The American Journal of Social Science and Education Innovations
ISSN 2689-100X Volume 08 - 2026

Instructional Strategies on Secondary School Students' Achievement in Biology in Makurdi Metropolis, Benue State, Nigeria

Dr. Haruto Nakamura
Department of Social Innovation and Educational Studies
Kyoto Institute of Human Development
Kyoto, Japan

Dr. Aiko Fujimoto
Faculty of Education and Social Transformation
Tokyo Center for Advanced Educational Research
Tokyo, Japan

Received: 29 Mar 2025 | Received Revised Version: 19 Apr 2025 | Accepted: 27 May 2026 | Published: 01 June 2026

Volume 08 Issue 06 2026 |

Abstract

The persistent decline in students' achievement in Biology in Nigerian secondary schools has generated concerns among educators, policymakers, and researchers. Traditional teacher-centered instructional approaches have been criticized for their inability to stimulate active learning, conceptual understanding, and long-term retention of scientific knowledge. Consequently, contemporary instructional strategies such as individualized learning and cooperative learning integrated with video-based instructional technologies have attracted considerable scholarly attention. This study examines the comparative effects of individualized and cooperative video-based instructional strategies on secondary school students' achievement in Biology in Makurdi Metropolis, Benue State, Nigeria. The study is situated within constructivist and social learning frameworks, emphasizing learner engagement, interaction, and multimedia-supported knowledge construction. A quasi-experimental research design involving pre-test and post-test measures is proposed to evaluate differences in achievement among students exposed to individualized video-based instruction, cooperative video-based instruction, and conventional teaching methods. Literature indicates that video-based instruction enhances visualization of biological processes, facilitates conceptual understanding, and improves retention of scientific concepts. Similarly, cooperative learning promotes peer interaction, collaborative problem-solving, and shared responsibility for learning, while individualized learning accommodates learner differences and self-paced instruction. Findings from the review suggest that both instructional strategies significantly improve students' achievement in Biology compared to conventional methods, although cooperative video-based instruction tends to yield higher achievement gains due to enhanced interaction and collective cognitive engagement. The study concludes that integrating video technology with learner-centered pedagogies can substantially improve Biology education outcomes in Nigerian secondary schools. Recommendations are offered for teachers, curriculum planners, educational administrators, and policymakers regarding effective implementation of video-based instructional strategies.

Keywords: Biology Education, Cooperative Learning, Individualized Learning, Video-Based Instruction, Academic Achievement, Secondary Schools, Educational Technology, Science Education, Nigeria.

Cite This Article: Nakamura, D. H., & Fujimoto, D. A. (2026). Instructional Strategies on Secondary School Students' Achievement in Biology in Makurdi Metropolis, Benue State, Nigeria. The American Journal of Social Science and Education Innovations, 8(06), 1–10. Retrieved from https://www.theamericanjournals.com/index.php/tajssei/article/view/8030

1. Introduction

Background

Science education occupies a strategic position in national development because it equips learners with the knowledge, skills, and competencies necessary for technological advancement and socioeconomic transformation. Biology, as a major science subject in secondary school curricula, contributes significantly to students' understanding of living organisms, environmental sustainability, health sciences, and biotechnology. The Federal Republic of Nigeria recognizes Biology as a core science subject essential for scientific literacy and national development (Federal Republic of Nigeria, 2014).

Despite its importance, students' academic achievement in Biology has remained unsatisfactory in many Nigerian secondary schools. Reports have consistently revealed poor performance in Biology examinations, raising concerns among stakeholders regarding the effectiveness of existing instructional practices. Several factors have been identified as contributors to this challenge, including inadequate instructional materials, ineffective teaching methodologies, poor teacher preparation, limited technological integration, and insufficient learner engagement (Ityokyaa & Adejoh, 2014; Eunice, Khatete & Ondigi, 2014).

Teaching effectiveness remains a critical determinant of educational quality and student achievement. According to Afe (2001), effective teaching requires the strategic application of instructional methods that facilitate meaningful learning experiences and accommodate learner differences. The challenges confronting science education increasingly demand innovative pedagogical approaches capable of enhancing students' interest, participation, and academic performance. The observations of Afe (2001) further suggest that teachers must continually adapt instructional practices to emerging educational realities and learner needs.

The emergence of information and communication technologies has transformed educational practices globally. Video-based instructional strategies represent one of the most promising technological innovations for science teaching and learning. Educational videos facilitate visualization of abstract concepts, demonstration of biological processes, and presentation of scientific phenomena that may be difficult to observe directly in classroom settings (Gambari et al., 2014). Through audiovisual stimulation, students can develop deeper conceptual understanding and increased motivation toward learning.

Video-based instruction can be implemented through different pedagogical approaches. Two prominent approaches include individualized video-based instruction and cooperative video-based instruction. Individualized instruction allows learners to progress at their own pace, revisit difficult concepts, and assume greater responsibility for their learning process. Cooperative instruction, on the other hand, encourages collaborative learning through group interaction, discussion, and collective problem-solving activities (Mobark, 2014).

Research evidence indicates that both individualized and cooperative learning approaches contribute positively to academic achievement. However, limited studies have comparatively examined the effectiveness of these approaches when integrated with video-based instructional technologies in Biology education, particularly within the context of Makurdi Metropolis, Benue State. This study therefore seeks to bridge this gap by investigating the comparative effects of individualized and cooperative video-based instructional strategies on secondary school students' achievement in Biology.

Problem Statement

The continued poor achievement of secondary school students in Biology remains a major educational concern in Nigeria. Traditional instructional methods frequently emphasize passive knowledge transmission rather than active learner participation. Consequently, many students struggle with abstract biological concepts, exhibit low motivation toward science learning, and perform poorly in examinations.

Although technological innovations and learner-centered instructional approaches have been advocated as solutions to these challenges, their integration into classroom practice remains inconsistent. Furthermore, limited empirical evidence exists regarding the comparative effectiveness of individualized and cooperative video-based instructional strategies in enhancing Biology achievement among secondary school students in Makurdi Metropolis. The absence of such evidence restricts informed decision-making

concerning instructional improvement and educational policy implementation.

Objectives of the Study

The study seeks to:

1. Examine the effect of individualized video-based instructional strategy on students' achievement in Biology.

2. Determine the effect of cooperative video-based instructional strategy on students' achievement in Biology.

3. Compare the achievement outcomes of students exposed to individualized and cooperative video-based instructional strategies.

4. Evaluate the relative effectiveness of video-based instructional approaches compared with conventional teaching methods.

5. Provide recommendations for effective integration of video-based instruction in Biology education.

Research Questions

1. What effect does individualized video-based instruction have on students' achievement in Biology?

2. What effect does cooperative video-based instruction have on students' achievement in Biology?

3. Is there a significant difference in achievement between students exposed to individualized and cooperative video-based instruction?

4. How do video-based instructional strategies compare with conventional teaching approaches in Biology education?

Significance of the Study

The study contributes to educational practice by providing empirical evidence regarding effective instructional strategies for improving Biology achievement. Teachers may benefit from insights concerning the pedagogical advantages of integrating video technologies with individualized and cooperative learning approaches. Educational administrators and policymakers may utilize findings to support curriculum innovation, teacher professional development, and technological investment in schools. Furthermore, the study contributes to the growing body of literature on educational technology and science education in Nigeria.

Scope of the Study

The study focuses on secondary school students within Makurdi Metropolis, Benue State, Nigeria. It specifically examines the comparative effects of individualized and cooperative video-based instructional strategies on students' achievement in Biology. The investigation is limited to instructional effectiveness and does not address broader educational variables such as socioeconomic status, school funding, or institutional governance.

2. Literature Review

Concept of Biology Education

Biology occupies a central position within science education because it provides foundational knowledge concerning living organisms, ecological systems, genetics, evolution, and human health. Effective Biology education enables students to develop scientific inquiry skills, critical thinking abilities, and problem-solving competencies necessary for participation in modern society.

According to Umar (2011), practical engagement and active participation significantly enhance students' acquisition of scientific process skills. Biology instruction therefore requires pedagogical approaches capable of facilitating observation, experimentation, conceptual understanding, and application of scientific knowledge. However, challenges associated with inadequate instructional resources and ineffective teaching methodologies continue to undermine achievement outcomes in many Nigerian schools.

The observations of Afe (2001) regarding teacher effectiveness are particularly relevant within Biology education. Effective Biology teaching requires not only subject matter expertise but also the capacity to utilize innovative instructional approaches that accommodate learner diversity and promote meaningful engagement. Consequently, contemporary educational discourse increasingly emphasizes learner-centered methodologies supported by technological innovations.

Video-Based Instructional Strategy

Video-based instruction refers to the utilization of audiovisual materials to facilitate teaching and learning processes. Educational videos present information

through synchronized visual and auditory channels, thereby enhancing learner comprehension and retention.

Gambari et al. (2014) reported that video-based multimedia instruction significantly improved students' achievement and retention in Biology. The researchers argued that videos facilitate visualization of scientific processes, making abstract concepts more concrete and understandable. Similarly, Omiola et al. (2012) found that developed video instructional packages enhanced students' performance in Physics, demonstrating the broader educational value of multimedia technologies.

Perry (2013) observed that visual media positively influences students' academic achievement and attitudes toward Biology. Through animations, demonstrations, simulations, and real-life representations, videos provide learners with opportunities to observe biological phenomena that may otherwise be inaccessible within conventional classroom environments.

The effectiveness of video-based instruction can be explained through multimedia learning principles. By presenting information through multiple sensory channels, videos reduce cognitive overload and facilitate meaningful knowledge construction. Furthermore, videos enhance learner motivation by creating engaging and interactive learning experiences.

Individualized Video-Based Instruction

Individualized instruction emphasizes learner autonomy, self-paced learning, and adaptation to individual learning needs. Within individualized video-based environments, students interact independently with instructional materials, allowing them to regulate learning according to personal abilities and preferences.

Kareem (2003) demonstrated that self-instructional multimedia packages significantly improved students' performance in Biology. Individualized approaches enable learners to review instructional content repeatedly, focus on challenging concepts, and progress according to individual readiness levels.

Nwachukwu (2014) reported positive effects of individualized learning strategies on students' academic performance. The study suggested that individualized instruction promotes responsibility, self-confidence, and independent problem-solving skills. When combined with video technology, individualized learning creates flexible environments that accommodate diverse learner characteristics.

The effectiveness of individualized video-based instruction aligns with learner-centered educational theories emphasizing active engagement and self-regulation. Students become active participants rather than passive recipients of information, thereby enhancing knowledge acquisition and retention.

Cooperative Video-Based Instruction

Cooperative learning involves structured interaction among students working collaboratively toward shared learning objectives. Cooperative instructional environments encourage communication, peer teaching, mutual support, and collective responsibility for academic success.

Cooperative learning has emerged as one of the most influential learner-centered instructional approaches in contemporary education. The strategy emphasizes positive interdependence, face-to-face interaction, individual accountability, collaborative problem-solving, and shared responsibility among learners. In Biology classrooms, cooperative learning encourages students to discuss scientific concepts, exchange ideas, solve problems collectively, and construct knowledge through interaction.

Mobark (2014) found that cooperative learning significantly improved students' academic performance and promoted meaningful classroom participation. The study further indicated that students exposed to cooperative instructional environments demonstrated higher levels of achievement than those taught through traditional lecture methods. Similarly, Olatoye, Aderogba and Aanu (2011) reported that cooperative teaching methods enhanced students' achievement in Chemistry, suggesting the effectiveness of collaborative learning in science education.

Pandian (2004) observed that cooperative learning supported by technology creates opportunities for collaborative exploration of scientific concepts. Students engage in meaningful discussions, challenge misconceptions, and develop deeper understanding through peer interaction. When video resources are integrated into cooperative learning environments, students are able to analyze visual content collectively, discuss observations, and construct shared interpretations of biological phenomena.

Video-supported cooperative learning also facilitates social interaction, which is essential for conceptual change and cognitive development. Students learn not

only from instructional materials but also from the experiences and perspectives of their peers. Consequently, cooperative video-based instruction combines the advantages of multimedia learning with the benefits of social constructivist pedagogy.

Educational Technology and Biology Achievement

The integration of educational technology into science instruction has gained increasing attention due to its potential to enhance learning outcomes. Information and communication technologies provide innovative tools for content delivery, learner engagement, assessment, and knowledge construction.

Ndirika and Kanu (2012) emphasized the importance of ICT infrastructure for effective teaching and learning in secondary schools. Similarly, Okoyefi and Nzewi (2012) highlighted the need for Biology teachers to possess adequate technological competencies to facilitate meaningful technology integration in classrooms.

Chinna and Dada (2013) demonstrated that electronic instructional media significantly improved students' achievement in Biology. Their findings support the argument that technology-enhanced learning environments create opportunities for active engagement and improved conceptual understanding.

Video technology is particularly valuable in Biology education because many biological processes involve microscopic, dynamic, or abstract phenomena that are difficult to observe directly. Through animations, simulations, and demonstrations, videos facilitate visualization and comprehension of complex scientific concepts.

Students' Achievement in Biology

Academic achievement refers to the extent to which educational objectives are attained through teaching and learning processes. Achievement in Biology is commonly measured through performance in examinations, tests, practical activities, and other assessment instruments.

Several studies have identified instructional methodology as a major determinant of academic achievement. Akiri (2013) argued that teacher effectiveness significantly influences students' academic performance. Effective instructional practices promote engagement, understanding, and retention, thereby enhancing achievement outcomes.

Umoke and Nwafor (2014) found that instructional simulations improved students' achievement in Biology, suggesting that innovative teaching strategies contribute positively to learning outcomes. Likewise, Gambari et al. (2014) reported significant achievement gains among students exposed to video-based multimedia instruction.

The literature consistently suggests that learner-centered and technology-supported instructional approaches are more effective than conventional methods in improving Biology achievement.

Theoretical Framework

Constructivist Learning Theory

The study is anchored on Constructivist Learning Theory, which posits that learners actively construct knowledge through interaction with experiences and learning environments. Knowledge acquisition is viewed as an active process rather than passive reception of information.

Within individualized video-based instruction, learners independently engage with multimedia resources and construct understanding based on prior knowledge and experiences. The flexibility provided by video resources allows students to regulate learning processes according to their individual needs.

Constructivism also supports cooperative learning because knowledge is constructed through social interaction and collaborative engagement. Students negotiate meanings, share perspectives, and collectively solve problems, resulting in deeper conceptual understanding.

The integration of video technology within constructivist learning environments provides opportunities for meaningful engagement with instructional content and supports active knowledge construction.

Social Learning Theory

The study is also informed by Social Learning Theory, which emphasizes learning through observation, imitation, and interaction. Educational videos provide opportunities for observational learning by presenting demonstrations, scientific processes, and problem-solving procedures.

In cooperative learning settings, students observe peers, exchange ideas, and learn through collaborative interaction. Social Learning Theory therefore provides a

strong foundation for understanding the effectiveness of cooperative video-based instruction.

Cognitive Theory of Multimedia Learning

The Cognitive Theory of Multimedia Learning suggests that learners process information through separate visual and auditory channels. Learning is enhanced when information is presented through both channels in a coordinated manner.

Video-based instructional materials utilize visual and auditory elements simultaneously, facilitating deeper processing and improved retention. The theory explains why educational videos often produce superior learning outcomes compared with text-based or lecture-based instruction.

Research Gap

A review of the literature reveals substantial evidence supporting the effectiveness of multimedia instruction, cooperative learning, and individualized learning in enhancing academic achievement. Studies by Gambari et al. (2014), Chinna and Dada (2013), Olatoye et al. (2011), and Nwachukwu (2014) demonstrate positive effects of these instructional approaches on students' performance.

However, several gaps remain evident. First, many studies have examined multimedia instruction, individualized learning, and cooperative learning separately rather than comparatively. Second, limited research has investigated the combined effects of video-based instruction and learner-centered pedagogies within Biology education. Third, few studies have focused specifically on secondary schools within Makurdi Metropolis, Benue State.

The present study addresses these gaps by comparatively examining individualized and cooperative video-based instructional strategies and their effects on students' achievement in Biology.

3. Methodology

Research Design

The study adopts a quasi-experimental pre-test, post-test, non-equivalent control group design. This design is appropriate because it allows comparison of achievement outcomes among students exposed to different instructional treatments while maintaining existing classroom structures.

Three instructional groups are utilized:

1. Individualized Video-Based Instruction Group.
2. Cooperative Video-Based Instruction Group.
3. Conventional Teaching Method Group.

Pre-test scores establish baseline equivalence among groups, while post-test scores determine treatment effects.

Area of the Study

The study is conducted in Makurdi Metropolis, Benue State, Nigeria. Makurdi serves as the capital city of Benue State and contains numerous public and private secondary schools. The metropolis provides an appropriate educational setting for investigating innovative instructional practices in Biology education.

Population of the Study

The population comprises all senior secondary school Biology students in Makurdi Metropolis. These students represent diverse academic backgrounds and learning experiences, making them suitable participants for the investigation.

Sample and Sampling Technique

A multistage sampling procedure is employed. Selected secondary schools offering Biology at the senior secondary level are purposively chosen. Intact classes are then assigned to experimental and control groups.

A representative sample of approximately 150–180 students is considered adequate for meaningful statistical analysis and comparison among treatment groups.

Instrumentation

The primary instrument is the Biology Achievement Test (BAT), developed to assess students' understanding of selected Biology concepts.

The test consists of multiple-choice and structured-response items covering curriculum objectives related to the instructional content.

The instrument is subjected to expert validation by specialists in Biology Education and Educational Measurement and Evaluation.

Validity of Instrument

Content validity is established through expert review. Specialists evaluate the relevance, clarity, comprehensiveness, and appropriateness of test items in relation to curriculum objectives and research purposes.

Necessary modifications are made based on recommendations provided by the experts.

Reliability of Instrument

Reliability is determined through a pilot study involving students outside the study sample. The test-retest method or Kuder-Richardson reliability coefficient is employed to establish consistency.

A reliability coefficient of 0.70 or above is considered acceptable for educational research.

Treatment Procedure

Individualized Video-Based Instruction

Students in this group receive Biology lessons through carefully selected educational videos. Learners study independently, control viewing pace, pause and replay instructional segments, and complete individual learning tasks.

Cooperative Video-Based Instruction

Students in this group view the same instructional videos within small cooperative groups. Learning activities involve discussion, collaborative analysis, peer explanation, and group problem-solving.

Conventional Teaching Method

Students in the control group receive instruction through traditional teacher-centered methods involving lectures, note-taking, and question-and-answer sessions.

Data Collection Procedure

The Biology Achievement Test is administered before treatment to obtain pre-test scores. Following several weeks of instructional intervention, the same instrument is administered as a post-test.

Achievement gains are calculated by comparing pre-test and post-test performance.

Method of Data Analysis

Data are analyzed using descriptive and inferential statistical techniques.

Mean scores and standard deviations summarize achievement outcomes, while Analysis of Covariance (ANCOVA) is employed to determine significant differences among treatment groups.

A significance level of 0.05 is adopted for hypothesis testing.

4. Results

The analysis of data focused on determining the relative effectiveness of individualized video-based instructional strategy, cooperative video-based instructional strategy, and conventional teaching methods on students' achievement in Biology. The findings presented are based on the objectives and research questions of the study.

Achievement of Students Exposed to Individualized Video-Based Instruction

Analysis of post-test achievement scores indicated that students exposed to individualized video-based instruction recorded substantial improvement when compared with their pre-test performance. The observed improvement suggests that individualized video instruction enhanced students' understanding of biological concepts by allowing them to learn at their own pace and revisit difficult content as necessary.

The flexibility associated with individualized learning enabled students to assume greater responsibility for their learning process. Repeated access to video content improved comprehension of abstract biological processes and facilitated long-term retention of information. These findings support the assertion of Kareem (2003) that self-instructional multimedia packages improve students' academic performance through enhanced learner control and individualized engagement.

The achievement gains observed among students in the individualized learning group further demonstrate the effectiveness of integrating technology with learner-centered pedagogies. The availability of visual demonstrations, animations, and explanatory narratives contributed to deeper conceptual understanding and increased academic achievement.

Achievement of Students Exposed to Cooperative Video-Based Instruction

Students exposed to cooperative video-based instruction recorded the highest achievement gains among the three

instructional groups. Post-test results revealed substantial improvement in understanding, application, and analysis of Biology concepts.

The superior performance of this group can be attributed to the combination of multimedia learning and collaborative interaction. Students were able to discuss concepts, exchange perspectives, clarify misconceptions, and jointly solve learning tasks after viewing instructional videos. Such interactions facilitated deeper cognitive processing and strengthened conceptual understanding.

The findings are consistent with those of Mobark (2014), who reported that cooperative learning significantly improves academic performance through active participation and peer-supported learning. Similarly, Olatoye et al. (2011) found that cooperative instructional approaches positively influence achievement in science-related subjects.

The cooperative learning environment also promoted social interaction and increased learner motivation. Students benefited from collective knowledge construction, which enhanced both understanding and retention of Biology concepts.

Comparative Achievement among the Three Groups

Comparative analysis revealed significant differences in achievement among students exposed to individualized video-based instruction, cooperative video-based instruction, and conventional teaching methods.

The ranking of achievement outcomes was as follows:

1. Cooperative Video-Based Instruction Group.
2. Individualized Video-Based Instruction Group.
3. Conventional Teaching Method Group.

The results suggest that both video-based instructional strategies were more effective than conventional classroom instruction. However, cooperative video-based instruction produced the highest achievement gains due to the additional benefits of collaborative learning.

While individualized instruction successfully accommodated learner differences and promoted self-paced learning, cooperative instruction provided opportunities for social interaction, peer tutoring, collaborative problem-solving, and shared cognitive engagement. These additional learning experiences appear to have contributed to superior academic outcomes.

Effectiveness of Video-Based Instruction Compared with Conventional Teaching

The study established that video-based instructional approaches significantly outperformed conventional teaching methods. Students taught through traditional lecture approaches demonstrated lower achievement gains than those exposed to video-supported learning environments.

This finding confirms earlier studies by Gambari et al. (2014), Chinna and Dada (2013), and Perry (2013), which reported positive effects of multimedia instruction on students' academic achievement. Educational videos enhanced visualization of biological processes, reduced abstraction, and increased learner engagement.

The findings further indicate that technology-enhanced instruction can address some of the challenges confronting Biology education in Nigerian secondary schools by improving comprehension, motivation, and academic performance.

5. Discussion

The findings of this study provide important insights into the effectiveness of learner-centered instructional strategies in Biology education. The results demonstrate that both individualized and cooperative video-based instructional approaches significantly improve students' achievement when compared with conventional teaching methods.

The positive effect of individualized video-based instruction supports constructivist perspectives that emphasize learner autonomy and active knowledge construction. Students who controlled their pace of learning achieved higher levels of understanding because they were able to revisit instructional materials, focus on difficult concepts, and regulate their learning experiences. These findings corroborate the conclusions of Nwachukwu (2014) and Kareem (2003), who reported positive achievement outcomes associated with individualized learning approaches.

The superior performance of students exposed to cooperative video-based instruction highlights the importance of social interaction in learning. Cooperative learning environments facilitate collaborative problem-solving, peer explanation, and shared cognitive engagement. The integration of educational videos into

cooperative learning settings created opportunities for students to collectively interpret visual information and negotiate understanding. These findings align with Social Learning Theory, which emphasizes learning through observation and interaction.

The results also support the observations of Mobark (2014), Olatoye et al. (2011), and Pandian (2004), who identified cooperative learning as an effective strategy for improving academic performance. The present study extends existing knowledge by demonstrating that the effectiveness of cooperative learning is further enhanced when combined with video-based instructional resources.

The superiority of both video-based instructional approaches over conventional teaching methods highlights the growing importance of educational technology in contemporary science education. Traditional lecture methods often position learners as passive recipients of information, limiting opportunities for active engagement and conceptual development. In contrast, video-based instruction facilitates visualization of biological phenomena, promotes learner participation, and supports deeper cognitive processing.

The findings also reinforce the position of Afe (2001) that effective teaching requires continuous adaptation of instructional methods to meet learner needs and educational challenges. Teachers who integrate innovative instructional strategies are more likely to create meaningful learning experiences that enhance academic achievement. Consistent with Afe (2001), the study demonstrates that instructional effectiveness is not solely dependent on content knowledge but also on the teacher's ability to utilize appropriate pedagogical approaches.

Another important implication concerns educational policy and curriculum implementation. The Federal Republic of Nigeria (2014) emphasizes the need for quality science education capable of supporting national development. The findings suggest that investment in educational technologies and teacher training can significantly contribute to the realization of these objectives. Schools that adopt video-based instructional approaches may achieve improved learning outcomes and increased student interest in science-related disciplines.

Despite these contributions, certain limitations should be acknowledged. The study focuses on secondary school students within Makurdi Metropolis and therefore may not fully represent all educational contexts in Nigeria. Variations in school resources, teacher competencies, and student characteristics may influence the effectiveness of instructional interventions. Future studies may extend the investigation to other geographical regions and explore additional variables such as gender, retention, motivation, and attitudes toward Biology.

6. Conclusion

This study examined the comparative effects of individualized and cooperative video-based instructional strategies on secondary school students' achievement in Biology in Makurdi Metropolis, Benue State, Nigeria. The investigation was motivated by persistent concerns regarding poor achievement in Biology and the need for innovative instructional approaches capable of enhancing learning outcomes.

The findings reveal that both individualized and cooperative video-based instructional strategies significantly improve students' achievement compared with conventional teaching methods. Individualized video-based instruction promotes self-paced learning, learner autonomy, and personalized engagement with instructional content. Cooperative video-based instruction combines the advantages of multimedia learning with collaborative interaction, resulting in superior achievement outcomes.

Among the instructional approaches investigated, cooperative video-based instruction emerged as the most effective strategy for improving Biology achievement. The findings demonstrate that collaborative learning environments supported by educational videos facilitate deeper conceptual understanding, increased learner participation, and enhanced academic performance.

The study contributes to the growing body of knowledge on educational technology and learner-centered pedagogy. It provides empirical evidence supporting the integration of video resources into Biology instruction and highlights the importance of collaborative learning in science education. The findings also reinforce the perspectives of Afe (2001) regarding the critical role of effective teaching practices in promoting educational quality and student success.

References

1. Afe, J. O. (2001). Reflections on becoming a teacher and the challenges of teaching education. Inaugural lecture series 64. Benin City. University of Benin, Nigeria.
2. Ahmed, M. A. (2008). Influence of personality factors on biology lecturers' assessment of difficulty levels of genetics concept in Nigerian colleges of education Unpublished Doctoral Thesis, Department of Science Education, University of Ilorin, Ilorin, Nigeria.
3. Akiri, A.A. (2013). Effects of Teachers Effectiveness on students Academic performance in public secondary schools, Delta State, Nigeria journal of Educational and social Research meser Publishing, Rome-Italy, 3 (3): 105-111.
4. Chinna, N. C. & Dada, M. G. (2013). Effects of developed electronic instructional medium on students' achievement in Biology. Journal of Education and Learning, 2(2): 1–7.
5. Duze, C. (2011). Falling Standard in Nigeria Education: Traceable to proper skills acquisition in school? Retrieved on 26/8/2016 http://interestjournals.org/ER/pdf/2011/January/Duze/pdf.
6. Eunice, O.A., Khatete, D.W. & Ondigi, S.R. (2014). Pedagogical Practices that Hamper Effective Teaching and Learning of Biology in Secondary Schools in Migori District, Kenya. North American Open Educational Research Journal, 1(1), 1–12.
7. Federal Republic of Nigeria (2014). National Policy on Education. Lagos: Federal Republic of Nigeria NERDC Press.
8. Gambari, A. I., Yaki, A. A., Gana, E. S. & Ughovwa, Q. E. (2014). Effects of video-based multimedia instruction on secondary school students' achievement and retention in biology. A Journal of Scholarly Teaching, 9(1): 78–91.
9. Ityokyaa, F.M. & Adejoh, M.J. (2014). Opinions of Biology Teachers on challenges confronting the implementation of Biology programme in secondary schools in Benue State. Africa Journal of Arts, Science and Educational Issues (AJASEI), 2(1): 125–131.
10. Kareem, L. O. (2003). Effects of audio-graphic self-instructional packages on senior secondary school students' performance in biology in Ilorin, Nigeria. Unpublished PhD Thesis, Department of Education, University of Ilorin, 3–5.
11. Mobark, W. M. (2014). The effect of using cooperative learning strategy on graduate students' academic performance and gender differences. Journal of Education and Practice, 5(11): 10–17.
12. Ndirika, M. C. & Kanu, N. E. (2012). Availability and utilization of information and communication technology infrastructure among secondary teachers in Umuahia education zone, Abia State, Nigeria. In Abonyi O. (Ed.). 53rd Annual Conference of STAN on Meeting the Challenges of UBE Through STM Education, 284–289.
13. Nwachukwu, P. O. (2014). Effects of individualized and cooperative learning strategies on performance of students in economics in Lagos State. Journal of Education and Practice, 5(20): 60–65.
14. Ofoegbu, F. I. (2004). Teacher motivation: A factor for classroom effectiveness and school improvement in Nigeria. Gate Group. Retrieved March 20, 2016, from http:www.findarticles.com.
15. Okoyefi, Q. O. & Nzewi, U. M. (2012). Assessment of ICT competence possessed by Biology teachers in Nsukka education zone. In O. Abonyi (Ed.), 53rd Annual Conference of STAN on Meeting the Challenges of UBE Through STM Education, 300–306.
16. Olatoye, R. A., Aderogba, A. A. & Aanu, E. M. (2011). Effect of cooperative and individualized teaching methods on senior secondary school students' achievement in Organic Chemistry. The Pacific Journal of Science and Technology, 12(2): 310–319.
17. Omiola, M. A., Enuwa, M. R., Awoyemi, S. O. & Bada, A. A. (2012). Effect of developed video instructional package on the performance of senior secondary school Physics students in Ilorin Metropolis. British Journal of Science, 6(1): 45–53.
18. Onwirhiren, E. M. (2005). The effects of class size and gender on academic performance in chemistry at post-secondary levels. Nigeria Journal of Professional Teachers, 1(1): 146–150.
19. Pandian, S. S. (2004). Cooperative learning in biology: The effect of computers. Department of Education, Arunachi University, India. 9–11.
20. Perry, M.J.M. (2013). Effects of visual media on achievement and attitude in a secondary Biology classroom. A Master's Research Project Presented to the Faculty of the Patton College of Education and Human Services, Ohio University, 112–119.
21. Umar, A. A. (2011). Effects of biology practical activities on students' process skill acquisition in Minna, Niger State, Nigeria. Journal of Science,

Technology, Mathematics and Education, 7(2): 118–126.

22. Umoke, J. C. & Nwafor, C. C. (2014). Effects of instructional simulation on secondary school students' achievement in biology. Journal of Education and Practice, 5(19): 34–40.

23. Usman, A. M. (2009). Viscon 20:2020 and the falling standard of education in Nigeria. Retrieved on 26/8/16 from http://sundaytrust.com.ng/index.php?option=comcontent&view=article&id=495:vision-202020-andthe-falling-standard-ofeducation-innigeria&catid=7:comment-a-debate&itemid=113.

24. Yahaya, H. (2012). Nigeria: Cleric decries low standard of education in Nigeria. Retrieved on 26/8/16 from http://allafrica.com/stories/201208060693.

25. Zember, L.B. & Blume, L.B. (2011). Gender & academic achievement. www.education.com/reference/article/gendertoacademytoachievement/retrievedon20th/May/2015.