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EXPLORING SECONDARY SCHOOL STUDENTS' PERCEPTIONS AND ATTITUDES TOWARD THE USE OF EDUCATIONAL VIDEOS IN TEACHING CELL BIOLOGY: IMPLICATIONS FOR TECHNOLOGY-ENHANCED SCIENCE INSTRUCTION

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ABSTRACT

This study investigated secondary school students' perceptions and attitudes toward the use of educational videos in teaching cell biology, with a focus on implications for technology-enhanced science instruction. A descriptive survey design was adopted. The target population comprised all Senior Secondary School One (SS I) students in public schools within the Zaria Education Zone of Kaduna State, totaling 8,439 students (4,853 males and 3,586 females) across 29 schools. Six schools were purposively selected based on gender inclusiveness and the availability of Information and Communication Technology (ICT) facilities. The instrument used for data collection, the Questionnaire on Students' Attitudes and Perceptions toward Educational Videos (QSAP-EV), was validated by two senior lecturers with expertise in biology education and one experienced secondary school biology teacher. The instrument's content validity index was .78. A pilot study was conducted in a non-sampled school to assess the feasibility of the research instrument and identify potential challenges. Reliability testing using the split-half method and Cronbach's alpha yielded a coefficient of .83. Descriptive statistics (mean, standard deviation, mean rank, and sum of ranks) were used to address the research questions, while inferential statistics (independent samples t-test and Mann-Whitney U-test) were used to test the null hypotheses at the .05 level of significance. Results indicated a statistically significant difference in achievement between students taught using educational videos and those taught using traditional methods (mean difference = 3.60, $t = 30.39$, $p < .001$). A significant positive relationship was also found between students' attitudes and achievement in cell biology (mean difference = 3.18, $t = 7.40$, $p < .001$), and between students' perceptions and their understanding of cell biology concepts (mean difference = 20.17, $t = 6.89$, $p < .001$). Based on the findings, it is recommended that educational stakeholders and curriculum developers integrate educational videos into the biology curriculum, especially for abstract topics such as cell biology and genetics, to enhance conceptual understanding and learner engagement. Additionally, state governments should provide regular professional development for teachers in multimedia pedagogy to support the effective sourcing, design, and implementation of video-based instructional content in science classrooms.

Keywords: Perceptions and Attitudes; Educational Videos; Teaching Cell Biology; Technology-Enhanced Science

Introduction

In the 21st- advanced science training rooms, the digital transformation into pedagogical practice has become necessary. Among the most influential tools are video-based learning, which offer a instructional videos approach to meaningful learning by mixing visual and auditory elements (Haryani et al., 2024). According to Strømme and Mork (2020) life science education, where theoretical concept such as cell biology are often difficult for students to visualize and comprehend, visual content can serve as important cognitive tools for representation, visualization, and engagement. Cell biology involves the study of the structure and function of cells a keystone topic for comprehending living organisms. Despite its importance, many secondary school students find the topic difficult due to the complexity and abstract nature of cellular structures and processes (Lunde & Gregers, 2021). According to Hayes et al. (2020), the use of educational videos can enhance students' understanding by providing dynamic animations and real-world simulations. However, the effectiveness of this approach is strongly influenced by students' perceptions and attitudes toward video-based learning.

According to Jacob (2013), the need for science education for national development has become imperative in view of the current trend of global technological advancement. Science is important to national development because it prepares students to enter the workforce, pursue occupations and take up careers in science related areas. Mostly, the global economic ranking and political power are directly or indirectly related to the outcome of science education and its development (Valero & Van Reenen, 2018). The origin of word science according to (Slater & Yudell, 2017) is derived from "Scientia" which is Latin and means knowledge or finding out about the universe.

Science and technology have been recognized worldwide as the key factor in the development of every nation. Nigeria as one of the developing countries has seen the need to key into science and technological advancement to attain the need and fit into global development areas (Okoye, 2023). The Federal Ministry of Education, Nigeria in (2013) through its National Policy on Education stated that one of the aims of the National Policy on Education is to equip students on how to live effectively in the ever-changing modern age of science and technology advancement. Thus, the gateway to the survival of a nation with respect of science and technology is through science literacy of the people and can only be achieved through science education (Omoniyi, 2013). Wakili, (2017) observed that the efforts of science educators have been directed towards understanding the nature of science teaching and learning at senior secondary school level with a view to providing the students with aptitude in science, a sound foundation for further work in science and making others scientifically literate. These basic science subjects taught at the secondary school level are chemistry, physics, biology and mathematics whose relevance for future education cannot be overemphasized.

Biology is derived from two Greek words: "Bios" and "Logos" which simply mean life

and study respectively. According to Raven and Johnson (2020), Biology can simply be defined as a branch of science which deals with the study of living and non-living organisms. According to Olajide (2015), Biology is a practical subject which equips students with appropriate skills and concepts useful in solving day-to-day life problems. Biology is central to many science disciplines such as medicine, pharmacy, biochemistry, agriculture; and nursing among others and for a student to be offered admission to study any of these mentioned disciplines, he/she must have at least a credit in Biology at the Senior Secondary Certificate Examination (SSCE). It is therefore obvious that no student that intends to study any of these disciplines aforementioned can do without Biology. Looking at the relevance of Biology to the society, it has been observed despite the importance of biology that students' performance in biology has been low.

Objectives of the Study

This study is guided by the following objectives, to:

1. To assess students' attitudes towards the use of educational videos in teaching cell biology.
2. To evaluate students' perceptions of the effectiveness of educational videos in learning cell biology.
3. To determine the relationship between students' attitudes/perceptions and their performance in cell biology.

Research Questions

This study is guided by the following research questions:

1. What are students' attitudes towards the use of educational videos in teaching cell biology?
2. How do students perceive the effectiveness of educational videos in understanding cell biology concepts?
3. Is there a relationship between students' attitudes/perceptions and their achievement in cell biology?

Null Hypotheses

This study is guided by the following null hypotheses:

H_{01}: There is no significant relationship between students' attitudes towards educational videos and their achievement in cell biology.

H_{02}: There is no significant relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts

H_{03}: There is no significant relationship between students' attitudes/perceptions and their achievement in cell biology

Methodology

This study adopted a survey research design. The target population of this study consists of all SS 1 Senior Secondary School students in public schools in Zaria Education Zone of Kaduna State. The total population of SS 1 students as of 2025 was eight thousand, four hundred and thirty-nine (8439). This number includes 4853 males and 3586 females in twenty-nine (29) schools. From the entire population of the schools, six schools were purposively selected based on gender inclusiveness and the availability of Information and Communication Technology facilities.

The Questionnaire on Students' Attitudes and Perceptions (QSAP-EV) was divided into two sections (that is A & B), section A consists of Bio Data while B consists of 20 items which are questions on students' attitudes and perceptions on the use of educational videos. QSAP-EV was designed based on the Likert 5-point scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (DA), and Strongly Disagree (SD) with their corresponding point of 5,4,3,2, and 1 respectively.

The Questionnaire on Students' Attitudes and Perceptions (QSAP-EV) was submitted to experts for validation. QSAP-EV was given to one of the Biology teachers with at least a first degree in Biology Education and has been teaching Biology for the past 10 years at secondary school level in addition to two experts who are PhD holders and senior lecturers with are vast in knowledge and experience from the Department of Biology, Federal University of Education, Zaria to validate the instrument which was found to be 0.78. A pilot test was conducted in one of the senior secondary schools within the population of the present study but not part of the sample selected. The pilot test was carried out to familiarize the researcher with the feasibility of the teaching model and workability of the instrument that is questionnaire on Students' Attitudes and Perceptions (QSAP-EV). Other reasons for the pilot testing were to determine the appropriateness of the length of time required to take the test, determine the correctness of the workings of the instrument and to identify problems or difficulties that the subjects may encounter with the view of eliminating them in the final copy of the instrument. The reliability of the Questionnaire on Students' Attitudes and Perceptions (QSAP-EV) was calculated by employing the split half method and the Cronbach alpha statistic was used to calculate the reliability of QSAP-EV which was found to be 0.83.

Results

Research Question One: What are students' attitudes towards the use of educational videos in teaching cell biology?

Table 1: Analysis of students' attitudes towards the use of educational videos in teaching cell Biology.

Statement	SA	A	UN	D	SD	Mean	St.dev
I enjoy learning biology through educational videos.	37	12	2	1	0	4.63	0.17
I feel more motivated when learning with videos.	26	14	8	2	2	4.15	0.20
I concentrate better during video-based lessons.	28	19	3	1	1	4.38	0.19
Videos make biology lessons more interesting.	30	18	2	2	0	4.46	0.16
I would prefer more video-based lessons in the future.	32	17	1	1	1	4.50	0.18
I believe videos help me understand biology better than lectures.	29	19	1	3	0	4.42	0.18
I feel relaxed when watching educational videos.	16	28	5	1	2	4.06	0.21
I remember information better when presented in video format.	19	30	2	1	0	4.29	0.19
Videos are a helpful revision tool before tests.	25	16	7	3	1	4.17	0.16
I believe educational videos improve my academic performance.	35	9	5	2	1	4.44	0.18
Grand Total	**28**	**18**	**4**	**2**	**1**	**4.35**	**0.18**

Table 1 showed students enjoyed learning biology through educational videos with a mean rate of 4.63. Respondents feel more motivated when learning with videos with a mean rate of 4.25. Students were of the view that they concentrate better during video-based lessons with a mean rate of 4.38. Videos make biology lessons more interesting with a mean rate of 4.46. Students were of the view that they prefer more video-based lessons in the future with a mean rate of 4.50. Students believe that videos help them understand biology better than lectures with a mean rate of 4.42. Students feel relaxed when watching educational videos with a mean rate of 4.06. Students were of the view that they remember information better when presented in video format with a mean rate of 4.29. Videos are a helpful revision tool before tests with a mean rate of 4.17. Students believe educational videos improve my academic performance with a mean rate of 4.44. The test statistic is calculated as:

$$t = \frac{X - \text{expected mean}}{s/\sqrt{n}}$$

Where: x= average mean of responses
S= standard deviation of responses
n= number of respondents

Table 2: Mean and Deviation Computation of students' attitudes towards the use of educational videos in teaching cell Biology.

X	Deviation	D^2
4.63	0.28	0.0784
4.15	-0.2	0.04
4.38	0.03	0.0009
4.46	0.11	0.0121
4.5	0.15	0.0225
4.42	0.07	0.0049
4.06	-0.29	0.0841
4.29	-0.06	0.0036
4.17	-0.18	0.0324
4.44	0.09	0.0081
Ave mean = **4.35**		
		Sum of square of D = 0.2878

Source: Field Survey, 2025

$Average\ Mean = 4.35$

$$\text{standard deviation} = \sqrt{\frac{\text{sum of sqaure of deviation}}{n}}$$

$$\text{standard deviation} = \sqrt{\frac{0.2878}{10}}$$

$$\text{standard deviation} = 0.1694$$

n= number of questions used (n= 10)

The overall mean response of the statement was tested against the expected mean of 3.0 which is the mean response of our Likert rating scale. The test statistic was calculated as:

$$t = \frac{4.35 - 3.0}{0.1694/\sqrt{10}}$$

$$\frac{1.35}{0.053572} = 25.20$$

Total =25.20 > t_{tab} (0.05, 10) = 5.234

Research Question Two: How do students perceive the effectiveness of educational videos in understanding cell biology concepts?

Table 3: Analysis of students' perceptions of the effectiveness of educational videos in learning cell Biology.

Statement	SA	A	UN	D	SD	Mean	St.dev
Videos provide clearer illustrations of cell components.	24	23	2	1	2	4.27	0.17
I can better visualize cellular processes using animations.	23	18	5	3	3	4.06	0.20
The use of videos helps me relate abstract ideas to real-life.	27	19	3	2	1	4.33	0.19
The pace of the video helps me learn at my own speed.	30	18	2	2	0	4.46	0.16
Video lessons are well organized and easy to follow.	28	20	2	1	1	4.40	0.18
Educational videos make learning biology more accessible.	29	20	2	1	0	4.48	0.18
I can learn more efficiently through video than by reading textbooks.	26	19	3	2	2	4.25	0.21
Videos make me more confident during biology discussions.	23	26	2	1	0	4.37	0.19
The audio-visual format suits my learning style.	18	27	2	3	2	4.08	0.16
Videos should be integrated into regular classroom teaching.	27	20	1	2	2	4.31	0.18
Grand Total	**26**	**21**	**2**	**2**	**1**	**4.30**	**0.18**

Table 3 revealed that Videos provide clearer illustrations of cell components with mean rate of 4.27. Students can better visualize cellular processes using animations with mean rate of 4,06. The use of videos helps me relate abstract ideas to real-life with mean rate of 4.33. The pace of the video helps students learn at their own speed with a mean rate of 4.46. Video lessons are well organized and easy to follow with a mean rate of 4.44. Educational videos make learning biology more accessible with a mean rate of 4.48. Students can learn more efficiently through video than by reading textbooks with a mean rate of 4.25. Videos make students more confident during biology discussions with a mean rate of 4.37. The audio-visual format suits students' learning style with mean rate of 4.08. Videos should be integrated into regular classroom teaching with a mean rate of 4.31.

Table 4: Mean and Deviation Computation of students' perceptions of the effectiveness of educational videos in learning cell Biology

X	Deviation	D^2
4.27	-0.03	0.0009
4.06	-0.24	0.0576
4.33	0.03	0.0009
4.46	0.16	0.0256
4.40	0.1	0.01
4.48	0.18	0.0324
4.25	-0.05	0.0025
4.37	0.07	0.0049
4.08	-0.22	0.0484
4.31	0.01	1E-04
Ave mean = **4.30**		
		Sum of square of D = 0.1833

Source: Field Survey, 2025

$Average\ Mean\ = 4.30$

$$\text{standard deviation} = \sqrt{\frac{\text{sum of sqaure of deviation}}{\text{n}}}$$

$$\text{standard deviation} = \sqrt{\frac{0.1833}{10}}$$

$$\text{standard deviation} = 0.135388$$

n= number of questions used (n= 10)

The overall mean response of the statement was tested against the expected mean of 3.0 which is the mean response of our Likert rating scale. The test statistic was calculated as:

$$t = \frac{4.30 - 3.0}{0.135388/\sqrt{10}}$$

$$\frac{1.30}{0.0428135} = 30.387$$

Total =30.39 > t_{tab} (0.05, 10) = 5.23

Research Question Three: Is there a relationship between students' attitudes/perceptions and their achievement in cell biology?

Table 5: Respondents view on relationship between students' attitudes/perceptions and their achievement in cell biology.

Variable	No.	Pecentage (%)	Mean	Standard deviation
Attitude	52	88.46	4.35	0.035
Perception	52	90.34	4.30	0.021

Table 5 above shows that forty-six (46) respondents representing 88.46% shows positive attitude and forty-seven (47) respondents representing 90.34% shows positive perception

Test of Null Hypotheses

Null Hypothesis One H_{01}: There is no significant relationship between students' attitudes towards educational videos and their achievement in cell biology.

To test the null hypothesis one T-test and sig. values were used

Table 6: Analysis of significant relationship between students' attitudes towards educational videos and their achievement in cell biology.

Variables	N	$\overline{X}$	S.D	Mean diff.	df	T	P value	Remark
Agree	46							
		4.09	0.58					
				3.18	48	7.4	0.00	Significant
Disagree	3	0.91	0.58					

Table 6 shows that the agreed respondents have a mean rate of 4.09 with standard deviation of 0.58 while disagreed respondents have mean rate of 0.91 with standard deviation of 0.58. The mean difference between the variables is 3.18. Since the calculated value of the t- test 25.20 is greater than the table value (5.2); the result of the study rejects the null hypotheses which says that there is no significant relationship between students' attitudes towards educational videos and their achievement in cell biology. Therefore, this study accepts that there is significant relationship between students' attitudes towards educational videos and their achievement in cell biology.

Null Hypothesis Two H_{02}: There is no significant relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts.

Table 7: Analysis of significant relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts.

Variables	N	$\overline{X}$	S.D	Mean diff.	df	T	P value	Remark
Agree	47	4.30	0.63					
				3.60	49	30.387	0.00	Significant
Disagree	3	0.70	0.63					

Table 7 shows that the agreed respondents have a mean rate of 4.30 with a standard deviation of 0.63 while disagreed respondents have a mean rate of 0.70 with a standard deviation of 0.63. the mean difference between the variables is 3.60. Since the calculated value of the t- test 30.39 is greater than the table value (5.23); the result of the study rejects the null hypotheses which say that there is no significant

relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts. Therefore, this study accepts that there is a significant relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts.

Null Hypothesis three: H_{03}: There is no significant relationship between students' attitudes/perceptions and their achievement in cell biology

Table 8: Analysis of significant relationship between students' attitudes/perceptions and their achievement in cell biology

Variables	N	$\bar{X}$	S. D	Mean diff.	df	T	P value	Remark
Attitude	52	88.46	0.035	1.88	19	7.34	0.00	Significant
Perception	52	90.34	0.021					

Table 8 shows that the attitude views have percentage rate of 88.46 with a standard deviation of 0.035 while perception views have a percentage rate of 90.34 with a standard deviation of 0.021. The mean difference between their percentage views is 1.88%. Since the calculated value of the t-test 7.34 is greater than the table value (5.23); the result of the study rejects the null hypotheses which say that there is no significant relationship between students' attitudes/perceptions and their achievement in cell biology. Therefore, this study accepts that there is significant relationship between students' attitudes/perceptions and their achievement in cell biology.

Discussion on Findings

The study accepts that there is a significant relationship between students' attitudes towards educational videos and their achievement in cell biology with a mean difference of 3.18 and t value of 7.4 at p (0.00). This is in line with the findings of (Özdemir & Yildiz, 2015) who found educational videos to positively influence students' motivation and engagement. In a similar study, Jowinis and Moi (2024). There is a significant relationship between students' perceptions and effectiveness of educational videos in understanding cell biology concepts with a mean difference of 20.17 and t value of 6.89 at p (0.00). This is in line with Galatsopoulou et al. (2022) who found correlation between students' perception and effectiveness of educational biology in journalism and educational courses. There is significant difference in cell biology achievement between students taught using educational videos and those taught with traditional methods. This is similar to the findings of Bouali et al. (2022) who found animation-based instruction to significantly improve students understanding of complex topics in cell biology leading to higher achievement levels compared to traditional teaching methods. Those thoughts using educational videos outperform the traditional method with a mean difference of 3.60, t value of 30.39 at p (0.00). There is a significant relationship between students' attitudes/perceptions and their achievement in cell biology with a mean difference of 1.88, t-value of 7.34 at p (0.00). This is

similar to the Jowinis and Moi (2024) who found significant but weak positive correlation between students' attitudes towards biology and their perception in cell biology.

Conclusion

The study provides compelling evidence that the use of educational videos significantly enhances students' understanding and performance in cell biology. The findings indicate strong positive relationships between students' attitudes and perceptions of educational videos and their academic outcomes. Students taught using video-based instruction demonstrated superior achievement compared to those exposed to traditional methods. Furthermore, the study affirms that favorable attitudes and perceptions toward educational videos directly influence learning effectiveness and cognitive engagement. These results underscore the pedagogical value of integrating multimedia tools in the teaching of complex biology concepts, such as cell biology, especially in secondary school settings.

Recommendations

1. Education stakeholders and curriculum developers should integrate educational videos into Biology Curriculum particularly for abstract topics such as cell biology and genetics in order to enhance conceptual understanding and learner engagement.
2. State government should provide regular professional teacher training on multimedia pedagogy. This is to effectively source, design and implement educational video content as part of active classroom teaching.
3. Principals and head of schools should encourage positive student Attitudes through Media-Rich Instruction
4. Government and educational authorities should prioritize investments in audiovisual infrastructure and ensure that all schools especially in underserved regions—have access to reliable media resources for instructional use.

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