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Investigating the Effectiveness of using YouTube Videos as an Alternative Learning Media for Grade 11 Life Sciences Learners

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ABSTRACT

Human impact on the environment has drastically affected South Africa's biodiversity. As a result, it is important for teachers to use the most effective teaching methods to highlight the consequences of harmful human activities on the environment. This reduces human impact on the environment and subsequently reduces the loss of biodiversity and solid waste. This study employed a mixed-method research approach to compare two teaching methods (lectures and YouTube videos) and their effects on the academic performance of life sciences learners. Specifically, the study focused on analysing how learners engaged with the lesson on human activities in the environment when delivered through YouTube videos. A total of 135 learners were purposefully sampled to engage in a quasi-experiment where pre-and-post-tests were used to identify the most effective teaching method for Life Sciences among grade 11 learners in Limpopo province, South Africa. The study hypothesised that YouTube videos as a teaching strategy would improve learners' content knowledge about Human Impact on the environment compared to the lecture method. The findings indicated that learners who received instruction through YouTube videos achieved notably higher scores compared to those instructed through traditional lectures ($p < 0.05$). This study recommends that schools should integrate YouTube videos into their teaching approaches for Life Sciences, as it has the potential to enhance learners' performance and deepen their understanding of the subject matter. Additionally, it highlights the importance of providing life science educators with ongoing professional development opportunities such as in-service training, workshops, seminars, and conferences to stay updated on effective teaching and learning methodologies in the field.

Keywords: *Grade 11 learners, teaching methods, human Impact, environment, solid waste disposal, loss of biodiversity*

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INTRODUCTION

It is safe to state that at the outset human activity in the environment is one of the most crucial topics in Life Sciences that looks into the interest of the living environment. Due to ongoing human activities, significant changes have occurred on the Earth's surface, oceans, and atmosphere, particularly within the

last two centuries.[1] Ming emphasizes that the Earth may face the loss of up to a million species in the forthcoming decades due to detrimental human actions that adversely affect the present environment.[2] Actually, it is estimated that 80% of the pollution loads in oceans and coastal waters originate from land-based activities.[3] Hence, there is a need for urgent and rigorous education that should be given to young people in order to prevent this catastrophe from persisting.

A study by Ming identified five direct drivers of biodiversity loss, that being changes in land and sea use, overexploitation, climate change, pollution, and invasive species.[4] This implies that a subject like Life Sciences which deals with biodiversity should strive to teach learners how to preserve the current environment. In fact, teachers should devise workable teaching methods that will adequately transfer the knowledge to learners and maximise their learning interest in biodiversity. There are studies that have given this research some thoughts on what strategies can be used by teachers to teach an important topic more interestingly. For example, a study by Widiantari, Dwi and Artini explored YouTube as the alternative learning media in literacy studies, English Language in particular.[5] These scholars determined that using YouTube as an alternative medium for learning polished learners understanding of the subject and increased self-motivation and self-regulated learning.

Referring to the previous example, it is crucial for educators to utilize impactful and proficient teaching approaches, such as incorporating YouTube videos, to attain the learning goals for every subject they teach. As per the World Health Organization, the decline in biodiversity could profoundly affect human health if ecosystem services fail to meet societal demands adequately.[6] Moreover, WHO contends that ecosystem alterations could disrupt livelihoods, income streams, and local migration patterns, potentially intensifying pre-existing global political tensions.

Between 50% to 80% of waste production originates from cities in developing nations, where these cities allocate 20% to 50% of their budgets for waste management.[7] Additionally, many low-income countries only collect approximately 10% of the waste generated in suburban areas, posing significant environmental and health hazards, including diarrhoea and acute respiratory infections, particularly among children residing near waste sites.[8] The World Health Organization further notes that inadequate waste collection management leads to environmental and marine pollution and can result in the obstruction of water drains.[9] All this ordeal is grounds for teaching learners to understand how human activities impact biodiversity because when not handled properly humanity may likely experience another world war when it is in a position to prevent it early. This study is on the premise that adequate teaching about these pressing matters is important, particularly for the current Grade 11 learners. Majozi suggests that an environmental teaching approach should be used to teach Life science's human activity topic.[10] Majozi posits that this approach such approach ensures that teachers become effective environmental educators rather than using only lecture discussion approaches do not make learning a worthwhile exercise for learners. In agreement with this assertion, Marcinkowski points out that if teachers use only lecture discussion approaches in teaching/learning, they cannot become effective environmental educators.[11]

[1] Nasrat Adamo, Nadhir Al-Ansari, and Varoujan Sissakian, "Review of Climate Change Impacts on Human Environment: Past, Present and Future Projections," *Engineering* 13, no. 11 (2021): 605–30; Turner B. L., *The Earth As Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years* (Cambridge, and New York: Cambridge University Press, 1990).
[2] Tony Andrean and David Ming, "The Study Of Theological Sin And The Meaning Of Transformation Based On Romans 12: 1-2," 2020.
[3] Global Waste Cleaning Network, " Land Waste," 2023, https://gwcnweb.org/about/areas-of-interest/land-waste/.
[4] Andrean and Ming, "The Study Of Theological Sin And The Meaning Of Transformation Based On Romans 12: 1-2."
[5] Ida Ayu Putu Anugrah Widiantari, Ni Luh Putu Eka Sulistia Dwi, and Luh Putu Artini, "YouTube as an Alternative Learning Media for Independent Bilingual Young Learners: A Review.," *Journal of English Teaching* 9, no. 1 (2023): 83–97.
[6] WHO, "World Health Statistics 2015," 2015, https://iris.who.int/handle/10665/170250.
[7] Ligia Guerrero et al., "Inhibition of Angiotensin-Converting Enzyme Activity by Flavonoids: Structure-Activity Relationship Studies," *PLoS ONE* 7, no. 11 (November 21, 2012): e49493, https://doi.org/10.1371/journal.pone.0049493; World Bank, "World Bank Solid Waste Management," 2018.
[8] Un-Habitat, *Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2010* (Routledge, 2010).
[9] WHO, *Compendium of WHO and Other UN Guidance on Health and Environment* (Geneva, Switzerland: World Health Organisation, 2021).
[10] Thembisile Rosemary Majozi, "Exploring Approaches to the Teaching of Life Sciences" (University of KwaZulu-Natal, 2013), https://researchspace.ukzn.ac.za/server/api/core/bitstreams/ace8285e-8b51-487b-82a3-e930c7101bbb/content.
[11] Tom Marcinkowski, "A Contextual Review of the 'Quantitative Paradigm' in EE Research," *Alternative Paradigms in Environmental Education Research*, 1993, 29–79.

Thus, a need for approaches that are augmented by technologies which learners enjoy using for their social interactions.

This study seeks to investigate how YouTube videos enhance the comprehension of grade 11 Life sciences learners regarding the influence of human activities on the environment. The hypothesis posits two main points: first, there will be variations in learners' understanding of concepts such as biodiversity loss and solid waste management based on the teaching method employed. Second, it is anticipated that the use of YouTube videos will enhance learners' comprehension of the subject matter due to the practical nature of the demonstration method, which is believed to facilitate more effective learning compared to other instructional approaches.

LITERATURE REVIEW

Educational Technology and Learning Outcomes

Educational technology has witnessed a paradigm shift in recent years, with multimedia platforms like YouTube becoming integral tools for enhancing learning outcomes.[12] YouTube, as a widely accessible platform, offers a rich source of multimedia content suitable for educational purposes.[13] YouTube videos can assist learners to engage more deeply with the subject matter and they are able to recall the information they have learned longer.[14] Additionally, it has been shown that student's comprehension of the course content deepens when they watch YouTube videos.[15]

Furthermore, Krauskopf et al., and Zahn et al., have proved that using multimedia components such as videos is effective in teaching and learning.[16] According to Mbanjwa, the use of YouTube videos in science classrooms is found to energize and motivate learners.[17] Studies suggest that YouTube videos can enhance student engagement and motivation in the learning process.[18] The captivating nature of video content can make the exploration of environmental science more appealing to learners. This increased engagement may positively impact comprehension, as motivated students are more likely to invest time and effort in understanding the subject matter.[19]

Learning Styles and Multimedia

Learning styles encompass the diverse preferences and approaches individuals exhibit in absorbing and processing information. The utilization of multimedia resources in education has gained prominence due to its potential to cater to diverse learning styles.[20] According to Smith et al., multimedia resources provide a dynamic and interactive approach, engaging students visually and auditory.[21] YouTube, as a prominent multimedia platform, offers a vast repository of educational content, making it an accessible and versatile tool for educators. Zukisani stated that if the teaching approach in a classroom does not suit the learning

[12] A. Smith, B. Johnson, and C. Williams, " The Impact of Multimedia-Enhanced Instruction on Grade 11 Life Science Comprehension," *Journal of Science Education and Technology* 27, no. 4 (2018): 328–42.
[13] Reynol Junco, Greg Heiberger, and Eric Loken, "The Effect of Twitter on College Student Engagement and Grades," *Journal of Computer Assisted Learning* 27, no. 2 (2011): 119–32.
[14] J. Hilner, "How to Use Online Video in Your Classroom," *How Teachers Can Bring the Best of YouTube and Other Online Video Services to Their Students. Edutopia*, 2012.
[15] N. Buzzetto-More, "Social Media and Prosumerism ," in *Proceedings of the Informing Science and Information Technology Education Conference* (Informing Science Institute, 2013), 67–80, https://www.learntechlib.org/p/114685/; Hilner, "How to Use Online Video in Your Classroom"; Rebecca Logan, "Using YouTube in Perioperative Nursing Education," *AORN Journal* 95, no. 4 (2012): 474–81.
[16] Karsten Krauskopf, Carmen Zahn, and Friedrich W. Hesse, "Leveraging the Affordances of Youtube: The Role of Pedagogical Knowledge and Mental Models of Technology Functions for Lesson Planning with Technology," *Computers & Education* 58, no. 4 (May 2012): 1194–1206, https://doi.org/10.1016/j.compedu.2011.12.010; Carmen Zahn et al., "Comparing Simple and Advanced Video Tools as Supports for Complex Collaborative Design Processes," *The Journal of the Learning Sciences* 19, no. 3 (2010): 403–40.
[17] Nobuhle Priscilla Mbanjwa, "The Effectiveness of YouTube Videos in Developing Process Skills in Grade 10 Life Sciences Curriculum" (University of KwaZulu-Natal, 2022), https://researchspace.ukzn.ac.za/items/0abd44de-b3ab-4113-a308-1b17f3f40d98.
[18] Reynol Junco and Candrianna Clem, "Predicting Course Outcomes with Digital Textbook Usage Data," *The Internet and Higher Education* 27 (October 2015): 54–63, https://doi.org/10.1016/j.iheduc.2015.06.001.
[19] Ellen Skinner et al., "A Motivational Account of the Undergraduate Experience in Science: Brief Measures of Students' Self-System Appraisals, Engagement in Coursework, and Identity as a Scientist," *International Journal of Science Education* 39, no. 17 (November 22, 2017): 2433–59, https://doi.org/10.1080/09500693.2017.1387946.
[20] R. Johnson and S. Anderson, " Multimedia in the Classroom: Enhancing Learning Through Visual and Auditory Resources," *Educational Psychology Review* 28, no. 1 (2022): 27–42.
[21] Smith, Johnson, and Williams, " The Impact of Multimedia-Enhanced Instruction on Grade 11 Life Science Comprehension."

style in the classroom, it could result in learners' losing interest in the lesson; consequently, resulting in a drop in academic performance.[22]

YouTube as an Educational Platform

The importance of integrating multimedia tools into education to enrich learners' grasp of complex scientific ideas is highlighted. Johnson and Anderson emphasize that multimedia channels such as YouTube provide dynamic visual illustrations and real-life instances, which can enhance understanding and long-term retention of information.[23] The interactive nature of videos can provide a more holistic learning experience, addressing various learning styles among students.

Furthermore, a study by Brown and White highlighted that the use of multimedia resources, particularly YouTube videos, can bridge the gap between theoretical knowledge and practical application.[24] Using videos portraying real-life situations concerning the impact of human actions on the environment can assist learners in linking theoretical concepts with tangible outcomes, facilitating a deeper understanding. As noted by Jones and Cuthrell, YouTube videos can be seamlessly integrated into classroom instruction.[25] YouTube, a platform allowing users to upload, watch, and distribute video content, also enables interaction through comments and discussions among users.[26] Multimedia components like videos engage both visual and auditory senses, encouraging a multi-sensory approach to learning.[27] The vibrant and interactive characteristics of YouTube materials can captivate learners' interest and facilitate a more profound comprehension of intricate scientific principles.[28]

The platform's visual and auditory features cater to diverse learning styles.[29] YouTube's popularity among learners is a testament to its effectiveness as an engaging educational tool.[30] Incorporating YouTube videos into the curriculum can address the challenges associated with traditional teaching methods, providing a dynamic and interactive learning experience.

Impact of Visual Learning on Environmental Education

Educational videos on YouTube serve as a prime example of how visual learning can be harnessed to convey environmental science concepts effectively. Research by Hao and Chen, highlights the significance of visual elements in education, emphasizing that well-crafted visual aids can enhance the understanding of complex scientific concepts.[31] Furthermore, a study by Hirvonen and Bergeå emphasizes the significance of well-crafted educational videos in engaging grade 11 learners and promoting active learning.[32] These videos incorporate visual elements such as animations, real-world footage, and graphics, creating a multisensory experience that resonates with diverse learning preferences.

Research by Smith and Doe indicates that incorporating visuals, such as infographics and videos, engages learners and fosters a deeper connection to environmental issues. Additionally, a study by Boca et al. found that visual aids in educational materials positively influenced students' awareness of

[22] Zukisani Mkhanyiswa, "Exploring Alternative Pedagogies for Teaching Grade 11 Further Education and Training Life Sciences" (Cape Peninsula University of Technology, 2022), https://etd.cput.ac.za/bitstream/20.500.11838/3820/1/Zukisani_Mkhanyiswa_209212063.pdf.
[23] Johnson and Anderson, " Multimedia in the Classroom: Enhancing Learning Through Visual and Auditory Resources."
[24] A. Brown and J. White, " The Role of Multimedia in Education: A Literature Review," *Journal of Educational Technology* 15, no. 2 (2020): 45–58.
[25] Troy Jones and Kristen Cuthrell, "YouTube: Educational Potentials and Pitfalls," *Computers in the Schools* 28, no. 1 (2011): 75–85.
[26] Blair Lehman, Sidney D'Mello, and Art Graesser, "Confusion and Complex Learning during Interactions with Computer Learning Environments," *The Internet and Higher Education* 15, no. 3 (June 2012): 184–94, https://doi.org/10.1016/j.iheduc.2012.01.002.
[27] R. E. Mayer, *Multimedia Learning*, 2nd ed. (Cambridge: Cambridge University Press, 2009).
[28] Edward H. Perry and Michelle L. Pilati, "Online Learning," *New Directions for Teaching and Learning* 2011, no. 128 (December 8, 2011): 95–104, https://doi.org/10.1002/tl.472.
[29] D Randy Garrison, Terry Anderson, and Walter Archer, "The First Decade of the Community of Inquiry Framework: A Retrospective," *The Internet and Higher Education* 13, no. 1–2 (2010): 5–9.
[30] Reynol Junco, C. Michael Elavsky, and Greg Heiberger, "Putting Twitter to the Test: Assessing Outcomes for Student Collaboration, Engagement and Success," *British Journal of Educational Technology* 44, no. 2 (March 2013): 273–87, https://doi.org/10.1111/j.1467-8535.2012.01284.x.
[31] Hao Chen, "The Development Trend of Visual Communication Design in the Internet Era," in *2022 2nd International Conference on Computer Technology and Media Convergence Design (CTMCD 2022)* (Atlantis Press, 2022), 156–63.
[32] N. Hirvonen and H. Bergeå, "Investigating Learning Styles and Perceived Quality in Video-Based Learning: A Case Study in Higher Education," *Education Sciences* 11, no. 4 (2021): 157.

ecological challenges, promoting a more sustainable mindset.[33] Research by Johnson and Smith demonstrated that visual representations of environmental processes significantly improved grade 11 learners' ability to grasp complex concepts related to human activities and their impact on the environment.[34]

Comparative Studies on Teaching Methods

There are different kinds of teaching and learning strategies that play an important role in the development and the grasping of concepts. Contrasting conventional teaching techniques such as lectures and textbooks with multimedia-centered strategies utilizing resources like YouTube videos has been explored.[35] Smith et al. discovered that lessons enriched with multimedia were linked to heightened engagement and comprehension levels in comparison to traditional methods.[36] This suggests a potential shift in pedagogical practices towards more interactive and visually stimulating strategies.

Challenges and Considerations in Using YouTube for Education

While the benefits of using YouTube for educational purposes are evident, challenges persist. Issues related to content quality, accuracy, and potential distractions necessitate careful consideration.[37] The accuracy and credibility of the videos posted on YouTube have been identified as a challenge to most teachers when selecting curriculum videos.[38] Educators must critically evaluate the reliability of YouTube content to ensure its alignment with the curriculum and educational objectives.

THEORETICAL FRAMEWORK

To understand how YouTube videos enhanced the comprehension of grade 11 Life sciences learners regarding the influence of human activities on the environment, this study used Horkheimer's concept of Critical Theory.[39] To find its relevance in the education space, Mavhungu defined critical theory as that which offers a way to comprehend the world by considering other people's perspectives and encourages rational and imaginative thinking.[40] It stresses the importance of acquiring knowledge by considering the perspectives and experiences of participants and aims to identify, analyse and transform aspects of education. The reason why this theory is best suited for this study is that it is used to evaluate and improve demotivating factors in Life Science education by turning them into positive learning experiences through effective teaching methods. The relevance of this theoretical framework lies in its examination of respondents who are aware of the shortcomings in their educational experiences and who desire to take a proactive stance in addressing these issues.[41]

The study aims to uncover the most effective teaching methods in Life Science to build the necessary skills to combat human impact on the environment in South Africa. As a result, the findings from this study can provide guidance for Life Science teachers in implementing effective teaching methods to help address food shortage problems among the human populace.

[33] Gratiela Dana Boca and Sinan Saraçlı, "Environmental Education and Student's Perception, for Sustainability," *Sustainability* 11, no. 6 (March 14, 2019): 1553, https://doi.org/10.3390/su11061553.
[34] A. Smith, B. Johnson, and C. Williams, "The Impact of Multimedia-Enhanced Instruction on Grade 11 Life Science Comprehension," *Journal of Science Education and Technology* 27, no. 4 (2018): 328–42.
[35] R. Brown and M. Jones, " Multiplication Pedagogy: A Comparative Study of Lattice and Traditional Methods ," *Journal of Educational Research* 42, no. 2 (2017): 189–211.
[36] Smith, Johnson, and Williams, " The Impact of Multimedia-Enhanced Instruction on Grade 11 Life Science Comprehension."
[37] Melody Nouri, "The Power of Influence: Traditional Celebrity vs Social Media Influencer. ," *Https://Scholarcommons.Scu.Edu/Engl_176/32* (Advanced Writing: Pop Culture Intersections, 2018).
[38] Sloane C Burke, Shonna Snyder, and Robin C Rager, "An Assessment of Faculty Usage of YouTube as a Teaching Resource," *Internet Journal of Allied Health Sciences and Practice* 7, no. 1 (2009): 8.
[39] Max Horkheimer, "Traditional and Critical Theory," *Critical Theory: Selected Essays* 188, no. 243 (1972): 1–11.
[40] Azwifarwi Phillemon Mavhungu, "Factors Influencing the Performance in Agricultural Science in Some High Schools in the Limpopo Province" (University of Pretoria (South Africa), 2004).
[41] Gregory S C Hine, "The Importance of Action Research in Teacher Education Programs," *Issues in Educational Research* 23, no. 2 (2013): 151–63.

METHODOLOGY

This research employed a mixed methods approach, enabling the collection and synthesis of data through both qualitative and quantitative means.[42] The selection of this mixed methods strategy was deliberate, aiming to leverage the strengths of various data types while mitigating the limitations associated with solely quantitative or qualitative methods.[43] Additionally, the researcher justified the mixed method approach by observing two groups of learners participating in lecture and YouTube teaching sessions.

Research Design

A quasi-experimental design involving pre- and post-test groups was utilized as the study framework.[44] This design, as described by Cohen et al., enables the comparison of control and experimental groups. It is commonly employed in classroom experiments when maintaining the natural classroom setting is crucial and cannot be disrupted for research purposes.[45] In this study, two groups of learners participated: one served as the experimental group, exposed to the YouTube video teaching approach, while the other acted as the control group, receiving instruction via the lecture method. The lecture method was conducted in its usual classroom setting where the teaching of human impact on the environment took place. The alternative method involved the utilization of videos sourced from YouTube. The videos included (1) "What is Climate Change" by AI Jazeera English, (2) "Human Impact on the Environment" by Miss Van Deventer's Life Sciences Class (3) "Causes and Effects of Climate Change" by National Geographic (4) "We Are the Problem and the Solution" (animated infographic) by Matt Miltonberger.

Population and Sample Size

For this study, three schools situated in Mankweng, Limpopo Province, South Africa, were purposefully selected. A randomized sampling method, which falls under probability sampling, was employed to ensure each learner had an equal opportunity of being chosen for the study. Across all schools, a total of 45 Grade 11 Life Science learners participated in each school, resulting in 135 learners in three schools that were involved in the study. Prior to the intervention, all learners took a pre-test assessment in the form of a class test. Following a two-week intervention period, learners from both the control and experimental groups in Life Science were administered a similar test.

Data Collection

In this study, written tests served as the means of data collection, conducted over a span of three weeks through pre-test and post-test assessments. While both groups received instruction utilizing a designated method, the control group was taught using the lecture method. A post-test, mirroring the pre-test, was administered to evaluate the experimental and control groups, facilitating a comparison of scores across all groups.

Data Analysis

The quantitative and qualitative data were analyzed separately. Initially, quantitative analysis involved examining the data from the learners' test results. Data from each school were independently analyzed using the t-Paired Samples test, with statistical significance established at $p < 0.05$. The assumptions of the t-Paired Samples test, normality and independence of pairs were met. All statistical analyses were conducted using the Statistical Package for Social Science (SPSS) version 29.0, developed by International Business Machines (IBM). Subsequently, qualitative analysis focused on analyzing learners' responses through document analysis. As described by Bowen, document analysis is a systematic approach for retrieving and evaluating both printed and electronic documents, including computer-based

[42] John W Creswell and Vicki L Plano Clark, *Designing and Conducting Mixed Methods Research* (Sage publications, 2017).
[43] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* , 5th ed. (London: Sage, 2018).
[44] L. Cohen, L. Manion, and K. Morrison, *Research Methods in Education*, 6th ed. (London and New York, NY: Routledge Falmer, 2007).
[45] Cohen, Manion, and Morrison, *Research Methods in Education*.

and Internet-transmitted materials.[46] Documents serve various purposes, including providing a means of tracking change and development.[47]

Reliability, Validity, and Objectivity

In this study, the reliability of the findings was based on the statistical analysis of the collected data at the probability level of 5%. This was based on Sumrin and Gupta's view that reliability in research should be reflected through the consistency, stability, and repeatability of research findings.[48] This shows the degree to which a research study yields reliable and consistent results when carried out in comparable circumstances. This study streamlined itself with Quintão, Andrade, and Almeida's version of guaranteeing results validity by making sure the data accurately reflect findings among individuals who are similar to the study participants.[49] So, validity was accomplished by gathering information from public high schools. Objectivity further was attained by certifying that the discoveries are discussed and grounded on empirical evidence, thus eradicating all biases.[50]

Ethical Consideration

The researcher was committed to ensuring that the participants in the study were protected. Participants in this study were given informed consent forms to indicate their willingness to participate. The informed consent forms ensured that participants fully understood what it entailed to participate in the study.[51] The anonymity of the participants was ensured through the use of pseudonyms instead of participants' real names in data analysis. The data collected was kept confidential and the school names were not used as they would have been the identifiers and threatened the privacy of the participants. Consent forms and transcripts were kept in a safe lockable space and recordings from interviews were stored in encrypted files and password-protected devices.

PRESENTATION OF FINDINGS

In order to explore how YouTube videos enhanced the comprehension of grade 11 Life sciences learners regarding the influence of human activities on the environment, this study employed pre and post-tests. During analysis by means of SPSS software, the following emerged.

- There were visible effects between learners who were taught using lecture methods and those with YouTube-assisted demonstration methods.
- Learners who were taught using the demonstration teaching method performed better on their post-tests.

These themes are elaborated upon below by means of data and discussions afterward.The scores from each treatment within each school were averaged, with "M" representing the mean score and "SE" representing the standard error (M ± SE). The results indicated significant effects of teaching methods in all schools (Table 1 & 2). The lecture method and YouTube video pre-test scores were similar at the beginning before the study's intervention, with no significant ($p < 0.05$) difference among them (Table 2). After teaching all the groups, YouTube videos in all schools performed better than the lecture method group (Table 2). In all the schools, which acted as replicates in the present study, the YouTube videos had higher marks/scores than the traditional lecture method. From the results shown in (Table 1), the data shows the relationship between the pre-and-post tests on learners' performance in Life science. The test statistic (t) is negative and significant at ($t = -20.49$: $p < 0.05$). This means that as the lecture method is not improving performance, the YouTube video is improving learners' performance. This implies that out

[46] Glenn A. Bowen, "Document Analysis as a Qualitative Research Method," *Qualitative Research Journal* 9, no. 2 (August 3, 2009): 27–40, https://doi.org/10.3316/QRJ0902027.
[47] Bowen, "Document Analysis as a Qualitative Research Method."
[48] S. Sumrin and S. Gupta, " Establishing Validity and Reliability in Case Study Research Projects," in *The Routledge Companion to Marketing Research* (London: Routledge, 2021), 119–31.
[49] Cátia Quintão, Pedro Andrade, and Fernando Almeida, "How to Improve the Validity and Reliability of a Case Study Approach?," *Journal of Interdisciplinary Studies in Education* 9, no. 2 (2020): 264–75.
[50] Paul D Leedy and Jeanne Ellis Ormrod, *Practical Research*, vol. 108 (Pearson Custom Saddle River, NJ, USA, 2005).
[51] C. C. Nnebue, "Informed Consent in Research," *Afrimedic Journal* 1, no. 1 (2010): 5–10; David Archard, "Informed Consent: Autonomy and Self-ownership," *Journal of Applied Philosophy* 25, no. 1 (2008): 19–34.

of 135 participants, 135 understood human activity in the environment chapter better YouTube videos were used.

Analysis of the quantitative results using Document analysis

The findings in this section are presented as themes, supported by congruent findings between current research and existing literature. Verbatim quotes, used to exemplify the findings were used for the purpose of this study. The data obtained from the learners' scripts were grouped into four categories which were utilized in the classification of linked data.In response to this study objective no.2, the researcher grouped learners' according to their performance.

Table 1: Learners' categories and percentages according to their performances.

Category	Percentage Value
1.Category A Low understanding (Poor)	10%
2.Category B Insufficient understanding (Satisfactory)	15%
3.Category C Sufficient understanding (Good)	25%
4.Category D Complete understanding (Very Good)	50%

Table 2: Themes

Theme	Emergent code 1	Emergent code 2
1. Human Impact on the Biodiversity	-Deforestation and habitat loss	-Landfills and their environmental impact
2. Conservation Efforts	-Wildlife reserves and protected areas	-Waste management policies and regulations
	-Reintroduction and breeding programs	-Community-based waste management initiatives

Retention and Application of Environmental Knowledge

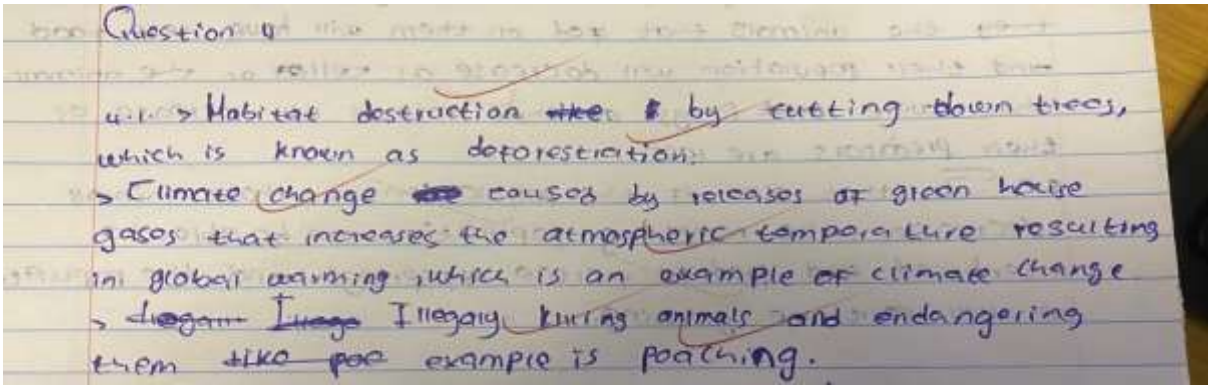
Human Impact on the Biodiversity

According to Sánchez-Bayo & Wyckhuys, habitat destruction occurs when a natural habitat such as a forest or wetland, is altered so dramatically that it no longer supports the species it originally sustained.[52] Habitat destruction is considered the most important driver of species extinction worldwide.[53]

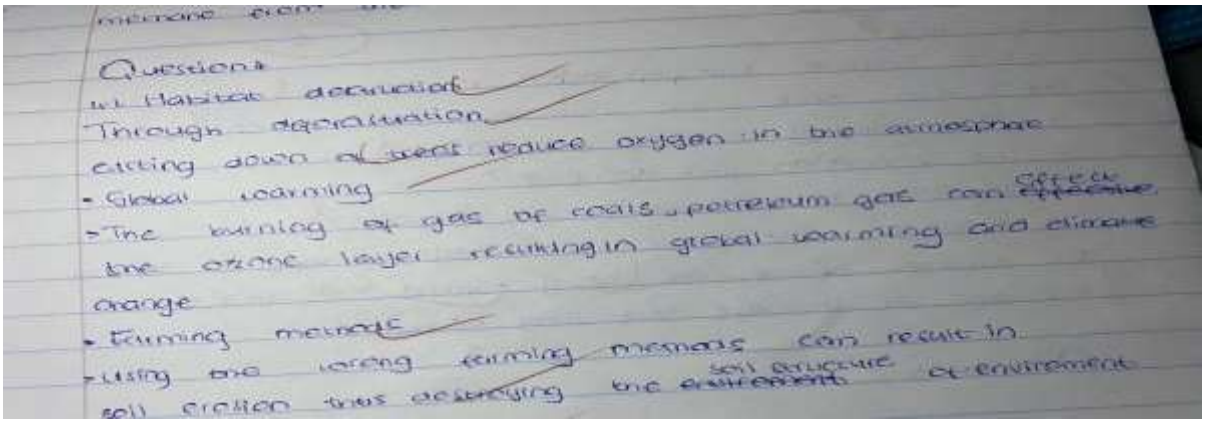
Category D performed very well, and this is an indication that teaching via YouTube videos was effective. Ncisana et al., suggest that YouTube videos are effective in developing understanding stimulate thinking and have the ability to sustain the interest of learners throughout the lesson.[54] Category D were able to apply their knowledge of how human activities impact the environment negatively.

The following are snapshots from Category D responses showing how they were able to respond to question 4.1.

[52] Francisco Sánchez-Bayo and Kris A.G. Wyckhuys, "Worldwide Decline of the Entomofauna: A Review of Its Drivers," *Biological Conservation* 232 (April 2019): 8–27, https://doi.org/10.1016/j.biocon.2019.01.020.
[53] Sánchez-Bayo and Wyckhuys, "Worldwide Decline of the Entomofauna."
[54] Lusanda Ncisana et al., "A Comparative Study of Teaching Approaches in Agro-Ecology: An Investigation of 10th-Grade Agricultural Sciences Learners in Selected Schools," *Sustainability* 15, no. 5 (February 23, 2023): 4048, https://doi.org/10.3390/su15054048.



Participant A



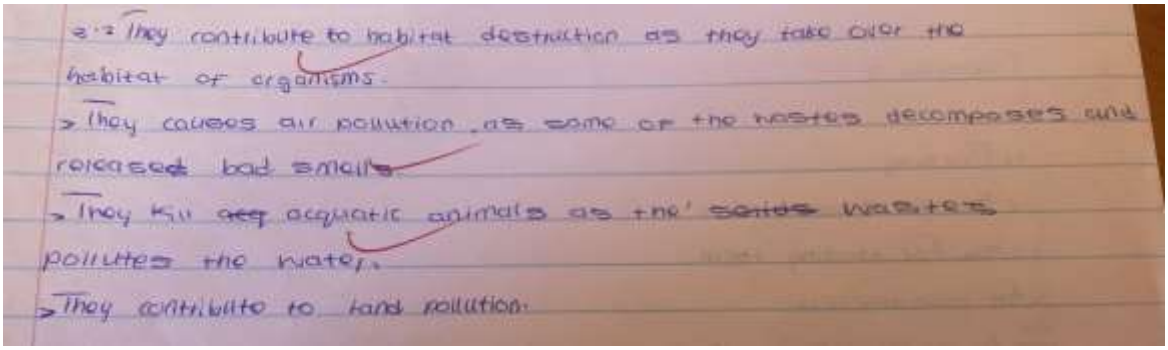
Participant B

Effectiveness in addressing environmental issues

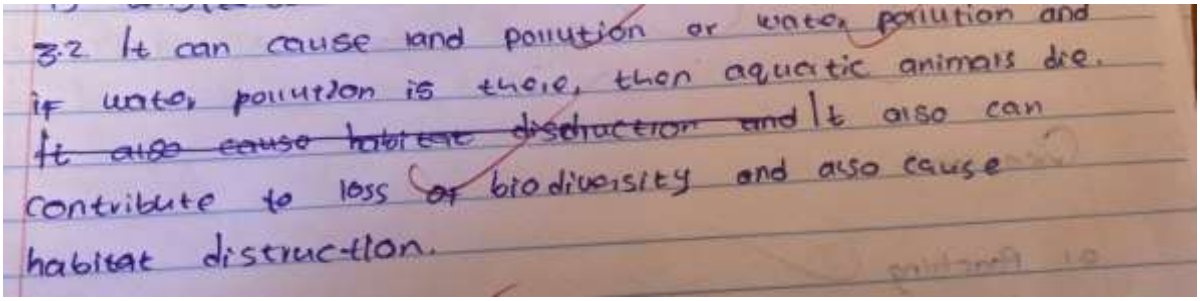
Conservation Efforts

Question 3.2. which states, 'Name three problems that can occur when dumpsites are not managed properly?' It is evident from Table 2 that categories C and D were able to answer this question correctly after being exposed to the teaching using YouTube videos. According to Hoornweg and Bhada if the waste disposals are not properly managed the following problems might occur:[55] (1). Water pollution: Whatever waste doesn't go into landfills or other disposal areas usually finds its way into the ocean or other bodies of water. It then breaks down into the ocean, slowly contaminating the water and choking out the life that water hosts. (2) Land pollution: Land pollution happens whenever waste ends up on soil or other land that people should process instead. (3) Air pollution: Air pollution is a major issue worldwide and understanding how improper waste disposal affects the environment through air pollution is necessary. Category C And D respectively were effective in addressing this question, the following screenshots show improvement in their content knowledge. Learners who were exposed to the demonstration teaching method responded correctly compared to those who were taught using the lecture method. The following are snapshots below were extracted from learners' scripts.

[55] Daniel Hoornweg and Perinaz Bhada-Tata, "What a Waste: A Global Review of Solid Waste Management," 2012.



Participant A



Participant B

Table 1: Summary of t-Paired T-test for Pre and Post Test

Parameter	Std. Deviation	Std. Error Mean	t-value	Df	Sig.2-tailed (p-value)
Pre and post-tests	**6.568**	**0.569**	**-20.491**	**132**	**<0.001**

Table 2: Teaching methods with marks (mean scores) obtained from Grade 11 Life Sciences learners at all schools

Treatments	School A	School B	School C
Lecture method	18.70 ± 0.97^{b}	18.77 ± 0.89^{b}	19.34 ± 0.89^{b}
YouTube videos	30.44 ± 1.22^{a}	32 ± 0.96^{a}	28.82 ± 1.13^{a}

[a,b,] Means and SE in the column row with different superscripts are significantly different ($p < 0.05$), within schools.

DISCUSSION

This study sought to investigate how YouTube videos enhance the comprehension of grade 11 Life sciences learners regarding the influence of human activities on the environment. Several reports have shown that teachers could use YouTube videos to make teaching more realistic, interactive, and relevant to the needs of the learners. The study's findings strongly supported the first hypothesis, that YouTube videos will improve the performance or scores of grade 11 Life sciences learners when it comes to the influence of human activities on the environment topic. In all three schools where the study was conducted same trend was observed with the demonstration teaching method in the form of YouTube videos improving the scores of grade 11 learners. These results concur with the study findings that showed YouTube videos improve the scores of learners in science.[56] The obvious explanation is that the lecture

[56] Akram Abood Jaffar, "YouTube: An Emerging Tool in Anatomy Education," *Anatomical Sciences Education* 5, no. 3 (May 2012): 158–64, https://doi.org/10.1002/ase.1268; Nicole A Buzzetto-More, "An Examination of Undergraduate Student's Perceptions and Predilections of the Use of YouTube in the Teaching and Learning Process," *Interdisciplinary Journal of E-Learning and Learning Objects* 10, no. 1 (2014): 17–32; Immanuel Chindongo Chindongo, *Teachers' Pedagogical Beliefs on the Use of Youtube Videos for Teaching and Learning Grade 9 Life Science Concepts* (University of Johannesburg (South Africa), 2021); Ncisana et al., "A Comparative Study of Teaching Approaches in Agro-Ecology: An Investigation of 10th-Grade Agricultural Sciences Learners in Selected Schools."

method deprives learners of engaging the teacher, which may lead to a negative attitude toward the subject.[57] However, learners subjected to YouTube videos have the privilege of engaging the teacher. The studies conducted by Jaffar and Chindongo confirm that using YouTube videos as a teaching method improves learners' performance when compared to the lecture method.[58]

The second hypothesis, that demonstration teaching methods (YouTube videos) would improve learners' content knowledge was also strongly supported by the study results. This prediction was informed by the fact that using scores or marks only to determine content knowledge is not enough. After marking the learners' scripts, the scripts were analysed checking which area of the topic learners understand better in both teaching methods. The study results agree with Loiser and Endne who reported that the demonstration method can be applied in the classroom which is expected to increase the level of thinking and experience of learners.[59] In addition, Uhumuavbi & Mamudu emphasises that the demonstration method is effective in learning science subjects.[60] Several studies have found that YouTube videos, particularly those on STEM topics, have pedagogical value and might be used as teaching and learning resources.

RECOMMENDATIONS

This study recommends the establishment of study groups among educators as a cost-effective approach to professional development, enabling them to share teaching strategies and support each other in addressing challenging or unfamiliar teaching areas. Teachers should also create channels on YouTube where they will upload useful information for learners to study. This channel will reduce the complications of searching for relevant information on YouTube.

CONCLUSION

The current study aimed to assess the impact of different teaching approaches on the academic performance of Grade 11 Life Science learners concerning their understanding of human impact on the environment within the curriculum. The results demonstrated the effectiveness of YouTube videos in enhancing learners' comprehension of the subject matter. These findings hold significance for educational policymakers in South Africa, providing valuable insights into the integration of technology into teaching and learning practices, particularly in rural schools. This study adds to the notion that YouTube videos can be used as a tool to leverage learners understanding of educational concepts.

LIMITATIONS OF THE STUDY

The study's scope was limited to three schools within a single circuit. It is suggested that future research should encompass a more comprehensive investigation across both rural and urban areas throughout the entire provinces of South Africa.

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[57] Ncisana et al., "A Comparative Study of Teaching Approaches in Agro-Ecology: An Investigation of 10th-Grade Agricultural Sciences Learners in Selected Schools."

[58] Jaffar, "YouTube: An Emerging Tool in Anatomy Education"; Chindongo, *Teachers' Pedagogical Beliefs on the Use of Youtube Videos for Teaching and Learning Grade 9 Life Science Concepts*.

[59] Philippe Tohon Loiser and Wanye Endne, "Effect of Demonstration Method on Learning Success," *International Journal of Curriculum Development, Teaching and Learning Innovation* 1, no. 1 (November 30, 2022): 1–6, https://doi.org/10.35335/curriculum.v1i1.51.

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