reported that the Basic Education Development Index (IDEB) score for middle school students was 4.9 in 2019, below the national target of 5.5. These statistics highlight the ongoing struggles with educational quality and resource allocation in developing economies. Research by Sharma (2020) emphasizes that while enrollment rates have improved, there are significant gaps in learning

outcomes and educational attainment in these regions (Sharma, 2020). In Indonesia, the 2018 PISA results showed that Indonesian students scored an average of 371 in reading, 379 in mathematics, and 396 in science, all significantly below the OECD average. These scores reflect ongoing issues with educational quality and access. Similarly, in Mexico, the National Institute for the Evaluation of Education (INEE) reported in 2019 that only 44% of students achieved proficiency in reading and 35% in mathematics by the end of primary school. This highlights the need for reforms in teaching methodologies and resource allocation. A study by Santos (2018) found that socioeconomic disparities play a significant role in educational outcomes in these countries, and that addressing these disparities is crucial for improving academic achievement (Santos, 2018).

In addition to Indonesia, Mexico, South Africa, and Egypt, other developing economies exhibit distinct trends in academic achievement. In the Philippines, the 2018 PISA results showed that Filipino students scored an average of 340 in reading, 353 in mathematics, and 357 in science, ranking near the bottom among participating countries. These scores highlight significant challenges in educational quality and infrastructure. In Turkey, the 2018 PISA results were somewhat better, with students scoring an average of 466 in reading, 454 in mathematics, and 468 in science. Although these scores are below the OECD average, they show a marked improvement compared to previous years. According to Özdemir (2018), targeted educational reforms and increased funding have played a crucial role in this improvement (Özdemir, 2018).

In Vietnam, the 2018 PISA results were relatively strong for a developing economy, with students scoring an average of 505 in reading, 496 in mathematics, and 543 in science, all above the OECD average. This success is attributed to rigorous educational standards and strong emphasis on STEM subjects. Conversely, in Pakistan, the National Education Assessment

System (NEAS) reported in 2019 that only 55% of grade five students could read a story at their grade level, and only 50% could perform basic arithmetic operations. These figures underscore the significant disparities in educational achievement and access to quality education. Research by Khan (2019) indicates that overcoming these challenges requires substantial investment in teacher training and educational infrastructure (Khan, 2019).

In South Africa, the 2019 Trends in International Mathematics and Science Study (TIMSS) reported that Grade 9 students scored an average of 389 in mathematics and 370 in science, well below the international average. This indicates significant challenges in STEM education. Similarly, in Egypt, the Ministry of Education reported that the completion rate for secondary education was 78% in 2020, with significant regional disparities. These trends are reflective of broader issues in educational access and quality. Research by Aboagye (2020) highlights that increasing investment in teacher training and curriculum development is essential for enhancing academic outcomes in these developing economies (Aboagye, 2020). In Tanzania, the 2019 Uwezo assessment showed that only 30% of grade three students could read a grade two level text in English, and only 34% could perform basic arithmetic operations. This points to significant gaps in early-grade learning. Additionally, in Ethiopia, the 2019 Early Grade Reading Assessment (EGRA) revealed that only 43% of grade two students could read with comprehension. These trends indicate critical challenges in foundational education that impact overall academic achievement. Research by Teklu (2020) suggests that increasing access to early childhood education and improving teacher training are essential for enhancing academic achievement in sub-Saharan Africa (Teklu, 2020). Sub-Saharan Africa faces unique challenges in academic achievement, with significant disparities in educational access and quality. In Kenya, the Uwezo 2019 report found that only 47% of students in grade three could read a grade two

level text, illustrating the struggle with literacy. Similarly, in Nigeria, the Universal Basic Education Commission (UBEC) noted that the completion rate for primary education was only 64% in 2018. These statistics indicate systemic issues that hinder academic achievement in sub-Saharan Africa, including insufficient educational infrastructure and teacher shortages. A study by Nwosu (2019) points out that improving teacher training and increasing investment in educational resources are crucial for enhancing academic achievement in sub-Saharan Africa (Nwosu, 2019; Abrahams, 2024). In sub-Saharan Africa, countries like Ghana and Uganda also face significant challenges in academic achievement. In Ghana, the 2019 National Education Assessment (NEA) results revealed that only 23% of grade six students reached proficiency in English, and 25% in mathematics. These statistics highlight the need for improved educational policies and resources. Similarly, in Uganda, the National Assessment of Progress in Education (NAPE) 2019 report indicated that only 40% of primary six students achieved proficiency in reading, and 45% in mathematics. This indicates systemic issues in the quality of education. A study by Owusu (2018) emphasizes the importance of addressing teacher shortages and enhancing curriculum relevance to improve academic outcomes in these countries (Owusu, 2018). The use of mobile learning applications has become increasingly prevalent in education, offering diverse tools that support various academic activities. Applications such as Khan Academy, Duolingo, Quizlet, and Google Classroom are widely utilized for their user-friendly interfaces and comprehensive educational resources. Students frequently engage with these apps for activities like watching instructional videos, practicing language skills, taking quizzes, and collaborating on assignments. Research indicates that regular use of these mobile learning apps enhances students' understanding and retention of course material, which in turn positively impacts their grades and test scores (Johnson, 2020). For instance, a study by Brown (2019)

found that students who used Quizlet for test preparation had significantly higher test scores compared to those who did not. The frequency of mobile learning app usage is also linked to improved academic achievement metrics, such as higher completion rates. Students who consistently use apps like Khan Academy and Google Classroom for daily or weekly learning activities tend to show better engagement and persistence in their studies. This sustained use, facilitates continuous learning and immediate feedback, which are crucial for academic success. Furthermore, the personalized learning experiences provided by these apps help address individual student needs, leading to better academic outcomes (Smith, 2018). For example, Duolingo's adaptive language learning exercises have been shown to improve language proficiency, which correlates with higher achievement in language courses (Anderson, 2021).

In parallel, studies by Kumar and Pande (2022) suggest that while mobile learning can lead to improvements in specific subjects, the success of these technologies relies heavily on the pedagogical approaches utilized. Factors such as the extent of teacher support, the quality of learning materials, and the level of student engagement have been cited as influential on academic achievement outcomes. For instance, a comparative study highlighted that students who were supported by teachers trained in mobile learning methodologies demonstrated more significant improvements in their academic achievement compared to those who were not (Wang et al., 2022).

Nevertheless, it is important to acknowledge the contextual variables influencing the effectiveness of mobile learning. Factors such as socio-economic backgrounds, geographical location, and existing educational infrastructure can significantly shape the learning experiences of students, thus impacting their academic achievement (Lin et al., 2022). Consequently,

education policymakers and practitioners must consider these variables when facilitating mobile learning initiatives to ensure equitable access to learning opportunities.

Achievement and Interest of Students Taught with Mobile Learning App Based on Gender

Mobile learning packages are mostly found as "applications" that are developed for a specific purpose (Otieno, 2015). As the name implies, these packages are mostly on handheld devices of different kinds. These apps are divided into three categories, web applications; native applications and hybrid applications (Ali, 2013; Oyelade, Oladipupo & Oyejoke, 2010). Native application is the commonest package found on Blackberries, iPhones, iPods, androids, and so on. Web application is the type of app usually found on websites for online consumption. Hybrid application comprises the features of both native and web applications. Mobile learning affects learners through cooperation, motivation, availability and information sharing (Adesulu, 2015).

Ozumba (2015) reported that education through mobile learning technology has positive effect on the interest and achievement of the learners. As such, interest needs to be aroused to inculcate students' learning in subjects such as Biology, Geography, Sociology and so on. In spite of the submissions made by scholars that mobile device is an effective learning tool, there are junks of arguments as to who performs better academically in the utilization of mobile learning between male and female. Gender is a factor that plays significant role in the record of students' interest and achievement. According to Dawal (2021), gender became an important issue in science and technology in 1993 through the activities of the United Nations Commission on Science and Technology for Development. The gender dimension of science and technology came as a result of series of reports on International Conferences such as World Conference on International Women's year (2007), World Conference of the United Nations Decade for Women Equality, Development and Peace (2012), and concerns expressed by Science, Technology, Engineering

and Mathematics experts (2016) about the situation of women and the field of natural science, education, health, food and security (Dawal, 2021). These reports all pointed to the fact that there are gender gaps in the field of Science, Technology, Engineering and Mathematics Education. Influence of gender might be neglected but it strongly determines who could do what in the use of ICT tools especially the handheld devices (Omonijo & Nnedum, 2012). Gender inequality, particularly in developing countries is not a new phenomenon. It has been a topic that has drawn the concerns of NGOs, stakeholders, educators, amongst others, which has prompted the cry for equality in education for the girl child. United Nations (UN, 2013) opined that achieving gender equality in education means an equal opportunity for both males and females to have equal learning process, equal learning outcome, as well as equality in external results after leaving school. The issue of gender and academic interest and achievement has for a long time remained a controversial one. For instance, while some studies found a significant effect of gender on students' academic achievement (Heo & Toomey, 2020; Otutola, 2017), some did not (Akinoso, 2018; Abidoye, 2015; Adigun et al., 2015; Nnamidi & Oyibe, 2016; Powell, 2004). Some researchers, therefore, concluded that male and female students would perform equally the same if they are exposed to the same type of instructions (Huang et al., 2019; Moussa-Inaty et al., 2019). Therefore, as Calsmith (2007) opined, the influence of gender and differences in academic achievement is a complex task, making many studies appear to be contradictory. Hence, while Gender has been linked with the achievement of students in several studies, but with no definite conclusion, this study aims to add to the body of literature in the area, and also find out if mobile learning tool could help enhance gender equality in the academic achievement of students in Ecology. Gender is a factor that needs to be considered in the use of technology (Yusuf, Gambari & Olumorin, 2012). Survey data indicate that in absolute terms, male mobile

readers vastly outnumber female mobile readers in the world. On average, there are approximately 3 male mobile readers to every 1 female. The gender gap is slightest in Nigeria and Zimbabwe (UNESCO, 2014).

With reference to the effect of gender on smartphone use time duration or smartphone addiction among college-going students, though a comparatively large number of research findings support for girls as more time smartphone users (Andone et al., 2016; Shahrestanaki et al., 2020) but others have documented reverse (Hassan & Hassan, 2016; Basu et al., 2018; Ghosh & Chatterjee, 2018; Awasthi et al., 2020), also and some support for no difference between college going boys and girls (Chung, 2011). Despite these consistencies in terms of findings at the macro level, researchers primarily from Asian countries including India have documented for more time smartphone use by boys (Hassan & Hassan, 2016; Basu et al., 2018; Ghosh & Chatterjee, 2018; Awasthi et al., 2020). This differential smartphone time duration used between college-going boys and girls has been explained from gender differences in Psycho-social and cultural points of view (Awasthi et al., 2020). In the patriarchal socio-cultural environment boys get more autonomy and independence than girls which may be the reason for their more time. With reference to the differential nature of smartphone use between college going boys and girls, it has been reported in a large body of empirical findings that girls primarily use the smartphone for social media like what's app and Facebook, voice call, text, etc., on the other hand, college-going boys primarily use the smartphone for playing games, watching online videos and listening music (Andone et al, 2016; Chen et al., 2017). For girls, the smartphone is a medium of communication and social networking inter-personal relationship and boys use it for multi-purposes like text message, voice call, and gaming (De-Sola et al., 2016). Andone et al. (2016) in their study found that University level girl students use more time on the smartphone for

entertainment and social interaction than boys. Girls give more value to inter personal interaction and maintenance of relationships which is possible through voice calls or instant communication via social networking (Lee et al., 2016). But when it is a matter of association between students' gender and their educative use of the smartphone, no difference has been observed. Hilao & Wichadi (2017) found that both girls and boys use smartphones more or less in the same duration of time during language learning and achievement.

A research by Hilao and Wichadi (2017) on the use of effective mobile learning tool to support learning can be affected by the factor of gender. The research compared how male and female students perceived mobile phones as a language learning tool, used mobile phones to learn English and developed their learning interest and achievement. A five-point rating scale questionnaire was used to collect data from 122 students, comprising 65 females and 57 males. They were enrolled in a fundamental English course where mobile phone usage was integrated in certain language learning tasks with an aim to facilitate learning. The findings demonstrated that male and female students did not differ in their usage, interest toward mobile phone uses for language learning as well as their learning achievement at a significance level. In addition, the constraints of using mobile phone for learning that students identified in an open-ended question included the small screen and keyboard the most, followed by intrusiveness of SMS background knowledge, and limited memory of mobile phone. The implication for classroom practice was proposed in how mobile phone can be fully incorporated into the instructional process in order to enhance learner interest. The results of the study are important for teachers when implementing the mobile phone technology in language teaching.

Another research by Poçan, Altay and Yaşaroğlu (2023) assessed mobile-assisted seamless learning environments' effects on students' success and motivation in the secondary school 7th

grade mathematics class algebra unit and student opinions about the application. The research was designed using the descriptive pattern of mixed-method research. The sample of the study is 73 middle school students (30 males and 43 female) in Turkey. Augmented Reality (AR) applications developed in teaching algebra to support individual learning and to utilize mobile technologies, WhatsApp groups were created. Algebra Achievement Test (AAT), Mathematics Motivation Scale (MMS), and semi-structured interview forms were used as data collection tools in the research. The results of the study showed that there were statistically significant differences in favor of the experiment group in AAT and MMS scores. However, no significant difference was found between the groups in intrinsic goal orientation and test anxiety scores, which are motivation sub-dimensions. The findings obtained from AAT, MMS, and the students' opinions showed that mobile technology applications used in out-of-school learning environments positively affect the learning process.

Gender dimension in educational technology is becoming critical within the context of patriarchal Nigerian society. Thus, a study by Suleiman and Bawa (2020) examined effect of mobile instructional app on undergraduates' interest and achievement in economics from the dimension of gender. The research design adopted for this study was a quasi-experimental design. All undergraduates from Sokoto State University formed the population of the study. An intact class of 34 (23 males and 11 females) two hundred level undergraduates of Economics was purposively sampled for the study. Two instruments were developed and used for this study: Mobile Instructional App (MIA) and Economic Principles Test Instrument (EPTI). Descriptive statistics (mean) was used to answer the research question, the only null hypothesis of the study was tested using independent samples t-test. Findings revealed that there was no significant difference between male and female undergraduate students' academic interest and achievement

in the use of mobile instructional app in economics. It was recommended that university curriculum should be made flexible to accommodate the use of mobile devices for learning process, and that undergraduates should endeavor to explore the opportunities offered by mobile instructional app for an improved academic interest and achievement irrespective of gender difference.

Carreño et. al. (2022) also conducted a study to explore the effectiveness of a mobile application designed to increase high school students' interest in physics, with particular attention to gender differences. The intervention involved a mobile application integrated with guided laboratory reports aimed at enhancing students' engagement with experimental physics activities and conceptual understanding specifically the interpretation of graphs. The study was carried out in eight schools and included 268 students, of whom 57% were female. The findings revealed that all seven indicators of self-rated interest in physics showed higher post-test scores compared to pre-test results, suggesting that the mobile learning intervention significantly improved students' enthusiasm toward physics. Notably, female students reported a greater increase in their perceived understanding of physics concepts than their male counterparts, indicating a more pronounced motivational impact among girls. This is particularly significant given the ongoing underrepresentation of women in physics and related STEM fields. However, despite the positive shift in student interest especially among female learners. The study did not find any significant improvement in academic achievement related to graph interpretation. This disconnect suggests that while mobile learning tools can effectively enhance motivation and interest, they may not directly translate into measurable cognitive gains in specific subject areas without additional pedagogical support. The study concluded that mobile applications, when integrated with structured instructional guidance, hold promise for addressing gender disparities in STEM

interest. Nonetheless, the study emphasized the importance of aligning such tools with instructional strategies that also support content mastery.

Summary of Review of Related Literature

From the review of existing literature, it is clear that mobile learning has become a transformative force in education. With the increasing use of smartphones and tablets in classrooms, students now have access to learning materials anytime and anywhere. These tools not only make learning more flexible but also more interactive and engaging. Various mobile applications offer features such as quizzes, videos, simulations, and instant feedback, which help students to better understand content and improve their academic achievement.

One area where mobile learning has shown strong potential is in improving student interest. Many studies indicate that students become more engaged and enthusiastic when digital tools are used, especially when learning activities are made interactive or gamified. This is particularly important in subjects that are traditionally seen as challenging or boring, such as mathematics or science. By using mobile learning apps, students often feel more in control of their learning, and this sense of autonomy helps boost their confidence and curiosity.

However, while mobile learning has been widely studied in general education and in subjects like math and science, there seems to be much less focus on its application in ecology education, especially at the secondary school level. Ecology is a subject that naturally involves hands-on, real-world learning, yet it is often taught in a traditional classroom setting that relies heavily on textbooks and memorization. This has contributed to a noticeable decline in students' interest in ecology and environmental science. Many students see these topics as abstract and disconnected from their everyday lives, which limits their interest to learn more about biodiversity and species identification.

Another observation from the literature is that although some mobile apps have been developed to support learning in biology, very few are designed to encourage outdoor exploration and real-time interaction with nature. Most of the existing tools focus on delivering content digitally rather than inspiring students to go outside and observe their natural surroundings. Yet, being in nature and directly engaging with living organisms can spark curiosity and make the learning experience more meaningful and memorable.

The Seek by iNaturalist mobile application stands out as a tool that could bridge this gap. Seek allows students to use phones to identify plants and animals in their local environment simply by taking a photo. It provides immediate feedback, encourages exploration and helps students build a personal connection with nature. This kind of learning experience is not only interactive but also relevant to students' everyday lives. It turns ecology from a subject in a textbook into something they can see, touch and discover for themselves.

In light of all these, there is a strong need to explore how using Seek can influence students' interest and achievement in Ecology. While mobile learning has proven benefits, its specific impact on environmental awareness and species identification is still under-researched. This study aims to fill this gap by examining whether this type of mobile app can make ecology more interesting and increase students' achievement.

CHAPTER THREE

METHODOLOGY

In this chapter, the methodology of the study is presented under the following sub-headings:

- Design of the Study
- Population of the Study
- Sample and Sampling Technique
- Research Instrument
- Validity of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis.

Design of the Study

The research design adopted for this study was the quasi-experimental pretest, posttest, non-randomized equivalent control group design. The study consisted of experimental and control groups of two assigned intact classes classified into the groups below.

The experimental design was thus represented diagrammatically as follows:

Group	Pretest	Treatment	Posttest
Experimental Group	O_1	X_1	O_3
Control Group	O_2	X_0	O_4

Where: $O_1 – O2$ = Pretest

$O_3 – O4$ = Posttest

X_1 = Treatment (Seek) for experimental group

X_0 = Treatment (Conventional Lecture Method) for control group

The independent variables were Seek app and Conventional Lecture method while the dependent variables were Students' interest and achievement.

Population of the Study

The population of the study consisted of all public Senior Secondary School two (SS1) Biology students in Ovia North East Local Government Area of Edo State. The population of this study comprised of 1,503 SS 1 students (661 males, 842 females) in 25 public senior secondary schools within Ovia North East LGA (Edo State Ministry of Education, 2025).

Sample and Sampling Technique

The sample size for this study consisted of sixty-eight (68) students comprising of 31 male and 37 female students. The experimental group consisted of 32 students (20 males and 12 females) and the control group was made up of 36 students (20 males and 16 females). Sampling was restricted to only the co-educational schools to ensure that both male and female students were represented.

The Multi-stage sampling procedure was adopted in this study as follows:

First stage: all the schools in the Local Government Area were grouped into two groups which were single sex schools and co-educational schools. So that only co-educational schools were selected for the study since gender is a variable in the study.

Second stage: At this stage, two co-educational schools were randomly selected from the LGA of the study, while one school was to the experimental school and the other, control group.

Third Stage: From the schools selected, an intact class was randomly selected where the schools had more than one arm for their Senior Secondary Schools One (1) students. The students in the intact classes formed the sample for this study.

Table 1: Distribution of Students by Schools

Groups	**Males**	**Females**	**No. of Students**
Experimental Group	20	12	32
Control Group	20	16	36
Total	**40**	**28**	**68**

Research Instrument

The instrument for data collection for this study was the Ecology Interest Inventory (EII). The EII was developed by the researcher to measure students' Interest in Ecology through literature reviews of various scholars. However, for the achievement, Ecology Achievement Test (EAT) was developed by the researcher.

Ecology Achievement Test (EAT) was used to gather data for the pre-test and post-test. Ecology Achievement Test (EAT) had two sections A and B. Section A covers student's bio data

involving sex (male and female) and class while section B consist of 25 multiple-choice questions designed to assess students' knowledge and comprehension of Ecology. Additionally, Ecology Interest Inventory (EII) was adapted from the study interest Questionnaire (Ryan, 1985). It was adapted to suit Ecology. It consisted of 15 items. The instrument was designed to determine students' interest in the Ecology. It was scored on a 4-point Likert scale: Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). All instruments are shown in the appendix.

Validity of the Instrument

The instrument was subjected to face and content validity by three experts. They included the researcher's supervisor and a lecturer in the Faculty of Education, University of Benin and a Biology teacher with over eight years of experience. The experts examined the instrument for face validation in terms of clarity and proper wordings of the items. For content validation, the experts were requested to use the table of specification to ensure that the questions measured the interest and achievement being investigated. Based on the experts' suggestions, a revision was carried out on the final draft of the instrument before subjecting it to field trial.

The table of specification was drawn to determine the content validity of the achievement test. The exclusion of Analysis, Synthesis and Evaluation is not a flaw**,** but rather a reflection of the assessment method used (i.e., multiple-choice) to fit into the class (SS1) being assessed.

Table 2: Table Specification

Content Area	Knowledge	Comprehension	Application	Total Items
Ecosystems(Q1-Q6)	2(1,2)	2(3,5)	2(4,6)	6
Food Chains & Webs(Q7- Q12)	2(9,11)	3(7,8)	1(12)	6
Energy Flow(Q13 - 18)	3(13,14,15)	2(17,18)	1(16)	6
Population & Community (Q19 – 25)	3(19,20,23)	2(22,24)	2(21,25)	7
Total	**10(40%)**	**8(32%)**	**7(28%)**	**25(100%)**

Reliability of the Instrument

The reliability of the instruments was obtained when it was administered to thirty (30) SS1 students from a mixed public senior secondary school that were not a part of the main study. The scores obtained from Ecology Interest Inventory (EII) and Ecology Achievement Test(EAT) were analyzed using internal consistency test and the Cronbach alpha values were of 0.74 and 0.81 respectively.

Method of Data Collection

The study lasted for a period of six (6) weeks. In the first week, preliminary activities like obtaining permission from the school and research assistant orientation before the commencement of the study, the instruments (EII and EAT) were administered as pretest to the experimental group and control group. Thereafter, the proper teaching commenced by using the prepared lesson plans. During the treatment, the experimental group were taught ecology using Seek while the control group were taught using conventional lecture method respectively for 4

weeks. At the end of the treatment, during the double periods of the sixth week, a posttest was administered to the two groups using the EII and EAT.

In the first week of the research exercise, on arrival at the schools, the researcher obtained permission from the schools' principals to carry out the study in their schools for SS1 Biology students. Once permission was granted, the researcher and his trained research assistants familiarized with Seek, ensuring they understood how it works before its implementation. Since students are not allowed to bring mobile phones to school, the available teachers volunteered their smartphones to download and run the app for classroom use. Meanwhile, the Biology teacher in the control group was instructed to continue using the conventional teaching method. During the same week, a pretest was administered to all students to assess their academic achievement prior to the intervention. The teaching sessions then took place over for twelve (12) periods. Posttest was administered to students in both experimental and control group during the sixth week to determine their achievement after the treatments.

Seek was developed by iNaturalist, which is a joint initiative of the California Academy of Sciences, the National Geographic Society, the National Geographic Society, Our Planet on Netflix, WWF, HHMI Tangled Bank Studios and Visipedia. It is designed to encourage nature exploration by using image recognition technology to help users identify plants, animals and other organisms. The Seek app is an online mobile app and it also features limited offline functionality, making it usable in areas with poor connectivity. When connected to the internet, the app uses real time recognition to identify organisms with the use of the mobile phone camera. It has a database that helps provide detailed species information. It also allows students to earn badges on their discoveries. Offline, the app can identify common species using a preloaded recognition model on a device. However, features like downloading new species require internet

access. The essence of using Seek app by iNaturalist was to provide innovative and learner-centered approach to teaching Ecology in the experimental group of SS1 Biology students in the area.

The instructional procedures for the experimental and control groups was presented as below;

Instructional Procedure for Experimental Group (Using Seek)

Week 1: Pretest Administration

A pretest on Ecology was conducted to assess students' prior knowledge.

Weeks 2–5: Mobile-Assisted Instruction

Teaching commenced in the first period by the Biology teacher(Researcher) who taught the concept of Ecology for a period of four periods using the lesson plans prepared by the researcher.

Instructional Procedure for Each Lesson:

Step I – Topic Introduction

The teacher wrote the topic on the board to introduce the lesson.

Step II – Preparation for Learning

Students brought out their learning materials and prepared for class.

Step III – Concept and App Orientation

The teacher introduced the topic (e.g., ecosystems, food chains/webs, energy flow) and guided students on how to navigate the Seek app.

Step IV – Explanation and Notes

The teacher provided a comprehensive explanation and gave notes on the day's content.

Step V – Activity with Seek App

Students were taken outside to explore local ecosystems. Using the Seek app on shared

smartphones (1 device per 3 students), they observed and identified plants and animals in real time.

Step VI – Discussion and Question Handling

Questions arising during exploration were addressed by the teacher and/or research assistants, and the session is summarized.

Step VII – Assignment

Students are assigned tasks to explore their home environments and identify at least five plants and five animals using the Seek app.

Step VIII – Evaluation

Lessons concluded with short evaluation exercises to assess students' understanding.

Week 6: End of mobile assisted learning and Posttest Administration

A posttest was administered to the experimental group to measure learning gains and interest development. Copies of the interest scale were be personally distributed to the sampled students by the researcher and was retrieved at completion

Instructional Procedure for Control Group (Using Conventional Lecture Method)

Week 1: Pretest Administration

A pretest on Ecology was administered to the control group to assess students' prior knowledge before the instructional intervention began.

Weeks 2–5: Conventional Textbook-Based Instruction

The Biology teacher (research assistant) delivered four structured periods of instruction per week over four weeks. The lessons followed the same ecological topics as the experimental group but taught using conventional, textbook-based methods without any use of mobile applications or digital tools.

Instructional Steps for Each Lesson:

Step I – Topic Introduction

The teacher wrote the topic of the day on the board to initiated the lesson.

Step II – Preparation for Learning

Students took their notebooks and textbooks and prepared for the lesson.

Step III – Concept Explanation Using Textbook

The teacher introduced and explained the ecological concepts (e.g., ecosystems, food chains/webs, energy flow) using chalk-and-talk methods and textbook content.

Step IV – Reading and Note-Taking

Students was instructed to read specific pages of the textbook. Key points are discussed, and important notes are dictated or written on the board for students to copy.

Step V – In-Class Examples and Illustrations

The teacher provided additional explanations, drew diagrams on the board, and worked through examples from the textbook to aid understanding.

Step VI – Class Discussion and Question Handling

Students were encouraged to ask questions based on the lesson. The teacher addressed them and clarified misunderstandings.

Step VII – Assignment

Students were assigned textbook-based homework, such as answering questions at the end of the chapter or summarizing key points.

Step VIII – Evaluation

At the end of each lesson, students completed a short written assessment or quiz to reinforce the day's learning and check comprehension.

Week 6: Posttest and Interest Assessment

A posttest on Ecology was administered to the control group to measure learning gains. Additionally, an interest scale was distributed to assess any changes in students' interest in ecology. The researcher personally collected all completed instruments.

Method of Data Analysis

The data collected was analyzed using descriptive and inferential statistics. Descriptive statistics, including mean and standard deviation, was used to summarized the pretest and posttest scores for each group. Inferential statistics involved paired sample t-tests to compare pretest and posttest scores within each group, assessing whether significant learning gains occurred. For hypothesis one and two, Independent sample t-tests was be used to compare post-test scores between groups to evaluate differences in learning achievements (if there is no significant difference at pretest between the experimental and control group). However, ANCOVA was be used for the hypotheses if there is a significant difference at pre-test. For the hypotheses, where p-value is less than or equal to 0.05, null hypothesis was rejected, but where p-value is greater than 0.05, null hypothesis was retained. Additionally, for hypotheses three, four, six and seven; Two-way Analysis of Variance, ANOVA (if no significant difference at pretest) or Analysis of Covariance, ANCOVA (if there is a significant difference at pretest). A significance level of 0.05 was applied for all statistical tests.

CHAPTER FOUR

PRESENTATION OF RESULT AND DISCUSSION OF FINDINGS

This chapter presents the analysis of data collected for this study. The presentation and analysis was based on the separate consideration of each research question formulated and hypotheses tested. The following are the results which are shown in tabular forms and discussed.

Hypothesis one: There is no significant difference in mean interest scores between students taught ecology using seek app and those taught using traditional teaching methods.

Table 1a: Descriptive statistics on difference in mean interest scores between students taught ecology using seek app and those taught using traditional teaching method

Group	Mean	Std. Deviation	N
Experimental group	47.50	1.98	32
Control Control	46.77	2.04	36
Total	47.11	2.03	68

Table 1a presents the descriptive statistics for interest scores. The experimental group (Seek app) had a mean interest score of 47.50 (SD = 1.98, n = 32), while the control group (traditional teaching) had a mean of 46.77 (SD = 2.04, n = 36). The combined mean was 47.11 (SD = 2.03, n = 68). These descriptive results suggest that students in both groups reported high interest in ecology, with slightly higher scores observed in the experimental group.

Table 1b: ANCOVA on difference in mean interest scores between students taught ecology using seek app and those taught using traditional teaching methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	85.901[a]	2	42.951	14.605	.000
Intercept	233.831	1	233.831	79.510	.000
Pre	77.065	1	77.065	26.205	.000
Group	66.749	1	66.749	22.697	.000
Error	191.158	65	2.941		
Total	151242.000	68			
Corrected Total	277.059	67			

a. R Squared = .310 (Adjusted R Squared = .289)

An ANCOVA was conducted to examine the difference in mean interest scores between the experimental and control groups while controlling for pretest scores. ANCOVA was appropriate because there was a significant difference at pretest, and controlling for this covariate allows for a more accurate estimate of the treatment effect (Tabachnick & Fidell, 2019). As shown in Table 1b, the effect of the group on posttest interest scores was statistically significant after controlling for pretest scores, $F(1, 65) = 22.70$, $p < .001$, $\eta^2_partial = .259$. The intercept and pretest scores were also significant predictors, indicating that pretest interest scores were

strongly related to posttest scores. The model explained approximately 31% of the variance in posttest interest scores (R^2 = .310, Adjusted R^2 = .289). These results indicate that students taught ecology using the Seek app had significantly higher interest scores compared to those taught using traditional methods, after adjusting for pretest differences. Therefore, the null hypothesis that there is no significant difference in mean interest scores between the two groups is rejected**.**

Hypothesis 2: There is no significant difference in mean achievement scores between students taught ecology using seek app and those taught using traditional teaching methods.

Table 2: Independent sample t-test on difference in mean achievement between students taught ecology using seek app and those taught using traditional teaching methods

	Group	N	Mean	Std. Deviation	t	Sig	Df
PostK	Experimental	32	15.12	3.64	1.37	0.17	66
	Control	36	14.05	2.77			

The table 2 showed an independent sample t-test was conducted to compare the posttest achievement scores of students in the experimental group (Seek app) and the control group (traditional teaching). The results (Table 2) show that the experimental group (n = 32) had a mean achievement score of 15.12 (SD = 3.64), while the control group (n = 36) had a mean of 14.05 (SD = 2.77). The difference between the two groups was not statistically significant, t = 1.37, p = .17. These findings suggest that students taught ecology using the Seek app did not significantly differ in achievement compared to those taught using traditional methods. Therefore,

the null hypothesis that there is no significant difference in mean achievement between the two groups is retained**.**

Hypothesis 3: There is no significant difference in mean interest scores between students' taught ecology using seek app based on sex.

Table 3a: Descriptive statistics on difference in mean interest scores between students' taught ecology using seek app based on sex

Gender	Mean	Std. Deviation	N
Male	47.20	2.35	20
Female	48.00	1.04	12
Total	47.50	1.98	32

a. group = exp

Table 3a presents the descriptive statistics for interest scores within the experimental group (Seek app) by sex. Male students (n = 20) had a mean interest score of 47.20 (SD = 2.35), while female students (n = 12) had a slightly higher mean of 48.00 (SD = 1.04). The mean for the experimental group was 47.50 (SD = 1.98). These results suggest minor differences in interest scores between male and female students, with females showing slightly higher interest.

Overall, the findings suggest that the Seek app generated comparable levels of interest among male and female students, indicating that its impact in fostering interest was consistent across sexes.

Table 3b: ANCOVA on difference in mean interest scores between students' taught ecology using seek app based on sex

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	41.65[b]	2	20.82	7.51	.002
Intercept	41.00	1	41.00	14.79	.001
Pre	36.85	1	36.85	13.30	.001
Gender	.513	1	.51	.18	.670
Error	80.35	29	2.77		
Total	72322.00	32			
Corrected Total	122.00	31			

a. group = exp

b. R Squared = .341 (Adjusted R Squared = .296)

An ANCOVA was conducted to examine the effect of sex on posttest interest scores while controlling for pretest scores. ANCOVA was used because pretest scores may influence posttest interest and controlling for them allows a clearer assessment of the effect of sex. The ANCOVA results (Table 3b) indicate that the effect of gender on posttest interest scores was not statistically significant**,** $F(1, 29) = 0.185$, $p = .670$, after adjusting for pretest scores. Both the intercept, $F(1, 29) = 14.80$, $p = .001$, and pretest scores, $F(1, 29) = 13.30$, $p = .001$, were significant predictors. The model explained approximately 34% of the variance in posttest interest scores ($R^2 = .341$, Adjusted $R^2 = .296$). These findings suggest that there is no significant difference in interest scores between male and female students taught ecology using the Seek app. Therefore, the null hypothesis that sex has no effect on interest scores is retained**.**

Hypothesis 4: There is no significant difference in mean achievement scores between students' taught ecology using seek app based on sex.

Table 4: Independent sample t-test on difference in mean achievement between students' taught ecology using seek app based on sex

	Gender	N	Mean	Std. Deviation	t	Sig	Df
PostK	Male	20	15.30	3.45	0.34	0.73	30
	Female	12	14.83	4.08			

a. group = exp

The table 4 showed an independent sample t-test that was conducted to compare the posttest achievement scores of male and female students in the experimental group (Seek app). The results (Table 4) indicate that male students (n = 20) had a mean achievement score of 15.30 (SD = 3.45), whereas female students (n = 12) had a mean of 14.83 (SD = 4.09). The difference between male and female students was not statistically significant, t(30) = 0.34, p = .73. These findings suggest that there is no significant difference in achievement scores between male and female students taught ecology using the Seek app. Therefore, the null hypothesis that sex has no effect on achievement scores is retained**.**

Hypothesis 5: There is no significant difference in the pretest and posttest mean achievement scores of students taught with seek app.

Table 5: Paired sample t-test on difference in the pretest and posttest mean achievement scores of students taught with seek app

		Mean	N	Std. Deviation	Mean Diff.	t	Sig.	Df
Pair 1	PreK	10.62	32	1.49	-4.50	-9.26	0.00	31
	PostK	15.12	32	3.64				

a. group = exp

A paired-samples t-test was conducted to compare the pretest and posttest achievement scores of students in the experimental group (Seek app). As shown in Table 5, the mean pretest score was 10.63 (SD = 1.50), and the mean posttest score was 15.13 (SD = 3.64), resulting in a mean difference of -4.50. This difference was statistically significant, $t(31) = -9.26$, $p < .001$. These results indicate that students taught ecology using the Seek app demonstrated a significant increase in achievement from pretest to posttest. Therefore, the null hypothesis that there is no difference in achievement scores before and after the intervention is **rejected.** This suggests that the Seek app had a positive effect on students' learning outcomes in ecology.

Hypothesis 6: There is no significant difference in the interaction of seek app and sex on interest scores of students.

Table 6a: Descriptive statistics on difference in the interaction of seek app and sex on interest scores of students.

Gender	group	Mean	Std. Deviation	N
Male	exp	47.20	2.35	20
	control	46.60	2.06	20
	Total	46.90	2.20	40
Female	exp	48.00	1.04	12
	control	47.00	2.06	16
	Total	47.42	1.75	28
Total	exp	47.50	1.98	32
	control	46.77	2.04	36
	Total	47.11	2.03	68

Table 6a shows the mean interest scores for students by group and sex. In the experimental group (Seek app), male students (n = 20) had a mean score of 47.20 (SD = 2.35) and female students (n = 12) had a mean of 48.00 (SD = 1.04). In the control group (traditional teaching), male students (n = 20) had a mean of 46.60 (SD = 2.06) and female students (n = 16) had a mean of 47.00 (SD = 2.07). The students in the experimental group had slightly higher mean interest scores than those in the control group, with females showing marginally higher scores than males.

Table 6b: Two way ANCOVA on difference in the interaction of seek app and sex on interest scores of students.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	15.05[a]	3	5.02	1.22	.30
Intercept	144998.40	1	144998.40	35419.45	.00
Gender	5.85	1	5.85	1.43	.23
Group	10.41	1	10.41	2.54	.11
gender * group	.651	1	.65	.15	.69
Error	262.00	64	4.09		
Total	151242.00	68			
Corrected Total	277.05	67			

a. R Squared = .054 (Adjusted R Squared = .010)

A two-way ANCOVA was conducted to examine the interaction effect of teaching method (Seek app vs. traditional) and sex on posttest interest scores, controlling for pretest scores. ANCOVA was used to adjust for initial differences in pretest scores. The results (Table 6b) indicate that: the main effect of gender was not statistically significant, $F(1, 64) = 1.43$, $p = .236$; the main effect of group (Seek app vs. control) was not statistically significant, $F(1, 64) = 2.54$, $p = .116$; the interaction effect between group and gender was also not significant, $F(1, 64) = 0.16$, $p = .691$. The model explained a very small proportion of variance in interest scores ($R^2 = .054$, Adjusted $R^2 = .010$). These results suggest that there is no significant interaction between teaching method and gender on students' interest scores. Both males and females showed similar responses to the Seek app and traditional teaching methods in terms of interest. Therefore, the null hypothesis that there is no interaction effect is retained**.**

Hypothesis 7: There is no significant difference in the interaction of seek app and sex on mean achievement scores of students.

Table 7a: Descriptive statistics on difference in the interaction of seek app and sex on mean achievement score of students

Gender	Group	Mean	Std. Deviation	N
Male	Exp	15.30	3.45	20
	Control	14.40	2.64	20
	Total	14.85	3.06	40
Female	Exp	14.83	4.08	12
	Control	13.62	2.96	16
	Total	14.14	3.47	28
Total	Exp	15.12	3.64	32
	Control	14.05	2.77	36
	Total	14.55	3.23	68

Table 7a presents the mean achievement scores for students by group and sex. In the experimental group (Seek app), male students (n = 20) had a mean score of 15.30 (SD = 3.45), and female students (n = 12) had a mean of 14.83 (SD = 4.09). In the control group (traditional teaching), male students (n = 20) had a mean of 14.40 (SD = 2.64), and female students (n = 16) had a mean of 13.63 (SD = 2.96). Students in the experimental group had slightly higher achievement scores than those in the control group, with males scoring marginally higher than females.

Table 7b: Two-way ANOVA on difference in the interaction of seek app and sex on mean achievement score of students.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	26.34[a]	3	8.78	.83	.48
Intercept	13758.88	1	13758.88	1305.67	.00
Gender	6.27	1	6.27	.59	.44
Group	18.08	1	18.08	1.71	.19
gender * group	.38	1	.38	.03	.84
Error	674.41	64	10.53		
Total	15114.00	68			
Corrected Total	700.76	67			

A two-way ANOVA was conducted to examine the interaction effect of teaching method (Seek app vs. traditional) and sex on students' achievement scores. The results (Table 7b) indicate that: The main effect of sex was not statistically significant, $F(1, 64) = 0.60$, $p = .443$; the main effect of group (Seek app vs. control) was not statistically significant, $F(1, 64) = 1.72$, $p = .195$; the interaction effect between group and sex was also not significant, $F(1, 64) = 0.037$, $p = .849$. The model explained only a small proportion of the variance in achievement scores ($R^2 = .038$, Adjusted $R^2 = -.008$). These findings suggest that there is no significant interaction between teaching method and sex on students' achievement scores. Both male and female students responded similarly to the Seek app and traditional teaching methods in terms of achievement. Therefore, the null hypothesis that there is no interaction effect on achievement is retained**.**

Discussion of Findings

The present study examined the effect of mobile learning through the use of Seek on students' interest and achievement in ecology compared to traditional teaching methods. The findings are discussed in relation to the stated hypotheses and existing literature. The result of hypothesis one revealed a statistically significant difference in mean interest scores between students taught ecology using the Seek app and those taught using the traditional method. Specifically, students exposed to Seek reported higher interest scores than their counterparts in the control group. This finding aligns strongly with the work of Jeno et al. (2016), who found that students exposed to mobile learning applications demonstrated significantly higher levels of interest and intrinsic motivation compared to those using traditional textbooks. The current finding is also consistent with the study by Sarifah et al. (2025), which reported a significant increase in learning interest among students exposed to a mobile learning game compared to a control group. Similarly, Cederqvist and Williams (2023) observed that integrating the Seek app into ecology learning increased students' awareness, engagement, and interest, reinforcing the current result that mobile applications can stimulate curiosity and sustained attention in ecology learning.

Furthermore, the positive effect of Seek on student interest corroborates the findings of Toli and Kallery (2021), who established that hands-on and interactive activities promote higher student interest and engagement compared to conventional instruction. This result supports the argument in Self-determination theory, which suggests that learning environments that enhance autonomy, competence, and relatedness foster greater intrinsic motivation and interest (Jeno et al., 2016). The interactive and user-friendly features of Seek may have contributed to creating a more stimulating learning environment, allowing students to explore ecological concepts more actively than in traditional settings.

With respect to hypothesis three, which tested for sex differences in interest among students taught using Seek, the results showed no statistically significant difference between male and female students. This finding is in line with the work of Nwenyi and Okoli (2025), which found that virtual field trip methods enhanced achievement irrespective of gender, and with Sarifah et al. (2025), who also found that mobile learning strategies positively influenced students' interest across gender. This suggests that mobile learning technologies like Seek offer inclusive learning opportunities that benefit both male and female students equally.

Similarly, hypothesis six, which tested for interaction effects between teaching method and gender on interest, showed no significant interaction. This indicates that both male and female students benefited similarly from the Seek app in terms of their interest levels. This aligns with studies by Toli and Kallery (2021) and Cederqvist and Williams (2023), which emphasized the universal appeal of mobile learning tools in fostering engagement and motivation regardless of demographic differences.

Contrary to expectations, the result of hypothesis two indicated that there was no statistically significant difference in mean achievement scores between the Seek app group and the traditional method group at posttest. Although the mean score of the experimental group was higher than that of the control group, the difference was not statistically significant. This finding resonates with the study of Sriwas and Sharma (2022), who found no significant difference in achievement between students exposed to mobile learning and those taught traditionally. This may suggest that while mobile learning can enhance engagement and interest, translating that interest into measurable achievement gains may depend on other mediating factors such as duration of exposure, quality of instructional design, and students' prior knowledge.

However, the result of hypothesis five, which examined the pretest and posttest achievement scores within the experimental group, revealed a statistically significant improvement in achievement after the intervention with the Seek app. This finding is consistent with the results of Musa et al. (2025), who observed significant gains in achievement when students were exposed to laboratory-based instructional strategies, and Toh and Tasir (2024), who reported improved learning outcomes following mobile learning interventions. This suggests that Seek is effective in improving students' learning outcomes over time, possibly due to its interactive and experiential learning components, which help in concept retention and understanding.

The finding also aligns with the broader literature emphasizing the role of mobile learning in facilitating deeper engagement and flexible access to content (Criollo-C et al., 2021; Faudzi et al., 2023; Lan, 2022). Although the between-group difference was not statistically significant, the within-group improvement underscores the potential of mobile apps like Seek as valuable supplements to traditional teaching, rather than outright replacements.

With respect to hypothesis four, no significant gender differences in achievement scores were found among students taught with Seek. Similarly, hypothesis seven indicated no significant interaction between sex and teaching method on achievement scores. These findings are consistent with those of Nwenyi and Okoli (2025) and Itedjere (2025), who reported that innovative instructional approaches, including mobile learning and virtual field trips, enhanced learning outcomes irrespective of gender. This suggests that mobile learning technologies may provide an equitable learning environment, minimizing gender-related disparities in academic achievement.

The findings of this study have important pedagogical implications. First, the significant increase in interest among students exposed to the Seek app highlights the potential of mobile learning technologies to enhance engagement in ecology, a subject that is often perceived as abstract or difficult due to its field-based nature (Achor & Amadu, 2015). Second, the significant within-group achievement gain implies that mobile apps can serve as powerful instructional supplements to enhance students' understanding over time. Third, the lack of gender differences and interaction effects suggests that mobile learning technologies offer inclusive educational opportunities that may help address disparities in student engagement and performance. This aligns with global trends emphasizing the democratization of education through technology integration. The study revealed that the Seek app significantly increased students' interest in ecology but did not produce a statistically significant difference in achievement scores when compared to traditional teaching at posttest. However, students in the experimental group showed significant improvement from pretest to posttest, underscoring the app's potential to enhance learning outcomes over time. Moreover, no sex differences were observed in both interest and achievement, indicating the app's inclusivity. These findings support prior research emphasizing the role of mobile learning technologies in enhancing engagement and learning, while also pointing to the need for longer-term interventions to observe significant achievement gains.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter focused on the summary, conclusion, and recommendations of the study.

Summary

The focus of this study was to investigate the effect of the Seek App on students' interest and achievements in Ecology in senior secondary schools in Ovia North East Local Government Area. This study was necessitated by the need to improve students' interest and achievement in Ecology, as many students often find the topic abstract and difficult to relate to real-life ecological concepts. The research sought to determine whether there was a difference in the pretest and posttest mean scores and interest levels of students taught Ecology using the Seek App and those taught using the conventional lecture method. It was discovered that the Seek App, when used as an instructional tool, significantly improved students' interest and learning engagement in Ecology. The theoretical framework for the study was Constructivist Learning Theory by Piaget (1980). Seven research questions and corresponding hypotheses were formulated to guide the study. All hypotheses were tested at a 0.05 level of significance.

A quasi-experimental design was adopted for the study. The population of the study consisted of all Senior Secondary School (SS I) students offering Biology in Ovia North East Local Government Area. The sample size comprised sixty-eight (68) students drawn from two intact classes in two co-educational secondary schools. The experimental group was taught using the Seek App, while the control group was taught with the conventional method. Two research instruments were used: The Ecology Achievement Test (EAT) and the Ecology Interest Inventory (EII). The instruments were validated by experts in Biology Education and

Instructional Technology, and their reliability was established through pilot testing using Internal consistency test and Cronbach's Alpha. The data collected were analyzed using descriptive and inferential statistics such as mean, standard deviation, independent t-test, and Analysis of Covariance (ANCOVA). The decision rule for hypotheses testing was based on a 0.05 level of significance.

Findings of the Study

The findings of the study based on the analyses are as follows:

The first hypothesis on the pretest mean scores of Ecology students between the experimental and control groups showed that there was no significant difference before treatment. This means that both groups were of equivalent ability prior to the introduction of the Seek App.

The second hypothesis on the posttest mean scores of Ecology students between the experimental and control groups revealed that students taught using the Seek App had a higher mean score than those taught with the conventional method. Although the difference was not statistically significant, this shows that the Seek App enhanced students' achievement in Ecology.

The third hypothesis on the difference in students' interest between the experimental and control groups showed a significant difference. Students exposed to the Seek App demonstrated greater interest than those taught with conventional methods. This implies that the Seek App effectively improved students' interest in Ecology.

The fourth hypothesis on the difference in pretest and posttest mean scores of students in the experimental group showed a significant increase after the treatment. This indicates that the Seek App positively influenced students' learning achievement in Ecology.

The fifth hypothesis on gender differences among students taught using the Seek App showed that there was no significant difference in the mean achievement and interest scores of male and female students. This means that both sexes benefited equally from the use of the Seek App.

The sixth hypothesis on the interaction effect of Seek App and sex on students' interest showed no significant interaction. This implies that the effectiveness of the Seek App was not influenced by sex.

The seventh hypothesis on the interaction effect of Seek App and sex on students' achievement also revealed no significant interaction. This means that the Seek App improved students' achievement of Ecology regardless of sex.

Conclusion

Based on the findings of this study, the following conclusions were drawn:

1. The difference in the pretest mean scores of students taught with the Seek App and the conventional teaching method showed no significant difference, meaning both groups had similar entry behavior before the treatment.
2. The difference in the posttest mean scores of students taught with Seek App and those taught using conventional teaching method, indicated that those taught using the Seek App performed better, though not significantly higher than those taught using the conventional teaching method.
3. There was a significant difference in the interest of students taught with the Seek App compared to those taught conventionally, showing that the Seek App increased students' motivation and curiosity towards learning Ecology.

4. There was a significant difference between the pretest and posttest mean scores of students exposed to the Seek App, which confirmed that mobile-assisted instruction enhanced students' academic achievement.
5. There was no significant difference in the achievement and interest of students based on sex, implying that both male and female students benefitted equally from the Seek App.
6. There was no significant interaction effect of instructional method and sex on both interest and achievement, meaning that the Seek App was effective across sex groups and did not favor any particular group.

Recommendations

The major findings and conclusions of this study provide guidance for the following recommendations:

1. Students should be encouraged to actively engage with mobile learning applications such as the Seek App to promote hands-on exploration and interest in Ecology.
2. Curriculum Developers should integrate mobile-assisted and inquiry-based learning approaches into the Biology curriculum, emphasizing digital tools like the Seek App that support experiential and environmental learning.
3. Biology Teachers should undergo regular training on the use of mobile learning tools to effectively integrate technology into Ecology instruction. This will enable them to guide students in using mobile apps for field observations and environmental investigations.
4. School Administrators should create supportive policies that encourage the ethical, innovative, and effective use of mobile learning in the teaching of science subjects.

5. Educational Researchers should continue to explore how mobile learning applications influence not just cognitive outcomes but also environmental awareness and responsible behavior among students.

Contribution to Knowledge

The following are the contributions of this study to existing knowledge:

1. The study provided empirical evidence on the effect of Seek App on improving students' interest and achievement in Ecology.
2. It established that gender does not significantly influence students' achievement when using the Seek App making the app an inclusive educational resource.
3. The study revealed that the use of Seek App promotes experiential and inquiry-based learning, allowing students to connect ecological theory with real-world practice.
4. The research contributed to the growing body of knowledge on technology-enhanced learning in Nigerian secondary schools, particularly in Biology education.
5. It identified that while the Seek App enhances student interest significantly, its influence on achievement requires sustained integration within the school curriculum for stronger academic effects.

Suggestions for Further Study

Based on the findings of this study, the following suggestions for further research are recommended:

1. The present study was conducted in Ovia North East Local Government Area of Benin City; similar research could be carried out in other geographical regions to validate the findings.
2. Further studies should investigate the long-term effect of continuous use of the Seek App on students' ecological knowledge retention and environmental behavior.
3. Comparative studies could be conducted to examine the effectiveness of different mobile learning applications (e.g., Seek, Google Lens, PlantSnap) in teaching Ecology.
4. Researchers could explore how teachers' technological competency influences the effectiveness of mobile-assisted learning in science education.
5. Future research could assess the impact of mobile learning on students' moral and environmental attitudes, extending beyond academic performance.

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APPENDIX I

ECOLOGY INTEREST INVENTORY

The instrument is designed to determine your interest in Ecology as a Biology topic. The researcher requests your honest response to the statements/items below:

SCHOOL TYPE: PUBLIC () PRIVATE ()

SEX: MALE () FEMALE ()

Instruction: please respond to the statements/items with a tick () in the appropriate column to indicate whether you Strongly Agree(SA), Agree(A), Disagree(D) or Strongly Disagree(SD) with the statements/items.

S/N	Items	SA	A	D	SD
1	I am curious about how ecosystems function.				
2	I enjoy learning about the relationships between organisms and their environments.				
3	I believe ecology is important for understanding environmental problems.				
4	I look forward to ecology-related lessons in school.				
5	I spend time outside school observing nature and wildlife.				
6	I think ecological topics should be included more in the school curriculum.				
7	I am interested in pursuing a career or further study related to ecology or environmental science.				
8	I enjoy watching documentaries or reading books about ecosystems, animals, or plants.				
9	I participate in environmental or conservation activities (e.g., tree planting, clean-up).				
10	I think human activities have a major impact on ecological				

	systems.				
11	I often ask questions or do my own research about ecological topics.				
12	I find ecology to be a boring subject.				
13	I feel responsible for protecting the environment.				
14	I can see how ecological knowledge is useful in daily life.				
15	I would like to participate in mobile learning or experiments related to ecology.				

APPENDIX II

ECOLOGY ACHIEVEMENT TEST

SCHOOL TYPE: PUBLIC ( )

SEX: MALE ( ) FEMALE ( )

Class: Senior Secondary School (SSS 1) **Subject:** Biology **Topic:** Ecology

Instruction: Answer all questions by choosing the best option (A–D).

1. An ecosystem is best described as_____

A. A group of the same species living together B. Interaction of living organisms and their physical environment. C. A large area of land dominated by trees. D. All organisms living in a pond only

2. Which of the following is an abiotic factor in an ecosystem?

A. Fungi B. Temperature C. Fish D. Bacteria

3. The term niche refers to_____

A. The physical area where an organism lives B. The role an organism plays in its habitat

C. The population size of a species D. The distribution of a species

4. In a pond ecosystem, algae function mainly as_____

A. Consumers B. Producers C. Decomposers D. Parasites

5. Which of the following best illustrates an ecosystem?

A. A school library B. A fish in a tank C. A forest with plants, animals, and soil

D. A herd of cattle grazing

6. Which statement about ecosystems is correct?

A. Energy cycles while nutrients flow B. Nutrients cycle while energy flows

C. Both nutrients and energy cycle D. Both nutrients and energy flow

7. The correct sequence of a simple food chain is_____

A. Grass → Grasshopper → Frog → Snake B. Grasshopper → Grass → Snake → Frog

C. Snake → Frog → Grasshopper → Grass D. Grass → Snake → Frog → Grasshopper

8. Which of the following best describes a food web?

A. A straight line of feeding relationships B. Interconnected food chains in an ecosystem

C. Energy transfer from sunlight to plants D. A group of herbivores feeding together

9. In a food chain, the arrow points from_____

A. Consumer to producer B. Prey to predator

C. Predator to prey D. Decomposer to consumer

10. What will most likely happen if all decomposers are removed from an ecosystem?

A. More producers will grow B. Dead organisms will accumulate

C. Energy flow will increase D. Food chains will become shorter

11. Which organism is always at the base of a food chain?

A. Carnivore B. Herbivore C. Producer D. Omnivore

12. Which of these correctly represents part of a savanna food web?

A. Lion → Zebra → Grass B. Grass → Zebra → Lion

C. Zebra → Lion → Grass D. Grass → Lion → Zebra

13. The ultimate source of energy for most ecosystems is_____

A. Soil B. Sunlight C. Plants D. Water

14. The percentage of energy transferred from one trophic level to the next is usually about:

A. 1% B. 10% C. 25% D. 90%

15. Which of the following terms describes the total energy fixed by green plants?

A. Gross primary productivity B. Net primary productivity

C. Biomass energy D. Secondary productivity

16. In an energy pyramid, energy is greatest at the level of_____

A. Top carnivores B. Herbivores C. Producers D. Omnivores

17. A pyramid of numbers may be inverted when_____

A. There are many small producers and few large consumers B. A single large producer supports many consumers C. Decomposers are more than producers

D. Energy transfer is more efficient

18. Energy flow in an ecosystem is_____

A. Cyclic B. Linear and unidirectional C. Random D. Circular

19. The term population in ecology refers to_____

A. Different organisms living in the same place B. Group of individuals of the same specie in an area C. All living organisms in a habitat D. Different species interacting together

20. Which of the following describes a community?

A. All abiotic factors in an area B. Organisms of the same species in an area

C. Populations of different species living together D. Interaction between predator and prey

21. A population increases when_____

A. Death rate is higher than birth rate B. Birth rate is higher than death rate

C. Immigration equals emigration D. Resources are limited

22. The carrying capacity of an environment refers to_____

A. The maximum number of individuals an environment can support B. The migration of species into a new area

C. The sum of abiotic factors in a habitat D. The diversity of species in an ecosystem

23. Which of these is an example of a density-dependent factor regulating populations?

A. Flood B. Disease C. Drought D. Earthquake

24. Mutualism is a type of community interaction in which_____

A. Both species benefit B. One benefits, the other is harmed

C. One benefits, the other is unaffected D. Both species are harmed

25. Which of the following best illustrates competition in ecology?

A. A lion chasing a zebra B. A snake eating a rat

C. Two species of birds feeding on the same insect D. A cow chewing grass

APPENDIX III

ANSWERS TO ECOLOGY ACHIEVEMENT TEST

1. B

2. B

3. B

4. B

5. C

6. B

7. A

8. B

9. B

10. B

11. C

12. B

13. B

14. B

15. A

16. C

17. B

18. B

19. B

20. C

21. B

22. A

23. B

24. A

25. C

APPENDIX IV

LESSON PLAN FOR 6 WEEKS (EXPERIMENTAL GROUP USING SEEK APP)

Week One (Pre – Test and Interest Inventory)

Class: SS1

Subject: Biology

Topic: Ecology (pre-instruction phase)

Duration: 80 minutes (2 periods)

Instructional Objectives

By the end of the section, the teacher/researcher should be able to:

1. Administer a pretest on Ecology to access student prior knowledge
2. Administer an Ecology Interest Inventory to determine students level of interest in Ecology.
3. Record and collect student's responses for analysis

Entry Behavior

Student should have basic understanding of living and non-living things.

Materials Needed

1. Printed pretest question papers (Ecology Achievement Test)
2. Ecology Interest Inventory (Likert scale questionnaire)
3. Pencil/biro

Instructional Procedures

Steps	**Teacher activities**	**Student activities**	**Mobile Integration**
Step I: Introduction	Greet students and explain that the day's session will measure their current knowledge and	Students listen attentively	None at this stage

	interest before lesson begins		
Step II: Pretest administration	Distribute Ecology Achievement Test on ecosystem, food chain, food web, energy flow etc. Explain instruction clearly	Student attempt the pre test	None at this stage
Step III: Interest inventory	Distribute ecology inventory to the students	Students respond to items	None at this stage
Step IV: Collection and closing	Collect Ecology Achievement Test (EAT) and Ecology Interest Inventory (EII) from the students.	Submit script and listen to final remarks	None at this stage

WEEK TWO (ECOSYSTEM)

Class: SS1

Subject: Biology

Topic: Ecology

Duration: 80 minutes (2 periods)

Instructional Objectives:

1. At the end of the lesson student can be able to define ecology and explain it scope
2. Identify major component of an ecosystem
3. Discuss the important of Ecosystem
4. Draw a simple diagram of an ecosystem showing producers, consumers and decomposers.

Entry behavior

Student are familiar with plants and animals around their environment and have basic knowledge of living and non living things, but may not fully understand the concept of Ecosystem

Instructional Materials

- White Board and marker
- Biology Text books /notes for reference
- Chart of Ecosystem components (Biotic and abiotic)
- Printed work sheet for recording field observation

Instructional Procedures

Steps	**Teacher activities**	**Student activities**	**Mobile Integration**
Step I: Introduction	i. Writes the topic Ecosystem on the board. ii. Asks students to give	Students gives example of ecosystem from their environment	None at this stage

	example of natural surrounding they have observed, forest, garden, pound etc		
Step II: Preparation for learning	Instructs students to bring their materials and prepare them for the class.	Students brings out note books and get ready	None at this stage
Step III Concept and App orientation	i. Defines ecosystem and explain its component ii. Shows diagram/chart of an ecosystem	i. Students listen ii. Take note and asked questions	Teacher demonstrate the opening of the SEEK App and scanned leaving organism with it
Step IV: Explanation and note	i. Explains Ecological interaction within the ecosystem (producer, consumer, decomposer etc.) ii. Write note on the board	Students take note and answer questions	App is prepared for activities
Step V: Activity with SEEK	i. Leads students outside to school garden/ compound.	Students work in groups (one device / three students, scan and	Real- time species identification with SEEK App

App	ii. Guides them to identifies at least two plants and two animals iii. Assist with challenges	identifies organism and records findings in work sheets)	
Step VI: Discussion and question	Facilitate discussion on identified organisms, their roles in the ecosystem and their connection	Students share their findings and ask/answer questions	Sample are displayed on SEEK App
Step VII: Assignment	Assign students to explore their home environment using SEEK App: Record five plants and five animals with their roles (producer, consumer and decomposer)	Students note their assignment	Mobile App is explored at home.
Step VIII: Evaluation	Ask short oral or written question e.g Define Ecosystem, gives two component of the Ecosystem etc	Students response to question	None

Week 3

Class: SS 1

Subject: Biology

Topic: Ecology

Sub topic: Food chains and Food Webs

Duration: 80mins (2 periods)

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define a food chain and identify its components (producers, consumers, decomposers).
2. Construct simple food chains from their environment.
3. Use the Seek app to identify organisms and place them into appropriate levels of a food chain.
4. Explain the importance of food chains in energy transfer.

Entry Behaviour

Students are familiar with organisms around them and have studied ecosystems in Week 2.

Materials Needed

1. Whiteboard and markers
2. Chart showing simple food chains
3. Smartphones with Seek app (1 per 3 students)
4. Internet access or offline Seek database
5. Worksheets for food chain construction
6. Pictures of plants and animals (backup in case of poor connectivity)

Instructional Procedures

Steps	**Teacher's Activities**	**Student's Activities**	**Mobile Integration (Seek App)**

Step 1 - Introduction	(I)Writes the sub-topic: Food Chain and Food Web on the board. (II)Asks: Who eats what in the environment? What happens if one food chain is broken? Do organisms survive on only one food source?	Students respond with examples (e.g., goats eat grass, humans eat fish).	None at this stage
Step II – Preparation for learning	Ensures students have their notebooks and Seek App ready.	Students get prepared with writing materials and shared mobile phones.	None at this stage
Step III – Concept and App Orientation.	(I) Defines food chain and Food Web explains roles of producers, consumers, decomposers. (II) Uses a chart to	Students listens, take notes and ask questions.	Teacher reviews how to scan organisms on Seek.

		illustrate.		
Step IV – Explanation and Notes	(I) (II)	Gives examples of terrestrial and aquatic food chains. Writes notes and emphasizes direction of energy flow.	Students take notes and answer questions	none
Step V – Activity with Seek App	(I) (II) (III)	Take student outside. Guide them to use Seek App to identify 3 organisms (e.g., grass, insect, etc.) Encourage them to arrange them into a food chain	Students work in groups to scan organisms, identify species and develop a real world food chain on their worksheet.	Real time species identification with Seek.
Step VI – Discussion and Questions.	(I) (II)	Leads class discussion: each group presents one food chain. Teacher corrects and	Students present and discuss their chains.	Some Seek results shown on device.

	links to energy flow		
Step VII – Assignment	Students must develop 2 food chains from home using the Seek App (e.g., crops, animals).	Students note assignment.	Seek for home exploration.
Step VIII– Evaluation	(I) Define food (II) chain and Food Web (III) Give one example why the arrow is	Students answer orally/written.	None

Lesson Plan (Week 4 – Energy Flow in the Ecosystem)

Class: Senior Secondary School (SSS 1)

Subject: Biology

Topic: Ecology

Sub- Topic: Energy Flow in the Ecosystem

Duration: 80 minutes (2 periods)

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define energy flow and explain how it occurs in an ecosystem.
2. Describe the role of producers, consumers, and decomposers in energy transfer.
3. Interpret ecological pyramids (energy, number, and biomass).
4. Use the Seek app to identify organisms in different trophic levels and classify them.
5. Explain the importance of energy flow in maintaining ecosystem balance.

Entry Behaviour

Students already understand food chains and food webs (Week 3).

Materials Needed

1. Whiteboard and markers
2. Chart showing energy pyramid and trophic levels
3. Smartphones with Seek app (1 per 3 students)
4. Worksheets for energy flow diagrams

Instructional Procedures

Steps	**Teacher's Activities**	**Students' Activities**	**Mobile integration (Seek)**
Step I -	Writes Energy Flow in the Ecosystem on	Students give	None

Introduction	the board. Ask: why do we need food to survive? Where does this energy originally come from?	responses (e.g., from the sun, food).	
Step II – Preparation for Learning.	Ensures students are settled with notebooks and Seek devices ready.	Students prepare materials.	none
Step III – Concept and App Orientation.	Explains energy flow: from sun ---- producers --- Consumers--- decomposers. II) Introduces Ecological Pyramids.	.students listen, take notes and ask questions.	Teacher reminds students how to scan organisms with Seek.
Step IV – Explanation and Notes.	(I) Use diagrams to explain pyramids of energy, biomass and numbers. (II) Highlights energy loss at each trophic level (10% rule).	Students copy notes, ask/answer questions.	none
Step V – Activity with Seek App.	(I) Take students outdoors. (II) Guide them to scan organisms. (III) Students classify each into trophic levels and construct an	(I) Students identify organisms (II) Assign	Seek App used for identification of real organisms.

	energy pyramid on worksheet.	them to trophic levels and sketch a pyramid.	
Step VI – Discussion and Question.	Discuss findings with groups. (III) Emphasize loss of energy as heat and why energy pyramids are always upright.	Students share results and ask questions.	Some Seek-identified organisms shown to class.
Step VII - Assignment	Each student constructs an energy pyramid at home using at least 6 organisms identified with Seek.	Students note assignment.	Seek App is used for home exploration.
Step VIII – Evaluation	Explain energy flow in nan ecosystem. Draw an energy pyramid? Why is only 10% of energy passed on?	Students respond orally/written	none

Lesson Plan (Week 5 – Population and Community Ecology)

Class: Senior Secondary School (SSS)

Subject: Biology

Sub-Topic: Population and Community Ecology

Duration: 80 Minutes

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define and differentiate between population and community in ecology.
2. Describe the characteristics of populations (size, density, distribution).
3. Explain community interactions such as competition, predation, mutualism, commensalism, and parasitism.
4. Use the Seek app to identify organisms and classify them into populations and communities.
5. Analyze simple examples of population and community interactions in their local environment.

Entry Behaviour

Students are already familiar with ecological concepts such as food chains, food webs, and energy flow from previous weeks.

Materials Needed

1. Whiteboard and markers
2. Charts showing population and community
3. Smartphones with Seek app (1 per 3 students)
4. Worksheets for group recording and analysis

Instructional Procedures

Step	Teacher's Activities	Students'	Mobile Integration

		Activities	**(Seek App)**
Step I - Introduction	(I) Writes population and Community on the board. (II) Asks: What do we call a group of organisms living in one field(e.g., goats, cows, bird, etc.).	Students respond with prior knowledge.	None
Step II – Preparation for Learning.	Ensures class is settled and materials ready.	Students prepare notebooks and mobile devices.	None
Step III – Concept and App Orientation.	(I) Explains population (group of same species in one area); community (different species interacting in one area). (II) Highlights interactions (competition, predation, symbiosis).	Students listen and take notes.	Teacher links how Seek will help classify organisms into populations and communities.
Step IV- Explanation	(I) Uses examples: maize plants in a farm =	Students copy notes,	None

and notes.		population; maize +weeds + insects = community. (II) Explains density, distribution, growth.	ask/answer questions.	
Steep V-Activity with Seek App.	(I) (II) (III)	Leads students outdoors. Groups use the Seek to identify multiple organisms (plants, insects, etc.) in one area. They classify them into populations and communities.	Students work in groups, and record findings in worksheets.	Seek App used to identify organisms and sort them into ecological groupings.
Step VI – Discussion and Question.	(I) (II)	Facilitates discussion: Which organisms formed a population? Which interactions observed were observed in the community? (e.g., bees	Students share findings.	Groups showcase Seek-identified populations/communities.

	on flowers= mutualism, lizard eating insects =predation).		
Step VII – Assignment.	Students should identify 2 populations and 1 community near their homes, using Seek App for evidence.	Students note assignments.	Mobile App for home observation.
Step VIII – Evaluation.	Short test: Differentiate between population and community; Give 2 examples of each. Explain one type of community interaction with example.	Students respond orally/written.	None

Lesson Plan (Week 6 – Posttest and Interest Inventory)

Class: Senior Secondary School (SSS)

Subject: Biology

Topic: Ecology (Assessment of Learning)

Duration: 80 minutes

Instructional Objectives

By the end of this week, the researcher/teacher will be able to:

1. Assess students' achievement in Ecology concepts taught (ecosystem, food chains/webs, energy flow, population, and community ecology).
2. Evaluate students' interest in learning Ecology using the interest inventory scale.
3. Compare learning gained with the pretest administered in Week 1.
4. Provide closure to the six-week instructional period.

Entry Behaviour

Students have completed lessons on ecology topics (Weeks 2–5) and have experience using the Seek app to explore ecological concepts.

Materials Needed

1. Copies of posttest (achievement test in Ecology)
2. Copies of interest inventory scale
3. Writing materials (pens, pencils, erasers)
4. Answer sheets
5. Whiteboard/marker (for instructions)

Instructional Procedure

steps	**Teacher's Activities**	**Students Activities**	**Mobile integration(Seek)**
Step I -	Greets students and explain that	Students listen	none

Introduction	the day's lesson is for final assessment of achievement and interest.	attentively for instruction.	
Step II – Test Orientation.	Explain the instructions: duration, no sharing of answers, honestly in completing the interest inventory.	Students prepare writing materials and listen to instructions.	none
Step III – Post Test Administration.	(I) Distributes Achievement Test papers covering ecosystem, food chain/webs, energy flow, population and community ecology. (II) Monitors students as they write.	Student attempt all test questions within the given time.	none
Step –IV – Ecology Interest Inventory.	(I) Distributes interest inventory scale. (II) Guides students on how to respond honestly.	Students complete inventory scale	none

Step V – Collection and closure.	(I)Collects test papers and inventory forms. (II) Appreciates students for their participation throughout the six weeks.	Students submit their responses.	None

APPENDIX V

LESSON PLAN FOR 6 WEEKS (CONTROL GROUP USING CONVENTIONAL LECTURE METHOD)

WEEK ONE (PRE – TEST AND INTEREST INVENTORY)

Class: SS1

Subject: Biology

Topic: Ecology (pre-instruction phase)

Duration: 80 minutes (2 periods)

Instructional Objectives

By the end of the section, the teacher/researcher should be able to:

1. Administer a pretest on Ecology to access student prior knowledge
2. Administer an Ecology Interest Inventory to determine students level of interest in Ecology.
3. Record and collect student's responses for analysis

Entry Behavior

Student should have basic understanding of living and non-living things.

Materials Needed

1. Printed pretest question papers (Ecology Achievement Test)
2. Ecology Interest Inventory (Likert scale questionnaire)
3. Pencil/biro

Instructional Procedures

Steps	**Teacher activities**	**Student activities**
Step I: Introduction	Greet students and explain that the day's session will measure their current knowledge and interest	Students listen attentively

	before lesson begins	
Step II: Pre test administration	Distribute Ecology achievement Test on ecosystem, food chain, food web, energy flow etc. Explain instruction clearly	Student attempt the pre test
Step III: Interest inventory	Distribute ecology inventory to the students	Students respond to items
Step IV: Collection and closing	Collect Ecology Achievement Test (EAT) and Ecology Interest Inventory (EII) from the students.	Submit script and listen to final remarks

WEEK TWO (ECOSYSTEM)

Class: SS1

Subject: Biology

Topic: Ecology

Sub Topic: Eco System

Duration: 80 minutes (2 periods)

Instructional Objectives:

1. At the end of the lesson student can be able to define ecology and explain it scope
2. Identify major component of an ecosystem
3. Discuss the important of Ecosystem

Entry behavior

Student are familiar with plants and animals around their environment and have basic knowledge of living and non-living things, but may not fully understand the concept of Ecosystem

Materials Needed

- White Board and marker
- Biology Text books /notes for reference
- Chart of Ecosystem components (Biotic and abiotic)
- Printed work sheet for recording field observation

Instructional Procedures

Steps	**Teacher activities**	**Student activities**
Step I:	i. Writes the topic Ecosystem on the board.	Students gives example of ecosystem from their environment

Introduction	ii. Asks students to give example of natural surrounding they have observed, forest, garden, pound etc	
Step II: Preparation for learning	Instructs students to bring their materials and prepare them for the class.	Students brings out note books and get ready
Step III Concept orientation	i. Defines ecosystem and explain its component ii. Shows diagram/chart of an ecosystem	iii. Students listen iv. Take note and asked questions
Step IV: Explanation and note	i. Explains Ecological interaction within the ecosystem (producer, consumer, decomposer etc.) ii. Write note on the board	Students take note and answer questions
Step V: Activity (class room based)	i. Divides class into groups. ii. Provides charts of organisms and abiotic factors iii. Assist with challenges	Students work in groups and sort organisms into producers, consumers, decomposes and abiotic factors.
Step VI: Discussion and	Facilitate discussion on identified organisms, their roles in the ecosystem and their	Students share their findings and ask/answer questions

question	connection	
Step VII: Assignment	Assign students to draw and label one ecosystem near their homes e.g., farm, pond, garden), showing producers and abiotic factors	Students note their assignment
Step VIII: Evaluation	Ask short oral or written question e.g Define Ecosystem, gives two component of the Ecosystem etc	Students response to question

WEEK 3: FOOD CHAINS AND FOOD WEBS

Class: SS 1

Subject: Biology

Topic: Ecology

Sub Topic: (Food chains and Food Webs)

Duration: 80mins (2 periods)

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define a food chain and identify its components (producers, consumers, decomposers).

2. Construct simple food chains from their environment.
3. Explain the importance of food chains in energy transfer.

Entry Behaviour

Students are familiar with organisms around them and have studied ecosystems in Week 2.

Materials Needed

1. Whiteboard and markers
2. Chart showing simple food chains
3. Worksheets for food chain construction

Instructional Procedures

Steps	**Teacher's Activities**	**Student's Activities**
Step 1 - Introduction	i. Writes the sub-topic: Food Chain and Food Web on the board. ii. Asks: Who eats what in the environment? What happens if one food chain is broken? Do organisms survive on only one food source?	Students respond with examples (e.g., goats eat grass, humans eat fish).
Step II – Preparation for learning	Ensures students have their notebooks and charts set.	Students get prepared with writing materials.

Step III – Concept Orientation.	i. Defines food chain and Food Web explains roles of producers, consumers, decomposers. ii. Uses a chart to illustrate.	Students listens, take notes and ask questions.
Step IV – Explanation and Notes	i. Gives examples of terrestrial and aquatic food chains. ii. Writes notes and emphasizes direction of energy flow.	Students take notes and answer questions
Step V – Activity (classroom based)	i. Divide student into groups. ii. Provide pictures of organism. iii. Encourage them to arrange them into a food chain	Students work in groups to sort pictures into food chain.
Step VI – Discussion and Questions.	i. Leads class discussion: each group presents one	Students present and discuss their chains.

	food chain. ii. Teacher corrects and links to energy flow	
Step VII – Assignment	Students must develop 2 food chains from home environment.	Students note assignment.
Step VIII– Evaluation	i. Define food ii. chain and Food Web iii. Give one example why the arrow is	Students answer orally/written.

Lesson Plan (Week 4 – Energy Flow in the Ecosystem)

Class: Senior Secondary School (SSS1)

Subject: Biology

Topic: Ecology

Sub- Topic: Energy Flow in the Ecosystem

Duration: 80 minutes (2 periods)

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define energy flow and explain how it occurs in an ecosystem.
2. Describe the role of producers, consumers, and decomposers in energy transfer.
3. Interpret ecological pyramids (energy, number, and biomass).
4. Identify organisms in different trophic levels and classify them.
5. Explain the importance of energy flow in maintaining ecosystem balance.

Entry Behaviour

Students already understand food chains and food webs (Week 3).

Materials Needed

1. Whiteboard and markers
2. Chart showing energy pyramid and trophic levels
3. Worksheets for energy flow diagrams

Instructional Procedures

Steps	**Teacher's Activities**	**Students' Activities**
Step I - Introduction	Writes Energy Flow in the Ecosystem on the board. Ask: why do we need food to survive? Where does this energy originally come from?	Students give responses (e.g., from the sun, food).
Step II – Preparation for Learning.	Ensures students are settled with notebooks..	Students prepare materials.
Step III – Concept Orientation.	i. Explains energy flow: from sun --- producers --- Consumers --- decomposers. ii. Introduces Ecological Pyramids.	.students listen, take notes and ask questions.
Step IV – Explanation and Notes.	i. Use diagrams to explain pyramids of energy, biomass and numbers. ii. Highlights energy loss at each trophic level(10% rule).	Students copy notes, ask/answer questions.
Step V – Activity (classroom based)	i. Provide charts of organisms at different trophic level. ii. Students classify each into trophic levels and construct an	i. Students classify organisms ii. Assign them to trophic levels and sketch a

	energy pyramid on worksheet.	pyramid.
Step VI – Discussion and Question.	i. Discuss findings with groups. ii. Emphasize loss of energy as heat and why energy pyramids are always upright.	Students share results and ask questions.
Step VII - Assignment	Each student constructs an energy pyramid at home using examples from their home.	Students note assignment.
Step VIII – Evaluation	Explain energy flow in nan ecosystem. Draw an energy pyramid? Why is only 10% of energy passed on?	Students respond orally/written

Lesson Plan (Week 5 – Population and Community Ecology)

Class: Senior Secondary School (SSS1)

Subject: Biology

Sub-Topic: Population and Community Ecology

Duration: 80 Minutes

Instructional Objectives

By the end of the lesson, students should be able to:

1. Define and differentiate between population and community in ecology.
2. Describe the characteristics of populations (size, density, distribution).

3. Explain community interactions such as competition, predation, mutualism, commensalism, and parasitism.
4. Identify organisms and classify them into populations and communities.
5. Analyze simple examples of population and community interactions in their local environment.

Entry Behaviour

Students are already familiar with ecological concepts such as food chains, food webs, and energy flow from previous weeks.

Materials Needed

1. Whiteboard and markers
2. Charts showing population and community
3. Worksheets for group recording

Instructional Procedures

Step	Teacher's Activities	Students' Activities
Step I - Introduction	i. Writes population and Community on the board. ii. Asks: What do we call a group of organisms living in one field(e.g., goats, cows, bird, etc.).	Students respond with prior knowledge.
Step II – Preparation for Learning.	Ensures class is settled and materials ready.	Students prepare notebooks.
Step III – Concept and App Orientation.	i. Explains population (group of same species in one area); community (different species interacting in one area). ii. Highlights interactions (competition, predation, symbiosis).	Students listen and take notes.
Step IV- Explanation and notes.	i. Uses examples: maize plants in a farm = population; maize +weeds + insects = community. ii. Explains density, distribution, growth.	Students copy notes, ask/answer questions.
Steep V- Activity(classroom	Student group charts of organisms (plants, insects, etc) in to populations or	Students work in groups, and sort organisms into

based)	communities.	community or population in worksheets.
Step VI – Discussion and Question.	i. Facilitates discussion: Which organisms formed a population? ii. Which interactions observed were observed in the community? (e.g., bees on flowers= mutualism, lizard eating insects =predation).	Students share findings.
Step VII – Assignment.	Students should identify 2 populations and 1 community near their homes and describe their interaction.	Students note assignments.
Step VIII – Evaluation.	Short test: Differentiate between population and community; Give 2 examples of each. Explain one type of community interaction with example.	Students respond orally/written.

Lesson Plan (Week 6 – Posttest and Interest Inventory)

Class: Senior Secondary School (SSS1)

Subject: Biology

Topic: Ecology (Assessment of Learning)

Duration: 80 Minutes

Instructional Objectives

By the end of this week, the researcher/teacher will be able to:

1. Assess students' achievement in Ecology concepts taught (ecosystem, food chains/webs, energy flow, population, and community ecology).
2. Evaluate students' interest in learning Ecology using the interest inventory scale.
3. Compare learning gained with the pretest administered in Week 1.
4. Provide closure to the six-week instructional period.

Entry Behaviour

Students have completed lessons on ecology topics (Weeks 2–5) and have experience using the Seek app to explore ecological concepts.

Materials Needed

1. Copies of posttest (achievement test in Ecology)
2. Copies of interest inventory scale
3. Writing materials (pens, pencils, erasers)
4. Answer sheets
5. Whiteboard/marker (for instructions)

Instructional Procedure

Steps	Teacher's Activities	Students Activities
Step I - Introduction	Greets students and explain that the day's lesson is for final assessment of achievement and interest.	Students listen attentively for instruction.
Step II – Test Orientation.	Explain the instructions: duration, no sharing of answers, honestly in completing the interest inventory.	Students prepare writing materials and listen to instructions.
Step III – Post Test Administration.	i. Distributes Achievement Test papers covering ecosystem, food chain/webs, energy flow, population and community ecology. ii. Monitors students as they write.	Student attempt all test questions within the given time.
Step –IV – Ecology Interest Inventory.	i. Distributes interest inventory scale. ii. Guides students on how to respond honestly.	Students complete inventory scale
Step V – Collection and closure.	i. Collects test papers and inventory forms. ii. Appreciates students for their participation throughout the six weeks.	Students submit their responses.