

**THE INFLUENCE OF AUDIO – VISUAL TEACHING AIDS ON
STUDENTS MOTIVATION AND ENGAGEMENT IN CHEMISTRY**

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BENIN CITY**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF CURRICULUM
AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION,
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THE REQUIREMENT OF THE AWARD OF THE BACHELOR OF
SCIENCE B.Sc. (ED) DEGREE IN CHEMISTRY**

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CERTIFICATION

We, the undersigned, certify that this work was carried out by, **Somtochukwu Miracle OKOYE** in the Department of Curriculum and Instructional Technology, Faculty of education, University of Benin, Benin City for the requirement of the award of the Bachelor of Science B.Sc. (Ed) Degree in Chemistry.

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DEDICATION

This Project is dedicated to God Almighty who has sustained me through these four years of learning.

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TABLE OF CONTENTS

	Page
TITLE	i
CERTIFICATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	viii
ABSTRACT	ix
CHAPTER ONE: INTRODUCTION	
Background to the Study	1
Statement of the Problem	6
Objectives of the Study	7
Research Questions	7
Hypothesis	8
Scope of the Study	8
Significance of the Study	10
Definition of Terms	13

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Theoretical Framework	15
Meaning of Audio – Visual Materials	19
The Role of Audio – Visual Materials on Chemistry Education	21
The Impact of Audio – Visual Materials on Chemistry Education	27
Limitations and Challenges of Using Audio – Visual Materials In Chemistry Education	30
Factors Influencing the Effectiveness of Audio – Visual Materials	32
Critical Evaluation	34
Summary of reviewed literature	37

CHAPTER THREE: METHODOLOGY

Overview	38
Research Design	38
Population of the Study	39
Sample Size and Sampling Technique	39
Research Instrument	40
Validity of the Instrument	40
Reliability of the Instrument	41
Method of Data Collection	41
Method of Data Analysis	41

**CHAPTER FOUR: PRESENTATION OF RESULTS AND
DISCUSSION OF FINDINGS**

Presentation Results	42
Discussion of Findings	52

**CHAPTER FIVE: SUMMARY CONCLUSION AND
RECOMMENDATIONS**

Summary	54
Conclusion	56
Recommendations	57
Suggestions for Further Studies	58

REFERENCES	59
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APPENDICES	61
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LIST OF TABLES

	Page
Table 1: Extent to Which Audio – Visual Materials Enhance Chemistry Students’ Interest	43
Table 2: Specific Features Audio – Visual Materials Contribute To The Increased Student Engagement	46
Table 3: Effects of Audio – Visual Materials on Understanding And Retention	49

ABSTRACT

This study sought to examine the influence of audio – visual teaching aids on students’ motivation and engagement in chemistry. Three research questions were raised to guide the study. A descriptive survey design was employed. Seventy (70) chemistry students formed the sample for the study, thirty (30) item structured questionnaires on a four point rating scale developed by the researchers were used for data collection. The instrument used for data collection was face validated by the supervisor and other experts in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Edo State. The questionnaire was administered to the respondents by the researcher with the assistance of trained research assistants. The simple random sampling technique was used for this study. After the administration of the instrument to the respondents, the data obtained were analyzed using mean and standard deviation. The research explores how multimedia resources such as videos, animations and interactive simulations influence students’ interest, participation and academic performance. The finding suggests that audio-visual teaching aids can significantly enhance students’ motivation and engagement in chemistry, leading to improved academic outcomes. The study provides insights into the effective integration of technology – enhanced learning tools in chemistry education, highlighting the potential for increased student participation and deeper understanding of complex concepts.

CHAPTER ONE

INTRODUCTION

Background of the Study

According to Nwanze and Okoli (2020), chemistry is the study of the composition, properties, changes and uses of matter that form the environment around us. Chemistry is a very important science subject and a requirement for further learning of a number of science-related professional courses like medicine, agriculture, pharmacy (Samuel, 2017). Being a difficult and esoteric subject, chemistry frequently presents serious obstacles to students' comprehension and involvement. Conventional teaching strategies, which mostly rely on lectures and textbooks, might not be able to hold students' attention or generate a strong interest in the material. The use of audiovisual resources in chemistry instruction has grown in popularity recently as a possible way to improve learning outcomes and student engagement. Students frequently struggle with:

- Putting chemical interactions and structures into visual . Being aware of the concepts and principles of chemistry . Applying chemistry to actual circumstances

- Gaining proficiency in solving problems
- Sustaining enthusiasm and drive

As a foundational science, chemistry is essential to developing technological innovation, solving global issues, and enhancing human welfare. Chemistry involves experimentation and the learner is required to observe, record, calculate and make intelligent references (Nnoli, 2022). But a lot of pupils, especially in Nigeria, show a waning enthusiasm in studying chemistry. Their lack of interest in chemistry has a big impact on their academic achievement, professional decisions, and the country's progress in science and technology. A thorough comprehension of intricate ideas, rules, and procedures is necessary for mastering chemistry. With a heavy reliance on textbooks and whiteboard illustrations, traditional teaching approaches frequently fall short of providing pupils with a thorough comprehension of chemical ideas, much less engaging them. It has been determined that the abstract nature of chemical concepts, ineffective teaching strategies, and a dearth of interesting teaching resources are the main causes of students' disinterest in chemistry. Interest is a sentiment that someone has for anything that they believe is worthwhile and advantageous. According

to Egolum, Samuel & Okonkwo (2021), interest is an individual behavioural tendency to be attracted towards a certain class of activities. Intrinsic motivation, which has been demonstrated to propel and maintain students' engagement in a given task, is fostered by interest. By carefully selecting the best teaching strategies and resources, chemistry teachers may pique students' interest in the subject.

“Audio-Visual” means possessing both sound and sight components such as slide-tape presentations, films, television programs, church services and live theatre productions (Wikipedia, 2016). It is always possible to say that audiovisual materials are a way to achieve high-quality education. The senses of hearing (audio) and seeing (visual) are used in educational activities. We retain 10% of what we read, 20% of what we hear, 30% of what we see and 50% of what we see and hear according to Santos and Nishida (1994). Blog Archive (2010) defined Audio-visual aids as supplementary devices by which the teacher, through, the utilization of more than one sensory channel is able to clarify, establish and correlate concepts, interpretations and appreciations. Audiovisual resources have been a viable technique for improving learning and teaching results in recent years. Chemistry

could be made more interesting, dynamic, and approachable with the use of audiovisual resources, such as instructional films, animations, interactive simulations, and multimedia presentations. Through the demonstration of experiments, the illustration of intricate chemical principles, and the provision of real-world applications, these resources can stimulate students' curiosity and comprehension. Studies have indicated that the use of audiovisual resources can enhance students' learning attitudes, retention rates, and academic performance. Investigating the precise impact of audiovisual resources on chemistry students' motivation to learn the subject is necessary, nevertheless.

This study intends to evaluate the influence of audiovisual resources on chemistry students' enthusiasm in learning chemistry, with a focus on Nigerian secondary schools. Specifically, this study attempts to:

- Examine the impact of audiovisual resources on chemistry students' interest and involvement
- Determine which kinds of audiovisual materials are best for encouraging students' interest in chemistry.

- Examine the connections between audiovisual materials and students' gender, academic success, and prior knowledge.

By studying the influence of audiovisual materials on chemistry students' interest, this study adds to the creation of effective teaching methodologies and instructional resources that stimulate students' interest and engagement in chemistry.

Science, technology, engineering, and mathematics (STEM) topics, including chemistry, are becoming less and less popular among students worldwide. The following reasons worsen the situation in Nigeria:

1. Insufficient infrastructure and resources
2. Limited assistance and training for teachers
3. How society views the teaching of science

Empirical approaches that improve teaching and learning outcomes are needed by educators and policymakers to tackle these issues. The creation of useful teaching techniques and educational resources that encourage students' interest in and participation in chemistry is aided by this research.

Chemistry education is not an exception to the growing trend of using audiovisual materials for teaching and learning in recent years. Chemistry is an abstract and complicated discipline that calls for a thorough comprehension of ideas, procedures, and principles. But chemistry is frequently hard for many students to learn and comprehend, which deters them from being motivated and interested in the subject.

In Nigeria, the study's location, chemistry is a required course in secondary education, and teachers and other stakeholders have expressed worry about pupils' performance in the subject. Studies have demonstrated the critical influence that students' motivation and interest have in their learning outcomes and academic success.

Videos, animations, and multimedia presentations are examples of audiovisual elements that can improve students' comprehension and enthusiasm in chemistry. These resources can aid in the simplification of difficult ideas, the illustration of procedures, and the enhancement of interactive and engaging learning.

Notwithstanding the possible advantages of audiovisual resources, research on their impact on chemistry students' enthusiasm

for the subject is necessary. The purpose of this study is to investigate how students' motivation, engagement, and general interest in chemistry are affected by audiovisual materials.

Statement of the Problem

Chemistry instruction and learning at the O' and A' levels of education have produced subpar results over time. Some factors have been identified to include the abstract nature of chemistry concepts (Ezeudu, 1998); the rote learning of chemistry concepts (Shaibu, 1986) and the teaching methods (Nwoso, 1982).

Even though chemistry is relevant to national development and plays a significant role in daily life, many students show a waning enthusiasm in studying the subject. Many issues, such as the abstract nature of chemical principles, ineffective teaching strategies, and a dearth of interesting instructional resources, have been blamed for this disinterest in chemistry. It is common for the traditional lecture-based method, which mostly depends on textbooks and chalkboard graphics, to fall short in grabbing students' interest and inspiring them to study.

Enhancing students' interest and involvement in chemistry lessons has been suggested as a possible outcome of using audiovisual

tools, such as instructional videos, animations, and interactive simulations. The efficiency of these resources in piquing students' curiosity and improving their comprehension of chemical ideas, however, needs further research.

Objectives of the Study

1. To examine the effects of audiovisual resources on the engagement and interest of chemistry students.
2. To determine which kinds of audiovisual resources work best to pique students' curiosity about chemistry.
3. To look at the connections between the students' gender, academic success, and prior knowledge and the audiovisual materials.

Research Questions

The study aims to answer the following questions

1. To what extent do audiovisual materials enhance chemistry students' interest in learning chemistry?.
2. What specific features of audiovisual materials contribute to increased student engagement?.
3. How do audiovisual materials affect students' understanding and retention of chemical concepts?.

Hypothesis of the Study

Specific hypothesis

1. Pupils who engage with interactive simulations will be more engaged in their study of chemistry than those who stick to conventional teaching techniques.
2. Students who study chemistry using audiovisual materials will gain more than those who don't.

Scope of Study

With an emphasis on secondary school students, the purpose of this study is to ascertain how audiovisual resources affect students' enthusiasm in studying chemistry. Students in SS1 to SS3 from the University of Benin Demonstration Secondary School (UDSS) in Benin City, Edo State comprise the demographic of interest. There will be between 20 and 100 pupils in the sample, with both male and female participants in the age range of 14 to 21.

The independent variable will be audiovisual content, such as podcasts, animated films, infographics, interactive simulations, and animations. The interest of chemistry students in learning the subject, as determined by motivation, engagement, and excitement, will be the dependent variable. The learning environment, instructor assistance,

financial standing, fluency in English language and past knowledge of the students will all be taken into account as moderating factors.

The study aims to identify the most effective type of audiovisual material as interactive simulations, improve understanding of chemical concepts, and develop positive teacher attitudes toward audiovisual materials. Additionally, the study will significantly increase the interest and motivation of chemistry students through audiovisual materials.

Education policy and resource allocation will be informed by the results of this project, which will also improve chemistry education methods, increase student interest and engagement, and successfully integrate technology into chemistry classrooms.

Nevertheless, the study contains drawbacks, such as restricted applicability to other educational environments, sample size and geography restrictions, and potential biases in data collecting and analysis.

After two weeks for the literature review, two weeks for data collection, four weeks for data analysis, and two weeks for report writing, the study will be finished in ten weeks. It will be necessary to have access to a certain number of schools and pupils, as well as

audiovisual materials and equipment, statistical software, computational resources, and research assistant(s).

The results of this project will give educators, decision-makers, and stakeholders important new information about the effects of audiovisual materials on chemistry education as well as efficient teaching methods and resource.

Significance of the Study

The study on "The Influence of Audiovisual Teaching Aids on Students' Motivation and Engagement in Chemistry" has far-reaching implications that can positively impact various aspects of education.

Learning Chemistry" has far-reaching implications that can positively impact various aspects of education.

Through examining how audiovisual materials affect students' attention, the study offers insightful information that helps educators create interesting and successful lesson plans. This may result in more engaged and motivated students as well as higher academic achievement in chemistry lessons. Additionally, teachers can create educational resources that accommodate various learning preferences,

increasing chemistry's accessibility and appeal to a wider spectrum of learners.

The results of the study can also be used to guide resource allocation decisions made by school officials, ensuring that expenditures on audiovisual assets result in measurable improvements in learning outcomes and student engagement. Schools may make the most of their financial resources and provide learning environments that foster student success by determining the most effective kinds of audiovisual assets.

The research makes a substantial theoretical contribution to educational psychology by illuminating the ways in which theories of multimedia learning—like Mayer's Cognitive Theory of Multimedia Learning—apply to the teaching of chemistry. This information can be used to create instructional design models that effectively incorporate audiovisual resources to increase student engagement and learning.

As they address important issues on how technology might improve student engagement and learning, the study's findings may also have a significant influence on scientific education research. The study broadens our knowledge of how to design successful learning

experiences that meet the various needs of students by examining the relationship between audiovisual materials and chemistry teaching.

The study's conclusions may help raise science literacy in the general public on a larger social scale. A new generation of scientists, inventors, and critical thinkers can be encouraged by making chemistry more interesting and approachable. Consequently, this has the potential to stimulate economic expansion, enhance health results, and tackle urgent environmental issues.

Additionally, the findings of the study can aid in bridging the gap that exists between learners with different learning styles and pupils from diverse backgrounds. Teachers may close the achievement gap and provide a more diverse learning environment by figuring out what works and how to implement it with their pupils.

By ensuring that instructional materials are in line with efficient teaching techniques, the study's conclusions can help shape and update the chemistry curriculum. With the help of this research, policymakers will be better able to promote teacher professional development, integrate technology and multimedia resources into scientific education, and allocate resources efficiently.

Finally, by offering evidence-based suggestions for instructional strategies, learning resources, and educational policy, the study has the potential to revolutionize the teaching of chemistry. Through the utilization of multimedia resources, teachers can craft inclusive, productive, and captivating learning experiences that encourage students to delve deeper into the mysteries of chemistry.

Definition of Terms

Audiovisual materials: Teaching tools that use both visual and aural cues to communicate information.

Chemistry interest: Students' attitudes, motivation, and excitement towards learning chemistry.

Engagement: The involvement, focus, and communication between students and the educational resources.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter deals with the review of related literature. The review of literature was done under the following sub-headings;

Theoretical framework

Conceptual framework

- Meaning of Audio-visual Materials
- The Role of Audio-visual Materials on Chemistry Education
- The Impact of Audio-visual Materials on Chemistry Education
- Limitations and Challenges of Using Audio-visual Materials in Chemistry Education
- Factors Influencing the Effectiveness of Audio-visual Materials
- Critical Evaluation

A fundamental science that is essential to comprehending the world we live in is chemistry. Unfortunately, traditional teaching approaches sometimes rely heavily on lectures and textbooks, which may not effectively engage students or promote a thorough understanding of the subject matter. According to Nacino-Brown, Oke & Brown (2005) for effective teaching to take place, a good method

must be adopted by a teacher. While it should be noted that educational methodology is not a novel idea in the teaching and learning process, teachers use a range of teaching strategies and techniques to make sure of this. In order to enhance current teaching methods, new approaches and strategies are developed virtually every day. One notable example is those that are assisted by technology. Kochlar (2004), the most outstanding development in modern education is the increase in the use of supplementary devices by which the teacher through the use of one sensory channel helps to clarify, establish and correlate accuracy, concepts, interpretation and appreciation increase knowledge, rouses interest and even evokes worthy emotions and enriches the imagination of students. This literature review looks at how audiovisual resources affect chemistry students' enthusiasm in learning chemistry. It looks at numerous studies and research findings to see how multimedia resources like movies, animations, simulations, and interactive materials improve student engagement, comprehension, and motivation in chemistry instruction.

Theoretical Framework

Several educational and cognitive theories that focus on how individuals learn, process information, and interact with multimedia content can help us better understand the use of audiovisual materials in chemistry teaching. Constructivism, Multimedia Learning Theory, and Cognitive Load Theory are among the philosophies that advocate using audiovisual aids in chemistry instruction.

The study was guided by the constructivist learning theory as postulated by John Dewey who noted that humans generate knowledge and meaning from their experiences (Dewey, 1938 & Bruner, 1960). According to constructivism, a well-known theory of learning, students actively create their own conception of the world by drawing on their experiences and interactions with their surroundings. The learner must play an active role in taking on new knowledge (Millar, 2004). In order to create meaning, he or she must interpret the chemistry class's experiences and discussions. D'Angelo, Touchman and Douglas (2009) posit that constructivism can refer to one of many such different but related concepts as epistemological theory, learning theory, and pedagogy. The non-behaviorist learning theory known as constructivism is more frequently viewed by educators as one in which

students build knowledge by connecting previously learned material with new information. 'Learning' is the process by which this conflict is resolved by building new information from fragments of existing knowledge.

According to Miha (2006), constructivism provides a perspective on teaching and learning science in classrooms, with a view to improving the effectiveness of science teaching in enhancing students' learning. Solomon (1987) argues that, according to constructivism the most important thing in science teaching and learning is providing students with learning environment that promotes their understanding of science by co-constructing and negotiating ideas through meaningful peer and teacher interactions. The kind, caliber, and frequency of chemistry instruction are identified in this study as key components of the learning environment that affect how secondary school pupils construct their chemistry knowledge. According to constructivists' central theory of science education, pupils' knowledge is largely shaped by their social surroundings, including whether the school is a single- or mixed-gender institution. Therefore, constructivists acknowledge social dimension of learning such as the classroom and learning community

whereby students make meaning of the world through both personal and social processes (Driver et al, 1994; Kearney, 2004).

According to Miha (2006), the emphasis of learning activities means two things: student- centered teaching and laboratory –centered teaching. Teacher-centered teaching has little effect on students' learning processes because the students themselves are at the center of instructional activities. Student comprehension can be developed by activities including conducting experiments (class experiments) and discussing the findings with classmates. The type, quality , and frequency of laboratory-centered instruction (chemistry practicals) are essential in helping students develop new ideas and knowledge. These lab exercises give students the chance to explore the process and techniques that are promoting conceptual shifts that could result in improved chemistry performance.

Research indicates that student achievement and motivation for the study of science improves dramatically if students are active participants in constructing their own knowledge and in learning to use that knowledge to analyze scientific processes (Khan, Hussain, Ali, Majoka & Ramzan, 2011). Also, Tobin (1990) and Ikeobi (2004), report

that meaningful learning is possible from a given laboratory experiments if the students are given ample opportunities to operate equipments and materials that help them to construct their knowledge of phenomena and related scientific concepts. Without active participation, many abstract notions in the context of chemistry, such as atomic models, chemical processes, and molecule structures, are challenging to understand. Several educational and cognitive theories that focus on how individuals learn, process information, and interact with multimedia content can help us better understand the use of audiovisual materials in chemistry teaching. With the help of audiovisual resources like movies, animations, and simulations, students can engage in active learning by seeing these ideas represented visually. By interacting with visual content, kids are able to better generate meaning rather than only memorize facts. Active science practice in structured learning environments that is, where the type and caliber of laboratory activities are taken into account leads to the development of profound scientific knowledge.

Meaning of Audiovisual Materials

Multimedia content in the form of videotapes, DVDs, audio tapes, audio CDs, and microforms are all referred to as audiovisual materials. These resources, which can be hard to find and obtain, are especially crucial in learning settings like university and school libraries. Bibliographic tools do not cover them in a systematic manner, and using or downloading anything from the open web requires caution especially when passing audiovisual materials on to third parties, such as students in a class. The durability and space-saving qualities of microforms, such microfilm and microfiche, make them ideal for distributing and preserving copies of information sources, particularly newspapers. Many libraries implemented microfilming initiatives in the 20th century to preserve priceless resources, however digitization is emerging as a substitute method of granting access to information in the 21st century without the dangers involved in people handling the originals.

A vast array of time-based media, including motion picture film, recorded sound, and various video formats, are included in the category of audio and moving image resources. The terms “audio and moving image” and “audiovisual” are used interchangeably. Although audio

and moving image resources currently comprise a relatively small percentage of digital libraries compared to textual and photographic materials, their numbers are steadily growing as analog collections are digitized and as digital content is created at a rapid pace. Due to their time-based nature and requirement for playback devices to access their content, audiovisual resources are fundamentally distinct from static documents and images. Patterns and signals that are perceived for a specific amount of time are used to transmit information in audio and moving image resources.

Audiovisual materials can be measured in hours and minutes, just like collections of archival documents are measured in linear feet. New types of external memory are made possible by audiovisual recordings, which offer a picture of reality in both space and time. Teruggi (2004) points out that the space-time unity, especially in the case of broadcast media, has transmitted an immediate sense of reality and created the essential record of our life, history, and culture. The author states, “conveying such immediacy also meant keeping a memory of and for society, building a historical record through both trivial and historic

events that have accumulated overtime and so have created a huge repository of our collective memory” (Teruggi, 2004, p. 4).

The Role of Audiovisual Materials in Education

The methods, resources, procedures, and attitudes used in the teaching process are all dependent on specific time constraints. These days, a teaching process would be impossible without the use of various audio-visual aids and high-tech equipment. Nearly every aspect of our lives is impacted by technology. We utilize technology for social interactions, travel, and our homes and businesses. Of course, these developments have also affected educational institutions. In recent years, classroom technology has grown in popularity. The majority of teachers worldwide now have access to the internet both at home and at their educational institutions. The primary justification for using the internet in education is research, and both educators and learners can access a multitude of information. Frequently, libraries lack the necessary books and resources for their research on a variety of subjects. The internet is now available to address this issue. When technology is used effectively, it can help students access a wide range

of information, knowledge, and skills that are essential for surviving and thriving in this technologically advanced world.

Teachers and students engage in organized interactions that facilitate the development of knowledge and skills. It takes place in the presence of a teacher, student, approach, and materials. Alaku stated that teacher's effectiveness depends on his use of appropriate instructional strategies and audio-visual aids. Proper instructional tactics demonstrate effective teaching methods and successful learning outcomes. They help students appreciate and comprehend the materials with ease. During the teaching-learning process, audiovisual materials offer multisensory experiences. Adult learners and students actively interact with audiovisual materials in addition to seeing and feeling them. This indicates that these experiences are entering through a variety of sensory channels. These experiences enter our bodies via our sensory organs: the eyes (to see), ears (to hear), nose (to smell), tongue (to taste), and skin (to touch). The sense organs are also known as the "Gateways of Knowledge" since they offer tactile, gustatory, olfactory, visual, and auditory experiences. Research done by Cobun (1968)

indicates that generally we learn 1% through taste, 1.5% through touch, 3.5% through smell, 11% through hearing and 83% through our sight.

Following our understanding of the principles, significance, and necessity of audiovisual materials, we will now look at their different kinds. In general, there are three categories of audiovisual materials:

I. Audio Materials

II. Visual Materials

III. Audio Visual Materials

I. Audio Materials

Media that rely solely on auditory perception are known as audio materials. They consist of spoken language, which is the most widely utilized and prevalent. Additionally, audio content includes music, sounds, and sound effects that enhance the beauty of spoken language. They could come straight from the source or through a device such a cell phone, iPod, tape recorder, or radio. The most effective technique for educators and facilitators is lecturing. In addition to lectures, other audio materials include recordings, audio snippets, radio broadcasts, and phones and mobile devices.

Radio: Information is transmitted from the source to the audience or receiver via radio waves. It is the most popular educational and entertaining media. Interactive Radio Instruction (IRI), community radios, and rural forums have all emerged as a result of educational radio for farmers, schools, and colleges. Despite being a one-time and one-way medium, radio offers a high level of emotional intensity, authenticity, and immediacy.

Recordings: They make two-way communication easier. They can be played and listened to again as often as necessary. The objectives of instruction and the students' learning requirements can guide the creation of recordings. Audio recordings can be listened to on tape recorders, discs, digital video discs (DVDs), CDs, and mobile phones. You can also get audio samples on the internet.

II. Visual Materials

Visual materials are those that are visible to us and can be comprehended by looking at an object's visual characteristics. These resources offer experiences that are close to reality. The visual sense is the most useful and efficient of the five senses when it comes to learning. A vivid mental image, accelerated comprehension, easier

memorization, and a shared experience are all provided by visual aids. An educator might choose from a wide variety of visual resources. They include pictures, charts, posters, maps, models, drawings, cartoons, display boards etc.

Pictures: Pictures are Visual Materials that help learners connect new words to known meaning, thus facilitating understanding and memorization (Jurich, 2001). Pictures and images have long played an important role as well as a useful resource in teaching and learning language (Goldstein, 2008). When words and images are presented together, they stimulate the audience's imagination and give spoken words more impact.

Posters: Posters are audacious and symbolic depictions of a single concept. In order to draw in passersby and hammer in messages, posters are typically hung at a height and well designed. They are employed to convey messages, educate people, and provide information in all spheres of life. to compel a layperson to understand the desired information.

Charts: Combining visual, graphic, numerical, or vertical elements, charts provide a succinct and understandable visual summary

of a concept. There are many charts like the pictorial chart, tabular chart, pie charts, flow charts, tree charts, organization charts, flip charts.

III. Audio Visual Materials

Materials that are simultaneously audible and visual are known as audio-visual materials. They give more realistic form to abstract ideas and concepts. They make it possible for teaching to progress from verbal to more tangible representation. They combine both acoustic and visual components. However, the majority of audiovisual products require equipment to be used because they cannot be accessed directly without the use of specialized playback technology, such as television, movies, video tapes, and projected materials. Audiovisual materials can be divided into two categories: projected and non-projected.

Projected Audio Visual materials: These include PowerPoint presentations, slides, film strips, films, and transparencies. To provide a larger image of the content, these are projected onto a screen or even a white wall. You may utilize them effectively in both small and large gatherings. Examples of projected audiovisual materials include televisions, films, PowerPoint presentations, etc.

Films: One of the best audiovisual resources is a film. When a story or event is captured on camera as a sequence of moving images and shown on television or in a theater, the "phi phenomenon," or persistence of vision, gives the impression that the images are moving. It makes learning new languages easier. They support students who are inclined toward self-directed learning. Additionally, movies foster the growth of critical thinking and imaginative abilities.

PowerPoint Presentations: These training materials are highly popular and consist of a series of slides created with software such as PowerPoint. They are becoming an essential component of many educational settings. The instructor or facilitator can conduct the entire lecture online if the PowerPoint presentation has audio commentary. The LCD projector can be used to project presentations.

Non-Projected Audio Visual materials: They provide firsthand experiences while also encouraging students to actively participate. These comprise the low-cost traditional practice media, such as puppets, folk theater, songs, and drama.

- Dramatization: Dramatization is a powerful teaching and learning tool that keeps the classroom engaging and dynamic. Students and learners

actively participate in theatrical productions as "on stage," "backstage," or spectators.

- Puppets: A puppet is an individual who uses a stick, thread, or his hands to operate a doll dressed as a character. On the puppet stage, the living beings are various actors who play their roles until a predetermined amount of time has passed. Children and adults alike are captivated by puppets, which have the capacity to raise awareness of problems and effectively convey messages.

When it comes to teaching the learning process, audiovisual aids are indispensable. It allows the teacher to deliver the lesson more effectively, and pupils learn and retain topics for longer periods of time. Students' analytical and critical thinking skills are enhanced by the usage of audio-visual aids. Visual representation aids in the removal of abstract ideas. However, using these tools carelessly or haphazardly can have a detrimental effect on the learning objective. Therefore, to get the most out of these tools, teachers should receive thorough in-service training.

The Impact of Audiovisual Materials on Chemistry Education

When compared to traditional teaching methods alone, audiovisual materials greatly improve chemistry education by simplifying difficult concepts, increasing student engagement and understanding, increasing motivation to learn, and enabling better visualization of chemical processes. This representation aids students in understanding abstract concepts such as atomic bonding and molecular dynamics, which can be difficult to grasp otherwise. Nevertheless, careful selection and curriculum integration are necessary for effective implementation.

Audiovisual resources can be especially useful in chemistry education for accommodating various learning preferences. Visual aids like videos, animations, and graphics can help students visualize complex chemical processes, while audio aids like podcasts and audio recordings can provide additional support for auditory learners (Felder & Silverman, 1988). The integration of these materials into the curriculum encourages active learning, as students can pause, replay, and engage with content at their own pace, deepening their understanding (Berk, 2009).

The materials' accessibility is yet another significant advantage. Students can access educational materials outside of the classroom with audiovisual content, which strengthens learning and offers more assistance to those who require it. It also helps bridge gaps in areas where teachers might have limited resources for hands-on laboratory work, as simulations and videos can replicate experiments that may be difficult or dangerous to perform in a typical classroom setting (López et al., 2021).

Additionally, audiovisual resources can encourage self-directed learning and foster creativity. By providing students with interactive and engaging learning materials, teachers can encourage students to take ownership of their learning and explore complex chemical concepts in a more self-directed way (Zhang et al., 2006).

Furthermore, using audiovisual resources in chemistry classes can increase students' motivation and interest. The thrill of witnessing a reaction in real time or using virtual reality to study molecular structures can pique interest and enhance the learning experience. It also allows for the integration of current scientific discoveries, giving

students a glimpse into the cutting-edge research that shapes the field of chemistry (Wolfe & Zuckerman, 2013).

In summary, the use of audiovisual resources in chemistry instruction has a significant positive influence on students' involvement and conceptual understanding. With the help of these resources, students from a variety of backgrounds and learning preferences can benefit from varied and adaptable learning possibilities.

Limitations and Challenges of Using Audiovisual Materials in Chemistry Education

Although the use of audiovisual materials can improve chemistry instruction, there are a number of drawbacks and difficulties. The availability of these resources is one of the main issues, especially for students from disadvantaged backgrounds or those who live in areas with inadequate access to technology. Many schools, especially in developing countries, lack the necessary infrastructure, such as computers, projectors, and internet connectivity, to effectively use audiovisual materials (Kozma, 2003). Devices with adequate processing power and internet connectivity are necessary for producing high-quality animations, simulations, and videos. In classrooms where such resources are not available, students may miss out on these valuable learning tools, exacerbating educational inequality (Baker & Franklin, 2017). This restriction can make it more difficult for audiovisual products to be widely used in all educational settings.

An over dependence on audiovisual aids may also result in less experiential learning. Practical laboratory experiments that are vital for learning critical skills like observation, problem-solving, and data

analysis are frequently incorporated into chemistry education. The tactile experiences of carrying out a lab experiment or conducting scientific research cannot be completely replicated by simulations or videos, even though they can mimic experiments. As a result, students might miss out on the critical skills developed through direct interaction with materials and instruments (Tobin & McRobbie, 1996). To keep chemistry teaching authentic, a balance between interactive exercises and video resources is necessary.

The possibility of cognitive overload presents another difficulty. Students who are unfamiliar with the underlying principles may become overwhelmed with audiovisual materials, particularly those that feature intricate simulations or fast-paced animations. According to Mayer's cognitive theory of multimedia learning, when the amount of information exceeds the learner's cognitive capacity, it can lead to ineffective learning (Mayer, 2005). Students may find it difficult to process the large amount of visual and auditory information presented simultaneously in chemistry classes, where concepts can be abstract and extremely complex. This would decrease the effectiveness of the educational process.

In summary, although audiovisual resources have many advantages for teaching chemistry, they also have drawbacks, such as problems with accessibility, cognitive overload, preparation time, expense, and the possibility of fewer opportunities for experiential learning. Teachers must carefully evaluate these limitations and incorporate them into a well-rounded and deliberate teaching strategy in order to optimize the impact of audiovisual tools.

Factors Influencing the Effectiveness of Audiovisual Materials

A number of important factors impact how well audiovisual materials convey their message and connect with the audience, which in turn shapes their effectiveness. The quality of the content, which includes relevance, accuracy, and clarity, is one of the most important factors. Excellent audiovisual material that is understandable, succinct, and educational has a higher chance of succeeding. For instance, a well-structured educational video that presents facts clearly and avoids unnecessary complexity is likely to help the audience grasp key concepts (Mayer, 2009). An additional crucial factor is the content's applicability to the audience. Content that is tailored to the interests and

requirements of the audience is more captivating and better at capturing and retaining their interest.

The audience's interests, learning preferences, and past knowledge are equally significant. According to cognitive theory, people retain information more effectively when the content is aligned with their existing knowledge base and learning style (Clark & Mayer, 2016). For example, educational content that caters to different learning preferences—visual, auditory, and kinesthetic—tends to have a greater impact on retention and understanding (Fleming & Mills, 1992). Similarly, materials tailored to the specific cultural context of the audience enhance their relevance and avoid misunderstandings that could hinder communication (Sue & Sue, 2012).

The length of time and pace of the content also affects effectiveness. Analyzing the length of audiovisual content is crucial because too long content can cause cognitive overload or disinterest, while too fast-paced content might make it difficult for the audience to properly assimilate the information. Research into cognitive load theory suggests that information should be presented at a pace that matches the learner's ability to process it (Sweller, 1988). While maintaining viewer

engagement, a well-paced audiovisual presentation makes sure the content is easy to understand.

Another crucial element is message clarity. The message of audiovisual content should be clear and concise. A study by Tversky, Morrison, and Betrancourt (2002) found that information presented in a clear, straightforward manner is more easily understood and retained. Overly elaborate or detailed graphics or music might be confusing, detracting from the main message and resulting to disengagement. To avoid this, instructional design principles, such as segmenting information and presenting it in manageable chunks, have been recommended to improve learning outcomes (Mayer, 2009).

In conclusion, a number of interconnected elements, such as production value, audience engagement, message clarity, timing, interactivity, and content quality, all affect how effective audiovisual products are. Proper alignment of these components guarantees that the material is remembered, captivating, and fulfills its intended function.

Critical Evaluation

There are a number of important conclusions from the research on how audiovisual resources affect chemistry students' motivation to

learn the subject. A critical assessment of the current literature, however, reveals a number of methodological flaws, inconsistencies, and gaps. Many studies have relied on small sample sizes, limited control groups, and short-term interventions, which can limit the generalizability and validity of the findings (Kozma, 2003). Additionally, not many research have used longitudinal designs to look at how audiovisual resources affect students' enthusiasm in learning chemistry over time.

Furthermore, there are conflicting results in the literature about how effective audiovisual resources are. While some research have discovered that using audiovisual materials excessively can cause students to lose their ability to think critically and solve problems, other studies have found that it can have good benefits on student motivation and engagement. These conflicting results emphasize the need for more investigation to fully understand how audiovisual resources affect student learning outcomes.

Moreover, the effect of audiovisual materials on students with varying learning styles, aptitudes, and cultural backgrounds has been mainly overlooked in the research that has already been done. This

oversight highlights the need for further research to examine the effectiveness of audiovisual materials in diverse educational contexts (Gay, 2000). As Gay (2000) notes, culturally responsive teaching requires consideration of the diverse backgrounds and experiences of students, which is essential for effective use of audiovisual materials. Research has shown that students with disabilities may require specialized materials or equipment to access audiovisual content (Seale, 2013).

Although the literature currently in publication indicates that audiovisual resources can enhance chemistry students' motivation to learn the subject, a critical assessment of the studies identifies a number of methodological flaws, inconsistencies, and gaps. Longitudinal designs, a variety of sample demographics, and in-depth analyses of how audiovisual materials affect student learning outcomes should be the main priorities of future research.

Conclusion and Implications

This critical examination has a wide range of repercussions. Firstly, future research should prioritize rigorous methodological designs, including longitudinal studies and diverse sample populations (Gay, 2000). This will make it possible for researchers to spot possible variations in efficacy among various student populations and gain a deeper understanding of the long-term effects of audiovisual materials on learning outcomes.

Educators and instructional designers should consider the potential benefits and limitations of audiovisual materials when integrating them into chemistry education (Mayer, 2009). Audiovisual resources, for instance, can be used to support various learning styles, offer additional instruction, and encourage student motivation and engagement. However, educators should also be aware of the potential drawbacks of audiovisual materials, such as over-reliance on technology and decreased critical thinking skills (Bullen, 2013).

Finally, policymakers and educational administrators should provide support for the development and implementation of high-quality audiovisual materials that cater to diverse student needs (Seale,

2013). This can include subsidizing the creation of accessible audiovisual resources, supporting chances for educators to advance professionally, and fostering cooperation between industry professionals, instructional designers, and educators.

In the end, a sophisticated grasp of the possible advantages and disadvantages of audiovisual resources is necessary for their efficient application in chemistry instruction. Teachers can use audiovisual resources to improve chemistry instruction and encourage student motivation and engagement by recognizing the complexity of the problem and placing a high priority on thorough research and inclusive practice.

CHAPTER THREE

RESEARCH METHODOLOGY

Overview

The methods and procedures that were employed to conduct this research study are described in this chapter. The following sections comprise the organization of the description: research design, target population, sample size and sampling techniques, research instruments, validity of the instrument, reliability of the instrument, method of data collection, method of data analysis.

Research Design

Kumar (2005) defines a research design as a plan, structure, and strategy of investigation to obtain answers to research questions or problems, while Kothari (2004) defines it as the blueprint for collection, measurement and analysis of data. The research design adopted for the study was survey method. Research design using the survey method involves a systematic plan for collecting and analyzing data from a sample of participants through self-report measures, typically in the form of questionnaires or interviews (Creswell, 2014). The survey method is commonly used in quantitative research to gather information

about attitudes, opinions, behaviors, and characteristics of a population (Fink, 2013). Studying big populations, seeing trends and patterns, and drawing generalizations about them are all made easier with this approach.

The survey method is a good way to find out how audiovisual resources affect chemistry students' motivation to learn the subject. Researchers can obtain first-hand information from students, compile information from a sizable and representative sample, and determine correlations between variables using this approach. Furthermore, surveys provide a useful and effective means of data collection, enabling researchers to examine students' beliefs, attitudes, and actions in a real-world setting.

Population of the Study

The population of the study consists of all students studying chemistry in Senior Secondary Schools in Ovia North East Local Government Area in Benin City, Edo State. This study will focus on students in the age range of 14-19. The students for the research are from both public and private secondary schools in the Local Government Area.

Sample Size and Sampling Techniques

The sample of the study of seventy(70) Students from the population. The sample was done using simple random sampling technique. Every student who was chosen at random would be given a questionnaire to complete as part of a planned sampling operation.

Research Instrument

The research data will be collected through a structured questionnaire which was developed by the researcher for the survey. The questionnaire, has been thoughtfully divided into two distinctive sections, namely section A and Section B. Section A is design to gather essential information regarding the demographic profile of the respondent, offering insight into the diverse background that contribute to the research context. On the other hand, Section B encapsulate 15 carefully crafted items strategically aimed at extracting pertinent information concerning the subject matter under investigation. It is worth noting that the questionnaire adopts a four points Likert scale, providing respondent with options ranging from Strongly Agree(SA), Agree (A), Disagree (D), and lastly Strongly Disagree (SD) if the items was positively phrased. This scaling system facilities a nuanced

understanding of participants perspectives, allowing for a more comprehensive analysis of the data collected.

Validity of the Instrument

The questionnaire was validated by the researcher's supervisor and two other lecturers in the Department of Curriculum and Instructional Technology from the Faculty of Education, University of Benin, Edo State, Nigeria. Their correction and suggestions will be used to produce the final draft of the instrument.

Reliability of the Instrument

The reliability of the instrument was established by administering it to 20 respondents who are chemistry students from Ovia North East Local Government and were not involved in the study, retrieving it, and then administering it to the same respondents again.

Method of Data Collection

The questionnaire would be administered by the researcher. Orientation on this research study will be given to respondent, so as to aid the proper answering of the questionnaire to be filled. The questionnaire will be collected by the researcher as soon as they are completed by the respondent.

Method of Data Analysis

The collected data is systematically organized and tabulated. Statistical analysis of the responses was conducted, utilizing mean and standard deviation for a comprehensive examination.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter focuses on data analysis, result presentation, and finding discussion. It is organized under two subheadings as follows;

- Presentation of result
- Discussion of findings

Presentation of Result

The results of the study are presented in accordance with the research questions. Questionnaire was distributed among 70 respondents (**n = 70**)

Research question 1: To what extent do audio-visual materials enhance chemistry students' interest in learning chemistry

Research questionnaire contained items relevant to the research question, allowing the researcher gather information about the degree to which audio-visual materials enhance chemistry students' interest.

Table 1

Extent to which audio-visual materials enhance chemistry students' interest

S / N	ITEMS	S A D S M S					
		A			D	E	T
						A	D
						N	V
1	Audio-visual materials significantly improve students' understanding of complex chemistry concepts.	1 9	3 0	1 5	6	2 . 8 9	0 . 9 3
2	Using audio-visual materials increases students' interest and motivation to learn chemistry.	2 0	3 6	1 4	0	3 . 0 9	0 . 6 9 0
3	Audio-visual materials help students visualize abstract chemistry concepts, making them easier to understand.	2 1	3 8	1 1	0	3 . 1 4	0 . 6 6 1
4.	Audio-visual material enhance students' critical thinking skills and problem-solving abilities in chemistry.	1 9	2 7	1 9	5	2 . 8 0	0 . 8 8 9
5.	The use of audio-visual materials leads to better retention of chemistry knowledge among students.	2 0	2 7	2 2	1	2 . 9 4	0 . 8 1 0

6.	Audio-visual materials provide an effective way to differentiate instruction and meet the needs of diverse learners in chemistry classes.	1 7	3 1	1 7	4	2 . 8 4	0 . 8 4 3
7.	Audio-visual materials increase students' confidence in their ability to learn and understand chemistry concepts.	1 5	3 4	1 7	4	2 . 8 6	0 . 8 1 5
8.	The use of audio-visual materials reduces students' anxiety and stress when learning chemistry.	8	3 3	9	7	2 . 2 2	0 . 8 4 9
9.	Audio-visual materials provide real-world examples and applications, making chemistry more relevant and interesting to the students.	1 7	2 7	1 9	7	2 . 7 7	0 . 9 3 0
10.	Audio-visual materials are essential for effective chemistry learning and should be used regularly used in classes.	1 9	3 1	1 3	7	2 . 8 9	0 . 9 1 9

Average mean = 2.84, Overall Std Dev= 0.831

(Interpretation: Low = 0 - 1.34, Medium = 1.35 - 2.67, High = 2.68 - 4)

In this study, Extent to which audio-visual materials enhance chemistry students' interest is measured using 10 items. The data in Table 1 shows the response gotten from the participants. The following data were drawn from the table.

For item 1 (Audio-visual materials significantly improve students' understanding of complex chemistry concepts) 19 of respondents strongly agreed, 30 agreed, 15 disagreed and 6 strongly disagreed. Item 2 (Using audio-visual materials increases students' interest and motivation to learn chemistry). 20 of respondents strongly agreed, 36 agreed, 14 disagreed and 0 strongly disagreed. Item 3 (Audio-visual materials help students visualize abstract chemistry concepts, making them easier to understand), 21 strongly agreed, 38 agreed, 11 disagreed and 0 strongly disagreed. Item 4 (Audio-visual material enhance students' critical thinking skills and problem-solving abilities in chemistry). 19 strongly agreed, 27 agreed, 19 disagreed and 5 strongly disagreed. Item 5 (The use of audio-visual materials leads to better retention of chemistry knowledge among students). 20 strongly agreed, 27 agreed, 22 disagreed and 1 strongly disagreed. Item 6 (Audio-visual materials provide an effective way to differentiate instruction and meet the needs of diverse learners in chemistry classes). 17 strongly agreed, 31 agreed, 17 disagreed and 4 strongly disagreed. Item 7 (Audio-visual materials increase students' confidence in their ability to learn and understand chemistry concepts). 15 strongly agreed,

34 agreed, 17 disagreed and 4 strongly disagreed. Item 8 (The use of audio-visual materials reduces students' anxiety and stress when learning chemistry). 8 strongly agreed, 33 agreed, 9 disagreed and 7 strongly disagreed. Item 9 (Audio-visual materials provide real-world examples and applications, making chemistry more relevant and interesting to the students). 17 strongly agreed, 27 agreed, 19 disagreed and 7 strongly disagreed. Item 10 (Audio-visual materials are essential for effective chemistry learning and should be used regularly used in classes). 19 strongly agreed, 31 agreed, 13 disagreed and 7 strongly disagreed.

Calculated mean from Table 1 are as follow. Item 1 (Mean = 2.89), Item 2 (Mean =3.09), Item 3 had the highest mean (Mean = 3.14), Item 4 (Mean = 2.80), Item 5 (Mean = 2.94), Item 6 (Mean = 2.84), Item 7 (Mean = 2.86), Item 8 (Mean = 2.22), Item 9 (Mean = 2.77), Item 10 (Mean = 2.89). Average mean is calculated to be 2.84, overall standard deviation is calculated to be 0.831.

Data gathered from the respondents on the extent to which audio-visual materials enhance chemistry students' interest showed that majority of

respondents agrees that audio-visual material do enhance students' interest toward learning chemistry.

Research question 2: What specific feature of audio-visual materials contribute to the increased student engagement

To address the research question, items relevant to the research question were generated to help measure how teachers perceive the AR use in their chemistry teaching.

Table 2
Specific feature of audio-visual materials contribute to the increased student engagement

S / N	ITEMS	S A	A	D	S D	M E A N	S T D E V
1	High quality visuals , such as images and videos, increase student engagement with audio-visual materials.	2 9	3 0	8	3	3 . 2 1	0 . 8 1 0
2	Interactive elements, such as quizzes and games, enhance student engagement with audiovisual materials.	1 8	2 9	1 7	6	2 . 8 4	0 . 9 0 4
3	Real-world examples and applications in audio-visual materials increases students interest and engagement.	2 2	2 9	1 5	4	2 . 9 9	0 . 8 7 0
4	Audio-visual materials with clear and concise narration improve students'	1 6	3 4	1 8	2	2 . 9	0 . 7

	interest and engagement.					1	7
							1
5	Incorporating humor and entertainment into audio-visual materials increases students' engagement.	2	2	2	5	2	0
.		0	5	0		.	.
						8	9
						6	1
							4
6	Audio-visual materials that allow students to control the pace of learning increase engagement.	1	3	1	2	2	0
.		6	4	8		.	.
						8	7
						4	7
							0
7	The use of animation and simulation in audio-visual material enhances student engagement.	2	3	1	0	3	0
.		7	0	3		.	.
						2	7
						0	2
							9
8	Audio-visual materials that incorporate student feedback and assessment increase engagement.	1	3	1	4	2	0
.		4	7	5		.	.
						8	7
						7	9
							0
9	Incorporating music and sound effects into audio-visual materials increases student engagement.	1	3	1	9	2	0
.		1	1	9		.	.
						6	8
						3	9
							7
1	Audio-visual materials that provide opportunities for collaboration and discussion increase student engagement.	2	2	1	5	2	0
0		0	8	7		.	.
.						9	9
						0	0
							0

Average mean = 2.92; Overall Std Dev = 0.836

(Interpretation: Low = 0 - 1.34, Medium = 1.35 - 2.67, High = 2.68 - 4)

The specific feature of audio-visual materials contribute to the increased student engagement using 7 items.

Table 2 contains data obtained from the respondents and data is summarized as follows;

Item 1 (High quality visuals, such as images and videos, increase student engagement with audio-visual materials) 29 of respondents strongly agreed, 30 agreed, 8 disagreed and 3 strongly disagreed. Item 2 (Interactive elements, such as quizzes and games, enhance student engagement with audiovisual materials) 18 of respondents strongly agreed, 29 agreed, 17 disagreed and 6 strongly disagreed. Item 3 (Real-world examples and applications in audio-visual materials increases students interest and engagement) 20 of respondents strongly agreed, 29 agreed, 15 disagreed and 4 strongly disagreed. Item 4 (Audio-visual materials with clear and concise narration improve students' interest and engagement) 16 of respondents strongly agreed, 34 agreed, 18 disagreed and 2 strongly disagreed. Item 5 (Incorporating humor and entertainment into audio-visual materials increases students' engagement) 20 of respondents strongly agreed, 25 agreed, 20 disagreed and 5 strongly disagreed. Item 6 (Audio-visual materials that

allow students to control the pace of learning increase engagement). 16 of respondents strongly agreed, 31 agreed, 19 disagreed and 4 strongly disagreed. Item 7 (The use of animation and simulation in audio-visual material enhances student engagement) 27 of respondents strongly agreed, 30 agreed, 13 disagreed and 0 strongly disagreed. Item 8 (Audio-visual materials that incorporate student feedback and assessment increase engagement) 14 of respondents strongly agreed, 37 agreed, 15 disagreed and 4 strongly disagreed. Item 9 (Incorporating music and sound effects into audio-visual materials increases student engagement) 11 of respondents strongly agreed, 31 agreed, 19 disagreed and 9 strongly disagreed. Item 10 (Audio-visual materials that provide opportunities for collaboration and discussion increase student engagement) 20 of respondents strongly agreed, 28 agreed, 17 disagreed and 5 strongly disagreed.

Item 1 has the highest mean (Mean = 3.21), Item 2 (Mean = 2.84), Item 3 (Mean = 2.99), Item 4 (Mean = 2.91), Item 5 (Mean = 2.86), Item 6 (Mean = 2.84), Item 7 (Mean = 3.20), Item 8 (Mean = 2.81), Item 9 (Mean = 2.63), Item 10 (Mean = 2.90). the average mean

is calculated to be 2.92 and the overall standard deviation calculated to be 0.836

For this research question, data obtained from the respondents on what specific feature of audio-visual materials contribute to the increased student engagement showed that majority of the respondents agrees that high quality visuals and the use of animations and simulations contributes to an increased level of engagement among students. This deductions can be seen from the very high mean value of Item 1 and Item 7.

Research question 3: How do audio-visual materials affect students’ understanding and retention of chemistry concepts

Items were generated in relation to the research question so as to help identify how audio-visual materials affect students’ understanding and retention of chemistry concepts.

Table 3
Effects of audio-visual materials on understanding and retention

S / N	ITEMS	S A	A	D	S D	M E A N	ST D E V
1 .	Audio-visual materials help students better understand complex chemistry concepts.	2 4	2 9	1 5	2	3 . 0 7	0.8 16

2	Visual aids in audio-visual materials improve students' ability to recall chemical information.	1 8	3 8	1 4	1	3 . 0 1	0.7 12
3	Audio-visual materials enhance students' understanding of chemical processes and reactions.	1 8	3 3	1 4	5	2 . 9 1	0.8 60
4	Interactive audio-visual materials promote deeper understanding and retention of chemical concepts.	1 7	2 6	2 3	4	2 . 8 0	0.8 70
5	Audio-visual materials help students connect chemistry concepts to real-world applications.	2 0	2 8	1 8	4	2 . 9 1	0.8 75
6	The use of audio-visual material reduces students' misconceptions about chemical concepts.	1 6	2 6	2 0	8	2 . 7 1	0.9 43
7	Audio-visual materials improve students' ability to visualize and understand chemical structures.	2 1	2 7	2 1	1	2 . 9 7	0.8 10
8	Audio-visual materials helps students' retention of chemistry information over time.	2 0	3 9	1 1	0	3 . 1 3	0.6 53
9	Audio-visual materials help students develop a more nuanced understanding of	2 1	3 1	1 6	2	3 . .	0.8 02

	chemistry concepts.					0	
						1	
1	Audio-visual materials are more effective	2	2	1	3	3	0.8
0	than traditional teaching method in	3	8	6		.	54
.	promoting students' understanding and					0	
	retention of chemistry concepts.					1	
Average mean = 2.95; Overall Std Dev = 0.820							

(Interpretation: Low = 0 - 1.34, Medium = 1.35 - 2.67, High = 2.68 - 4)

The effects of audio-visual materials on understanding and retention is measured using 10 items.

Table 3 contains the data gotten from the respondents and is summarized as follows:

Item 1 (Audio-visual materials help students better understand complex chemistry concepts). 24 of respondents strongly agreed, 29 agreed, 15 disagreed and 2 strongly disagreed. Item 2 (Visual aids in audio-visual materials improve students' ability to recall chemical information). 18 of respondents strongly agreed, 38 agreed, 14 disagreed and 1 strongly disagreed. Item 3 (Audio-visual materials enhance students' understanding of chemical processes and reactions). 18 of respondents strongly agreed, 33 agreed, 14 disagreed and 5 strongly disagreed. Item 4 (Interactive audio-visual audio-visual materials promote deeper understanding ad retention of chemical

concepts). 17 of respondents strongly agreed, 26 agreed, 23 disagreed and 4 strongly disagreed. Item 5 (Audio-visual materials help students connect chemistry concepts to real-world applications). 20 of respondents strongly agreed, 28 agreed, 18 disagreed and 4 strongly disagreed. Item 6 (The use of audio-visual material reduces students' misconceptions about chemical concepts). 16 of respondents strongly agreed, 26 agreed, 20 disagreed and 8 strongly disagreed. Item 7 (Audio-visual materials improve students' ability to visualize and understand chemical structures). 21 of respondents strongly agreed, 27 agreed, 21 disagreed and 1 strongly disagreed. Item 8 (Audio-visual materials helps students' retention of chemistry information over time). 20 of respondents strongly agreed, 39 agreed, 11 disagreed and 0 strongly disagreed. Item 9 (Audio-visual materials help students develop a more nuanced understanding of chemistry concepts). 21 of respondents strongly agreed, 31 agreed, 16 disagreed and 2 strongly disagreed. Item 10 (Audio-visual materials are more effective than traditional teaching method in promoting students' understanding and retention of chemistry concepts). 23 of respondents strongly agreed, 28 agreed, 16 disagreed and 3 strongly disagreed.

Item 1 (Mean = 3.07), Item 2 (Mean = 3.04), Item 3 (Mean = 2.91), Item 4 (Mean = 2.80), Item 5 (Mean = 2.91), Item 6 (Mean = 2.71), Item 7 (Mean = 2.97), Item 8 (Mean = 3.13), Item 9 (Mean = 3.01), Item 10 (Mean = 3.01). Average mean = 2.95, Overall Std Dev = 0.820.

For this research question, data gathered from the respondent on the effects of audio-visual materials on understanding and retention shows that most of the respondent agrees that audio-visual materials promote better understanding and retention to a high extent.

Discussion of Findings

Incorporation of visual aids for students retention

From the research findings, students can review and reinforce chemical information by replaying visual content, which enhances long-term memory. Students are better able to understand abstract concepts when they are shown visuals like animations of chemical reactions, molecular interactions, or periodic trends. Pictures that depict actual commercial uses or chemical experiments can pique interest and make learning more engaging and accessible. This is supported by Jurich(2001) who said that pictures are visual materials that help learners connect new words to known meaning, thus facilitating understanding and memorization. It is also supported by Goldstein(2008) who stated that pictures and images have long played an important role as well as a useful resource in teaching and learning language.

The use of simulations for students engagement

The study's conclusions include the usage of simulations to increase student engagement. Because they can work through the models at their own pace, students can receive individualized

instruction and practice again as needed. Because virtual labs do not require costly supplies or equipment, educational institutions with limited funding can still provide engaging lab experiences. Through the use of simulations, students can investigate difficult or dangerous chemical reactions in a virtual setting, encouraging safety while retaining interest. This is backed up by (López et al. 2021) who made the statement that audio-visual materials help bridge gaps in areas where teachers might have limited resources for hands-on laboratory work, as simulations and videos can replicate experiments that may be difficult or dangerous to perform in a typical classroom setting.

Improving students understanding of complicated concepts

Based on the findings of the study, audio-visual materials help simplify complex chemistry concepts. With the use of audio-visual resources, students can progressively advance their comprehension of chemistry from fundamental to more intricate ideas. Students can follow along at their own pace and reinforce fundamental concepts before continuing with this methodical approach. This is supported by (Zhang et al., 2006) who stated that by providing students with interactive and engaging learning materials, teachers can encourage

students to take ownership of their learning and explore complex chemical concepts in a more self-directed way.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study examined the effects of audio-visual resources on students' motivation to learn chemistry, focusing on their features, accessibility, benefits, and limitations. Three main questions served as a guide for the study:

1. To what extent do audiovisual materials enhance chemistry students' interest in learning chemistry?.
2. What specific features of audiovisual materials contribute to increased student engagement?.
3. How do audiovisual materials affect students' understanding and retention of chemical concepts?.

Students enrolled in senior secondary schools teaching chemistry in Ovia North-East Local Government Area, Edo State, Nigeria, made up the study's population.

The study found a significant conflict between students' enthusiasm for audio-visual materials and the harsh reality of limited resources in many schools. Students' frequently lack access to essential

resources like online simulations, multimedia, and textbooks, despite their awareness of how crucial these tools are to enhancing their education. Students' potential to interact with complex chemistry topics and take part in real-world experiments is limited by this lack of resources. According to the students, interactive, instructive, realistic, flexible, and engaging audio-visual materials are essential to meeting their unique learning needs. They also acknowledged the advantages of these resources in creating better comprehension, higher levels of engagement, better retention, more customized learning, and greater drive.

However, certain barriers prevent the full potential of these materials. Poor classroom conditions, a dearth of top-notch audiovisual materials, limited access to digital devices, insufficient teacher preparation, a slow internet connection, and technical issues are some of these difficulties. Furthermore, students find it challenging to effectively use audio-visual materials due to issues like cognitive overload, the potential for inaccurate information, and linguistic and cultural barriers. To overcome these challenges, schools must prioritize expanding access to high-quality audiovisual materials that cater to the

unique learning needs of each student. This necessitates a focused effort to enhance these resources' accessibility, quality control, and alignment with students' educational requirements.

Conclusion

The integration of audio-visual tools is necessary to enhance the teaching and learning process in chemistry classes. By using these tools, educators may make complex concepts easier to understand, foster a more engaging learning environment, and foster critical thinking and scientific literacy—two essential skills. In many educational institutions, audio-visual resources are severely lacking, despite their importance. Students' access to experiential learning opportunities and their ability to understand fundamental concepts may be severely hampered by this lack of resources. Maximizing the effectiveness of audio-visual materials requires addressing the disparity between their intended and actual quality.

Despite emphasizing the value of concise, relevant, and clear materials, students usually receive materials that fall short of these expectations. A multifaceted approach is required to address these problems. Educational establishments should place a high premium on investing in top-notch audio-visual materials and educating instructors on effective integration strategies. Furthermore, policymakers play a crucial role in developing and establishing a robust technological

infrastructure that will enable the seamless integration of digital tools.

By bridging these gaps, educators may create a more supportive and inclusive learning environment that fosters growth in chemical knowledge and academic achievement.

Recommendations

1. **Provision of High-Quality Audiovisual Materials:** The government and educational establishments should invest in the supply of top-notch audiovisual resources in order to enhance chemistry teaching and learning.
2. **Classroom Environment:** Audio-visual resources have to be accessible to students in a welcoming and encouraging setting.
3. **Maintaining of Audio-visual Materials:** The lifetime and effectiveness of instructional resources should be ensured by regular updates and appropriate maintenance.
4. **Teacher Development and Training:** Regular workshops and training sessions on the appropriate use of audio-visual resources should be attended by chemistry teachers.
5. **Collaboration Amongst Participants:** Working together, parents, educators, and legislators can enhance the financing and distribution of resources for educational resources in schools.

Suggestions for Further Studies

The effectiveness of various audio-visual materials in improving student understanding, teacher attitudes and competencies in using these materials, the role of government policies in promoting their availability and use, and their impact on student performance in other science subjects like biology and physics should all be examined in future research. Specific instructional materials like virtual labs and 3D models should also be examined, and the advantages and disadvantages of incorporating these materials into secondary school chemistry instruction in Nigeria should be evaluated.

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**DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL
TECHNOLOGY
FACULTY OF EDUCATION
UNIVERSITY OF BENIN, BENIN CITY, EDO STATE**

Dear Respondent,

I am OKOYE SOMTOCHUKWU MIRACLE, an undergraduate student from the above mentioned department. As part of the requirements for the program, I am conducting a research titled “The Influence of Audio-Visual Teaching Aids on Students' Motivation and Engagement in Chemistry”. In this regard, you have been dully selected as a sample. I also wish to assure you that answers will be treated with strict confidentiality and used for the stated academic purpose only.

SECTION A

Please tick {√} to your preferred choice(s) on a question

Personal Information

Gender: Male [] Female []

Age: 14-18years [] 19-21years []

SECTION B

Instruction: Please indicate the extent to which you agree to the following information. You are to access the following in the scale of “Strongly agree to Strongly disagree”

KEYS: SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree

S/N	ITEMS	SA	A	D	SD
RQ1	To assess the extent to which audio-visual materials enhance chemistry students' learning				
1	Audio-visual materials significantly improve students' understanding of complex chemistry concepts				
2	Using audio-visual materials increases students' interest and motivation to learn chemistry				
3	Audio-visual materials help students visualize abstract chemistry concepts, making them easier to understand				
4	Audio-visual materials enhance students' critical thinking skills and problem-solving abilities in chemistry				
5	The use of audio-visual materials leads to better retention of chemistry knowledge among students				
6	Audio-visual materials provide an effective way to differentiate instruction and meet the needs of diverse learners in chemistry classes				
7	Audio-visual materials increase students' confidence in their ability to learn and understand chemistry concepts				
8	The use of audio-visual materials reduces students' anxiety and stress when learning chemistry				
9	Audio-visual materials provide real-world examples and applications, making chemistry more relevant and interesting to students				
10	Audio-visual materials are essential for effective chemistry learning and should be used regularly in classes				

RQ2	What specific features of audiovisual materials contribute to increased student engagement?	SA	A	D	SD
11	High-quality visuals, such as images and videos, increase student engagement with audio-visual materials.				
12	Interactive elements, such as quizzes and games, enhance student engagement with audio-visual materials				
13	Real-world examples and applications in audio-visual materials increase student interest and engagement				
14	Audio-visual materials with clear and concise narration improve student engagement				
15	Incorporating humor and entertainment into audio-visual materials increases student engagement				
16	Audio-visual materials that allow students to control the pace of learning increase engagement				
17	The use of animations and simulations in audio-visual materials enhances students engagement				
18	Audio-visual materials that incorporate student feedback and assessment increase engagement				
19	Incorporating music and sound effects into audio-visual materials increases student engagement				
20	Audio-visual materials that provide opportunities for collaboration and discussion increase student engagement				

RQ3	How do audio-visual materials affect students' understanding and retention of chemical concepts?	SA	A	D	SD
21	Audio-visual materials help students better understand complex chemical concepts				
22	Visual aids in audio-visual materials improve students' ability to recall chemical information				
23	Audio-visual materials enhance students' understanding of chemical processes and reactions				
24	Interactive audio-visual materials promote deeper understanding and retention of chemical concepts				
25	Audio-visual materials help students connect chemical concepts to real-world applications				
26	The use of audio-visual materials reduces students' misconceptions about chemical concepts				
27	Audio-visual materials improve students' ability to visualize and understand chemical structures				
28	Audio-visual materials enhance students' retention of chemical information over time				
29	Audio-visual materials help students develop a more nuanced understanding of chemical concepts				
30	Audio-visual materials are more effective than traditional teaching methods in promoting students' understanding and retention of chemical concepts				