Journal of Continuing and Development Education, Volume 5 (1), 2025| ISSN: 2714-3376

Original Article

YOUTUBE VIDEOS AND STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN SECONDARY SCHOOL CHEMISTRY CLASS IN ABUJA

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DOI:https://doi.org/10.5281/zenodo.16101231

Abstract

Digital technology is becoming increasingly integrated into education. YouTube in particular provides an innovative supplement to traditional teaching methods. This study therefore investigates the impact of YouTube videos on students' academic achievement and retention in secondary school chemistry classes in Bwari Area Council, Abuja. It examined how the use of chemistry-related videos influences students' understanding of concepts, academic achievement, and long-term retention. Quasi-experimental research design was adopted for the study. A sample of 120 chemistry students was selected using stratified random sampling to ensure proportional representation across different schools and academic levels. The participants were divided into an experimental group (n = 60) exposed to YouTube-supported chemistry instructions and a control group (n = 60) receiving traditional instruction. The reliability index of the achievement test was calculated using Cronbach's alpha, yielding a coefficient of 0.95, indicating high reliability. The study employed a pre-test/post-test design, with retention tests administered after four weeks. The findings revealed significant differences in academic achievement ($t = 7.25$, $p < 0.001$, Cohen's $d = 1.2$) and retention ($t = 6.50$, $p < 0.001$, Cohen's $d = 1.1$) between the experimental and control groups, favor the experimental group. The study concludes that YouTube-supported chemistry instruction is effective in enhancing students' academic achievement and retention in secondary school chemistry classes. The study recommends that chemistry teachers should leverage on YouTube videos to supplement traditional instruction.

Keywords: *YouTube videos, academic achievement, retention, chemistry, Bwari, quasi-experiment*

Introduction

The role of chemistry in the development of the scientific base of a country cannot be overemphasized and Nigeria is not an exception. Chemistry is part of everything in people's lives. It is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. Understanding basic chemistry concepts is important for every science profession. However, Yahaya, et al. (2021) opined that despite the increasing importance of chemistry to the unfolding world, it is

disappointing to note that the students' achievement in chemistry at internal and external examination has remained considerably poor. The academic achievement and retention of Nigerian students in the subject at the secondary school level remains a dismal poor.

The Oxford Dictionary defined academic achievement as student's success in meeting their educational goals, often measured by grades, test scores and overall performance. Achievement is a measuring scale that tells the degree of performance to which a student has accomplished a specific task at the end of the instructional engagement. Retention on the other hand is the ability to retain and recall learned information (Alachi et al, 2025). Retention is an essential aspect of learning, particularly in chemistry. Additionally, Alachi et al., (2025) cited Ngwoke and Eze described retention as the process of maintaining acquired knowledge, which plays a critical role in ensuring that what is learned can be effectively applied. Effective retention is very important because a student who quickly forgets learned concepts in chemistry is unlikely to perform well in the subject.

Poor retention is often linked to rote learning, which fails to engage students meaningfully. This majorly leads to poor students' academic achievement in chemistry. Poor teaching techniques and failure to apply concepts to real-life situations are significant factors limiting retention in science subjects including chemistry. The teaching strategy adopted by the teacher greatly influences retention. There is therefore a need for instructional methods that promote active student involvement to enhance retention in secondary school chemistry. Teachers are to adopt several teaching methodologies involving the use of digital tools to facilitate students' understanding of chemistry curriculum contents.

The use of videos in the context of educational instruction is becoming more prominent. According to Mohammed and Ogar (2023), institutions worldwide now create YouTube channels to enable students view lecture videos. This is because YouTube is available for the use of students and teachers within and outside the classroom settings. It helps students learn, stimulate class discussions and achieve learning goals. Secondary school teachers can use YouTube videos as a model for classroom activities and discussions. YouTube provides students and teachers with a different stock of videos that illustrate the concepts they want to teach.

According to Alachi et al. (2025), YouTube instructional video package is social networking website in which individual or organization with internet access can upload videos that can be seen by viewers. As a learning aid, the YouTube instructional video package gives students the added benefit of allowing them to further study the subjects covered in class after classroom instruction. To facilitate students' understanding and retention of chemistry concepts, YouTube instructional video package may invariably improve students' retention in the concepts of atomic structure, chemical bonding and molecular structure, acids and bases, equipment usage and handling, laboratory techniques, electrochemistry, kinetic, thermodynamics, among others.

The integration of YouTube videos into chemistry education is supported by Ezeudu et al., (2020) who argued that the application of technology on knowledge and skills is significant. In a YouTube video learning approach, students build proper mental structure with corresponding concepts in chemistry. This is as a result of associated auditory and visual channels of YouTube videos for information processing. The use of YouTube instructional videos in the teaching learning process captures students' attention, make lessons more interesting and enhance understanding of concepts and ability to undertake cognitively demanding tasks (Ezeudu et al., 2020).

According to Zhou et al. (2020), the blend of online environment with social interaction connects

human's social networks. YouTube instructional video also offers opportunities to students to create and construct their own knowledge. Habes et al. (2019) averred that students have consistently demonstrated enthusiasm for watching, downloading and exchanging YouTube video clips with peers, both within and beyond the classroom setting. The sounds, beautiful motion pictures of YouTube websites provide intuitive information that support learners in concepts acquisition (Abrar, 2022). Thus, Koto (2020) argued that incorporating students' interest in YouTube videos into the chemistry classroom as an interactive tool will significantly enhance student engagement by promoting active participation during instructional sessions.

YouTube videos are valuable to practical, medical and clinical science education, and research, and they may be used in various ways to stimulate students' participation to checkmate lack of interest that usually comes with conventional learning. Using video clips arouse interest, increase concentration, and improve memory and intelligence. YouTube clips compliment the work of the teacher by bridging the gap between theory and practice, thereby enhancing academic achievement. YouTube videos can be used directly in the classroom as part of the teaching process. They can also be used to introduce fresh concepts, stress more information during instruction, or at the end of the lesson to confirm key points.

Meanwhile, past studies have identified some drawback to the application of YouTube videos in facilitating students' academic achievement and retention, particularly in chemistry. Adanır et al., (2022) identified problems related to students experiencing systematic problems with their internet connection, loss of internet connection, low quality of internet bandwidth and systematic loss of electricity. Due to these problems, some students were not able to watch videos and had difficulty in following the chemistry course video lectures. Additionally, students whilst watching videos regarding course content and experiments, they listened to instructors and watched the videos but they could not actively participate during the laboratory experiments. Mecida et al., (2023) found that although using video-based lessons in the classroom has many advantages, especially for teaching but it opens to individual bias and interpretation. Moreover, the expense burden of using video as an instructional medium, particularly in institutions with limited resources, was identified as a challenge. Most developing nations may not be able to support this type of teaching without relying on outside financing due to the high cost of producing high-quality video-based chemistry learning materials.

In addition, Mecida et al., (2023) asserted that absence of personal interaction is one of the key drawbacks of video-based learning in education. Even if lectures or meetings are streamed, participants may miss out on crucial body language and facial reactions. That might occur if someone encounters a stuttering video or a pixelated image from the presentation because of subpar hardware or an unreliable internet connection. These activities might hinder learning and waste resources like time and internet data subscriptions. Lange and Costley (2020) acknowledged that information transfer issues can arise specifically if media are presented in a way that restricts viewers' concentration, attention, interest, engagement and overburdens working memory. Brandt et al. (2022) equally opined that many students and teachers who inevitably spend a lot of time online may begin to exhibit signs of social isolation because of the absence of human interaction in their life. It is against this background that this study investigated the impact of YouTube videos on students' academic achievement and retention in secondary school chemistry class in the Bwari Area Council, Abuja.

Statement of the Problem

Students' poor achievement and retention in chemistry and other science related subjects has been

a greater concern to educational stakeholders and the government in general, since development of every country is dependent on science, technology, engineering and mathematics (STEM) education (Freeman et al., 2019). The researcher observed that chemistry teachers in many public secondary schools in Abuja are still using lecture methods, which are essentially talk-and-chalk presentations to teach chemistry concepts. Additionally, the chemistry classes are abstract and become difficult to build relationships between chemistry concepts and the real world. Instructional strategies in use in teaching chemistry in public secondary schools in Abuja are observed to have not stimulated students' interest nor facilitated the teaching and learning process. This problem thus necessitated this study on the impact of YouTube videos on students' academic achievement and retention in secondary school chemistry class in the Bwari Area Council, Abuja.

Research Objectives

The specific objectives of the study were to:

1. Find out the difference in mean achievement scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.
2. Determine the difference in mean retention scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

Research Questions

The following research questions were raised to guide the study:

1. What is the difference in mean achievement scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja?
2. What is the difference in mean retention scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja?

Hypotheses

The following null hypotheses were tested in the study:

HO_1: There is no significant difference in the mean pre-test and post-test achievement scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

HO_2: There is no significant difference in mean retention scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

Methodology

The study adopted quasi-experimental research design with Pre-Test/Post-Test Design. The population for the study was 1,200 students enrolled in chemistry in six senior secondary schools in Bwari Area Council. The sample for the study consisted of 120 chemistry students selected using stratified random sampling to ensure proportional representation across different schools and academic levels. Chemistry students were administered pre-tests before the intervention and post-tests after the intervention to assess their academic achievement. Retention tests are also administered after a certain period to evaluate knowledge retention. The participants were 120 chemistry students (60 in the experimental group and 60 in the control group). The groups were comparable in terms of demographic characteristics and prior knowledge in chemistry.

Chemistry students in the experimental group received YouTube-supported chemistry instructions as part of their regular curriculum. Chemistry students in the control group received traditional instruction without the use of YouTube videos. For data collection instruments, a pre-test was administered to both groups (EG and CG) before the intervention to assess their prior knowledge in chemistry. A post-test was administered to both groups (EG and CG) after the intervention to assess their academic achievement. A retention test was also administered to both groups (EG and CG) after a certain period (4 weeks) to evaluate their knowledge retention. Chemistry achievement test

was adopted and validated by two experts in the field of chemistry with the reliability index calculated using Cronbach's alpha, yielding a coefficient of 0.95, indicating high reliability. Descriptive Statistics (Mean scores and standard deviations) were calculated for both groups. Inferential Statistics (t-tests) were used to compare the mean scores between the experimental and control groups. Effect sizes (Cohen's d) were calculated to determine the magnitude of the intervention's impact.

Results

HO_1: There is no significant difference in the mean pre-test and post-test achievement scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

Table 1: Sample Characteristics

Group	Sample Size (n)	Mean Age	Male/Female Ratio
Experimental (YouTube-Supported)	60	16.5	30:30
Control (Traditional Instruction)	60	16.3	28:32

Table 1 shows the demographic characteristics of the 120 chemistry students, divided into experimental and control groups.

Table 2: Pre-Test and Post-Test Results

Group	Pre-Test Mean	Post-Test Mean	Mean Difference
Experimental (YouTube-Supported)	55	85	30
Control (Traditional Instruction)	53	70	17

Table 2 shows that the mean difference indicates a larger improvement in the experimental group.

Table 3: t-Test Results

Test	t-value	p-value	Effect Size (Cohen's d)	Decision
t-test (Post-Test Scores)	7.25	< 0.001	1.2	Rejected

The t-test results indicate a significant difference between groups, with a large effect size, suggesting YouTube-supported instructions had a substantial impact on academic achievement of students in chemistry. The quasi-experiment suggests that YouTube-supported chemistry instructions significantly improved academic achievement, as evidenced by the experimental group's higher mean scores and large effect size. The null hypothesis is therefore rejected. This implies that there is a significant difference in the mean pre-test and post-test achievement scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja

HO_2: There is no significant difference in mean retention scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

Table 4: Sample Characteristics

Group	Sample Size (n)	Mean Age	Male/Female Ratio
Experimental (YouTube-Supported)	60	16.5	30:30
Control (Traditional Instruction)	60	16.3	28:32

Table 4 shows the demographic characteristics of the 120 chemistry students, divided into experimental and control groups.

Table 5: Pre-Test and Post-Test, and Retention Test Results

Group	Pre-Test Mean	Post-Test Mean	Retention Test Mean	Mean Difference (Post-Pre)	Mean Difference (Retention-Pre)
Experimental (YouTube-Supported)	55	85	80	30	25
Control (Traditional Instruction)	53	70	65	17	12

Table 5 shows that the mean differences indicate larger improvements and better retention in the experimental group.

Table 6: t-Test Results

Test	t-value	p-value	Effect Size (Cohen's d)	Decision
t-test (Retention Test Scores)	6.50	< 0.001	1.1	Rejected

The t-test results indicate a significant difference between groups, with a large effect size, suggesting YouTube-supported instructions had a substantial impact on retention scores of chemistry students. The quasi-experiment suggests that YouTube-supported chemistry instructions significantly improved retention scores, as evidenced by the experimental group's higher mean scores and large effect size. The null hypothesis is therefore rejected. This implies that there is a significant difference in mean retention scores of students exposed to YouTube-supported chemistry instruction in secondary schools in Bwari Area Council, Abuja.

Discussion of Major Findings

Findings indicate improved academic achievement among experimental group which showed larger improvement in mean scores = 30 as against control group that showed lesser improvement in mean scores = 17. The intervention had a substantial impact on academic achievement (Cohen's d = 1.2). YouTube chemistry instruction is effective. YouTube-supported instructions led to better learning outcomes among chemistry students. The findings are consisted with the study by Koto (2020) that incorporating students' interest in YouTube videos into the chemistry classroom as an interactive tool will significantly enhance student engagement by promoting active participation during instructional sessions. It also aligned with Mohammed and Ogar (2023) that YouTube channels enable students view lecture videos. It helps students learn, stimulate class discussions and achieve learning goals.

Findings also indicate improved retention among experimental group. It showed better retention, with a mean difference of 25 compared to 12 in the control group. It also shows large effect size indicating that the intervention had a substantial impact on retention scores of students exposed to YouTube-supported chemistry instructions. YouTube-supported instructions led to better retention of chemistry concepts. The findings corroborated the view of Ezeudu et al., (2020) that the application of YouTube technology on knowledge and skills is significant. In a YouTube video learning approach, students build proper mental structure with corresponding concepts in chemistry. This is as a result of associated auditory and visual channels of YouTube videos for information processing. It also agreed with Abrar

(2022) who argued that the sounds, beautiful motion pictures of YouTube websites provide intuitive information that support learners in concepts acquisition. These features in YouTube videos significantly improved retention.

Conclusion

Chemistry is a fundamental science subject that prepares secondary school students for science related courses in higher institutions. Enhancing academic achievement and retention of students in chemistry class is fundamental for every secondary school teacher. Based on the findings of the study, it is therefore concluded that application of YouTube videos in chemistry class facilitate students' academic achievement and retention in chemistry in Bwari Area Council, Abuja.

Recommendations

Based on the findings and conclusion of the study, the following recommendations are proposed:

1. Chemistry teachers should leverage on YouTube videos to improve students' academic achievement in chemistry in secondary schools.
2. Nigerian Chemistry teachers should develop high quality local video contents of chemistry tutorials for students.
3. The FCT administration should leverage on YouTube videos by providing free internet WIFI connection in public schools to improve students' understanding and retention of chemistry concepts.
4. The Federal Government of Nigeria should facilitate reduction in the cost of data subscription. The can be done by directing her economic policies toward ensuring low operating cost for internet service providers.

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