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Learners' Perceptions on the Integration of Audio-Visual Simulations and WhatsApp into Physical Sciences Teaching and Learning – A Case Study of a University of Technology in South Africa

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ABSTRACT
The purpose of this study was to examine Physical Science learners' perceptions of the use of audio-visual simulations and WhatsApp in high school. The literature revealed that learners perceive Physical Science to be inadequately presented by teachers because rote and surface learning were promoted, while the application of deep thinking and learning was neglected. This is the gap in the literature that this study intended to address. The participants comprised 38 learners registered for a Grade 12 Physical Science upgrade course at a University of Technology in South Africa. A qualitative case study design was used. Data were obtained from the open-ended questionnaire, learner remarks on the audiovisual simulations (AVSs), and a focus group interview. The data was analysed using Atlas.ti. It was found that the real-life AVSs enhanced learners' understanding of key concepts, which assisted them in solving Physical Science problems effectively. Furthermore, learners believed that WhatsApp assisted in providing immediate feedback from other learners on the problems they encountered at any time, and they gained more knowledge and new information. It is recommended that AVSs should be short, interesting, impactful, and depict real-life scenarios related to key Physical Science concepts to enhance the learner's critical thinking and problem-solving competencies. This study contributes to the body of knowledge about the incorporation of technology in high school Physical Science to enhance critical thinking and problem-solving.

Keywords: Learners' Perceptions, Audio-Visual Simulations, WhatsApp, Physical Science, High School

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INTRODUCTION
South Africa's Department of Basic Education (DBE) developed a comprehensive and detailed Curriculum and Assessment Policy Statement (CAPS) for Grade 10 to 12 Physical Science, which provides teachers with specific requirements for what should be taught and how assessments should be conducted.[1] However,

[1] Medwin Sepadi and Karabo Molapo, "Exploring Teacher Understanding of Curriculum and Assessment Policy Statement Document Implementation in South African Schools," *Frontiers in Education* 9 (June 26, 2024), https://doi.org/10.3389/feduc.2024.1354959;

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literature revealed that learners perceive Physical Sciences to be inadequately presented by teachers because rote and surface learning were promoted, while the application of critical thinking in learning is neglected.[2] The challenges encountered in this study were that learners were unable to apply higher-order thinking or critical thinking skills to succeed in Physical Sciences. This problem is supported in the literature by Sikhosana and Mudau, who emphasised that most learners lack problem-solving skills and cannot effectively solve Physical Sciences problems.[3] Balla et al. argued that learner motivation and critical thinking are fostered when learners actively participate in the process of creating meaning and knowledge rather than merely absorbing information.[4]

To address the problem, the researchers integrated audio-visual simulations and WhatsApp into Physical Sciences classes. Learners engaged in a WhatsApp group to learn more and discuss concepts relating to vertical projectile motion, Doppler effect, momentum and impulse and fertiliser industry. The aim was to contribute to the body of knowledge in alleviating the identified challenges by investigating learners' perceptions on the use of audio-visual simulations (AVSs) and WhatsApp to improve their critical thinking and problem-solving skills in Physical Science. Learner perceptions of learning and teaching in high school Physical Science afford valuable insight into the feasibility of integrating 21st-century technologies to improve their performance in the subject. The literature revealed that learners perceive Physical Science to be inadequately presented by teachers because rote and surface learning were promoted, while the application of deep thinking and learning was neglected.[5] Moreover, research revealed the positive impact of technology on attracting learners' attention, facilitating learning, and increasing learner motivation.[6] Integrating technology and online collaboration into teaching and learning supports the development of higher-order skills, including critical thinking and problem-solving.[7] This is the gap in the literature that this paper intends to contribute to the body of knowledge about the incorporation of technology in high school Physical Science to enhance critical thinking and problem-solving.

The purpose of this study is to examine Physical Science learners' perceptions regarding the use of AVSs and WhatsApp in a South African High School. The research question posed in this study is: What are learners' perceptions towards integrating AVSs and WhatsApp into Physical Sciences teaching and learning? The findings of the study are presented subsequently.

LITERATURE REVIEW

Higher-order thinking skills are necessary for learners to succeed in Physical Sciences; however, the literature revealed that most learners perform inadequately in the subject due to a lack of critical thinking

Department of Basic Education (DBE), *National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (FET) Grades 10 – 12 Physical Sciences* (Pretoria: Government Printing Office, 2011).

[2] Banoth Ramdas and G. Yashoda, "A Study on the Learning Difficulties in Physical Science at Secondary School Level," *SSRN Electronic Journal*, 2020, 12–13, https://doi.org/10.2139/ssrn.3701442.

[3] Lettah Sikhosana and Awelani V. Mudau, "Echoes on the Teaching of Physical Science Using the Topic Projectile Motion," *International Journal of Research in Business and Social Science (2147- 4478)* 11, no. 7 (November 6, 2022): 276–83, https://doi.org/10.20525/ijrbs.v11i7.1994.

[4] Fatima Shaira J Balla et al., "Challenges in Learning Sciences Among Senior High School Science, Technology, Engineering, And Mathematics (STEM) Students of Private School in Indanan, Sulu," *Ignatian International Journal for Multidisciplinary Research* 2, no. 4 (2024): 1724–38.

[5] Ramdas and Yashoda, "A Study on the Learning Difficulties in Physical Science at Secondary School Level."

[6] Jurakulov Sanjar Zafarjon Oghly, "New Computer-Assisted Approaches to Teaching Physics," *American Journal of Public Diplomacy and International Studies (2993-2157)* 1, no. 10 (2023): 173–77.

[7] Frances Wijnen, Juliette Walma van der Molen, and Joke Voogt, "Primary Teachers' Attitudes towards Using New Technology and Stimulating Higher-Order Thinking in Students: A Profile Analysis," *Education and Information Technologies* 28, no. 6 (June 11, 2023): 6347–72, https://doi.org/10.1007/s10639-022-11413-w; Leonard Nungu, Evode Mukama, and Ezechiel Nsabayezu, "Online Collaborative Learning and Cognitive Presence in Mathematics and Science Education. Case Study of University of Rwanda, College of Education," *Education and Information Technologies* 28, no. 9 (September 8, 2023): 10865–84, https://doi.org/10.1007/s10639-023-11607-w.

skills.[8] Furthermore, the DBE (2013) indicated that the inability of learners to understand and analyse Physical Sciences problems contributes to their poor performance in the subject. Furthermore, Physical Sciences test questions based on subject retention were answered poorly, as crucial concepts and phrases were omitted from the definitions.[9] This means that without comprehending the key Physical Sciences concepts, learners learned and memorized abstract concepts without understanding them. Ramdas and Yashoda discovered that learners preferred rote and surface learning because they needed to memorize the concepts, as they had no logical comprehension of them.[10]

Today's educational system requires innovative teaching methods that may attract the younger generation to learn.[11] Research findings further highlighted the effectiveness of integrating videos into Physical Sciences practical work, which showed improvement in both the speed and quality of practical laboratory tasks, helped learners to gain a deeper understanding of experimental techniques, and develop good practical skills.[12] In this regard, Jamil et al. noted that creating supplementary content elaborating real-life applications of Physical Sciences concepts enhances relevance and provides authentic contexts for learners to apply critical thinking.[13] This implies that real-life AVSs based on Physical Sciences concepts should be used more frequently in learning and teaching Physical Sciences.

Hasanah et al. found that 52% of teachers used YouTube more than other media to clarify abstract science concepts during the COVID-19 pandemic.[14] Furthermore, Afriza and Nasution's study in Indonesia found that using AVS resources in teaching and learning enhanced learner-learning outcomes.[15] The DBE encouraged AVS videos downloaded from various websites to be incorporated into learning and teaching to strengthen learners' understanding of Physical Sciences concepts.[16] In this regard, Ngonso et al. reported that 86.2% of Nigerian high school learners believe that AVS material available on social media has a greater influence over them.[17] It is for these reasons that the researchers used AVSs in Physical Science classes to bring real-life scenarios and understanding of abstract concepts.

Social media, particularly WhatsApp, is the most popular means of online communication throughout Africa, including Zimbabwe and South Africa, due to its widespread availability and accessibility in remote areas.[18] A study conducted by Nkanyani et al. revealed that learners responded positively by

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[8] S. Surjoo, "Enhancing Critical Thinking and Problem-Solving Skills of Grade 12 Physical Science Learners Using Audio-Visual Simulations and Social Network Sites" (Tshwane University of Technology, 2023).

[9] Department of Basic Education (DBE), *National Senior Certificate Results Schools Subject Report* (Pretoria: Government Printing Office, 2022).

[10] Ramdas and Yashoda, "A Study on the Learning Difficulties in Physical Science at Secondary School Level."

[11] I A Ojelade et al., "Effects of Audio-Visual Instructional Materials on Teaching Science Concepts in Secondary Schools in Bwari Area Council Abuja, Nigeria," *Ojelade, IA, Aregbesola, BG, Ekele, A., & Aiyedun, TG (September 2020). Effects of Audio-Visual Instructional Materials on Teaching Science Concepts in Secondary Schools in Bwari Area Council Abuja, Nigeria. The Environmental Studies Journal (TESJ)* 3, no. 2 (2020): 52–61.

[12] Nihal Bouras et al., "Mobile Learning in Physics Education: Evaluating the Impact of Interactive Videos on Practical Work," *International Journal of Interactive Mobile Technologies (IJIM)* 19, no. 13 (July 14, 2025): 4–18, https://doi.org/10.3991/ijim.v19i13.53617.

[13] Muhammad Jamil, Faiza Abdul Hafeez, and Noor Muhammad, "Critical Thinking Development for 21st Century: Analysis of Physics Curriculum," *Journal of Social & Organizational Matters* 3, no. 1 (March 5, 2024): 01–10, https://doi.org/10.56976/jsom.v3i1.45.

[14] Uswatun Hasanah, "Exploring the Need for Using Science Learning Multimedia to Improve Critical Thinking Elementary School Students: Teacher Perception," *International Journal of Instruction* 16, no. 1 (January 1, 2023): 417–40, https://doi.org/10.29333/iji.2023.16123a.

[15] Dedy Afriza Afriza and Nanda Eska Anugrah Nasution, "Comparison of the Learning Outcomes of Junior High School Students Utilizing Audio-Visual and Chart Learning Media to Study Ecosystem,"*META: Journal of Science and Technological Education* 1,no.1(2022):46–57.

[16] Department of Basic Education (DBE), *National Senior Certificate Diagnostic Report Part 1: Content Subjects* (Pretoria: Government Printing Office, 2021).

[17] Blessed Frederick Ngonso et al., "Impact of Social Media on Secondary Schools' Youths within Edo North, Edo State, Nigeria: A Psychological Perspective," *Journal of Education and E-Learning Research* 11, no. 1 (February 26, 2024): 181–92, https://doi.org/10.20448/jeelr.v11i1.5419.

[18] Shoorai Konyana and Modise Alfred Motalenyane, "A Changing World and a Changing Teaching Practice Model for Zimbabwe in a Post COVID-19 Context," *Journal of Culture and Values in Education* 5, no. 1 (2022): 43–58; S. Galal, "Leading Social Media Platforms in South Africa 2022," June 21, 2023, https://www.statista.com/statistics/1189958/penetration-rate-of-social-media-in-southafrica/#:~:text=WhatsApp is the most popular,percent and 73 percent%2C respectively.

submitting their Physical Sciences tasks on the WhatsApp group.[19] This study adopted WhatsApp during the Physical Science classes because most learners had access to it through their smartphones. WhatsApp has the potential to facilitate collaborative learning through engagement, communication, knowledge dissemination, entertainment, resource sharing, socialization, and collaboration.[20] Learners learn better in WhatsApp because it is interactive, visually appealing, and creative in engaging and exploring ideas.[21] WhatsApp was utilized in this study to facilitate discussion, communication, and collaboration, which impacts promoting critical thinking and problem-solving skills.

METHODOLOGY

The research question posed in this study was: What are learners' perceptions towards integrating AVSs and WhatsApp into Physical Sciences teaching and learning? To answer this question, a qualitative case study design was used. Qualitative research is utilised when the research question seeks to understand, explore, or describe people's behaviour, as well as the themes in behaviours, trends, attitudes, or relationships.[22] The data was obtained from the open-ended questionnaire, learner remarks on AVSs, and focus group interviews based on the AVS intervention phase. Data was analysed by means of Atlas.ti version 2022 using Saldaña's thematic method. A thematic analysis comprises the process of finding, evaluating, and identifying patterns or themes in the data.[23] The university granted this study's ethics approval.

Participants

Purposive and convenient sampling was used to select 38 learners registered for a Grade 12 Physical Sciences upgrade course at the University of Technology in South Africa. The participants comprised 23 females and 15 males. All the learners had cell phones and were members of the Physical Sciences WhatsApp groups. The purpose of these groups was to evaluate the group interaction of learners in the classroom and on the use of WhatsApp groups.

Data Sources and Procedure

Audio-visual simulation intervention

Learners participated in a six-month intensive intervention phase using AVSs to incorporate real-life physics and chemistry scenarios into the learning and teaching process. The AVS learners watched were YouTube videos that the researcher chose, consisting of vertical projectile motion, the Doppler effect, impulse and momentum, the industry, acid-base titrations, the Doppler flow meter, ultrasound, and organic chemistry. The learners watched 10 AVSs and engaged in group discussions to solve related problems through scientific inquiry and problem-based learning within six groups in class and on WhatsApp. Table 1 shows the example of five AVSs, the title and description, Physical Sciences concepts, and the link.

[19] Tebogo Edwin Nkanyani, Awelani V. Mudau, and Lettah Sikhosana, "Teaching and Learning of Physical Sciences Grade 11 in Rural Schools through Rural Blended Learning Strategy," *Eurasia Journal of Mathematics, Science and Technology Education* 20, no. 3 (March 1, 2024): em2413, https://doi.org/10.29333/ejmste/14295.

[20] Damian Maher, "Collaborative Learning in Schools With Social Media," in *Handbook of Research on Facilitating Collaborative Learning through Digital Content and Learning Technologies* (IGI Global, 2023), 44–61, https://doi.org/10.4018/978-1-6684-5709-2.ch003.

[21] Surjoo, "Enhancing Critical Thinking and Problem-Solving Skills of Grade 12 Physical Science Learners Using Audio-Visual Simulations and Social Network Sites."

[22] A. Strydom and R.M. Bezuidenhout, " Qualitative Data Collection," in *Research Matters*, ed. Du Plooy Cilliers F., C. Davis, and R.M. Bezuidenhout (Cape Town: Juta, 2014), 228–63.

[23] J. M. Saldaña, *The Coding Manual for Qualitative Researchers*, 4th ed. (Sage Publications, 2021).

Table 1: Example of five AVSs, title and description, Physical Sciences concepts and links

AVSs (YouTube Videos)	Title and description	Physical Sciences Concept	Link
AV 1	Special Operations Soldiers Parachute Free-Fall Training A soldier experiencing freefall.	Vertical projectile motion free-fall	https://www.youtube.com/watch?v=GdwNCP1Vvl0
AV 2	How do we know the universe is accelerating? A video illustration about the expanding universe.	Doppler effect Red-shift	https://www.youtube.com/watch?v=tXkBfkeJJ5c
AV 3	How do you catch the ball in cricket? A cricket fielder demonstrates how to catch the ball in a cricket game.	Momentum and impulse	https://www.youtube.com/watch?v=IQUbko9LbgU
AV 4	High jump in slow motion. A high jumper demonstrates a slow-motion high jump and lands on a mattress.	Momentum and impulse	https://www.youtube.com/watch?v=WaWkDf6b_j4
AV 5	How are fertilisers made?	Fertiliser industry	

During the intervention, learners took the AVS tests to assess their knowledge and comprehension of concepts. The researcher asked questions orally, and the learners provided written responses. The AVS test was marked using a rubric. The three typical questions that were asked for each AVS were: *Identify the key Physical Sciences topic represented in the real-life video. Identify the specific Physical Sciences concept represented in the real-life video. Describe all the Physical Sciences aspects visible in the real-life video*.

Open-ended questionnaire

The open-ended questionnaire consisted of two sections. Section A of the questionnaire asked for demographic information from learners. Section B consisted of eight questions. The typical questions asked were: (1) What did you gain from the use of a WhatsApp group in Physical Sciences? (2) What did you gain from the use of AVS in Physical Sciences? (3) Explain your experiences using WhatsApp in teaching and learning. (4) Explain your experiences using AVS in Physical Sciences.

Focus group interview

A focus group interview with similar open-ended questions was used to confirm and verify the findings. The typical questions asked were: (5) What are the benefits of using WhatsApp in the Physical Sciences class? (6) What are the benefits of using AVS in the Physical Sciences class? (7) What are the disadvantages of using WhatsApp in the Physical Sciences class? (8) What are the disadvantages of using AVS in the Physical Sciences class?

PRESENTATION OF FINDINGS

Through analysis of the collected data, the findings of this study are presented under the following headings: (1) Audio-visual Simulation Intervention and (2) Learner Perceptions on the use of Audio-visual Simulations and WhatsApp in Physical Sciences.

Audio-visual Simulation Intervention

The findings revealed that in AVS1, most learners could identify the topic and the concept of vertical projectile motion that was represented in the video, where a soldier was parachuting. Moreover, almost two-thirds of the learners were able to describe the real-life situation in the video correctly and relate it to Physical Sciences. It was found that most of the learners were able to identify the topic and concept of the Doppler effect and were also able to describe the red shift present in the AVS2 accurately and apply this concept to Physical Sciences. It was discovered that more than three-quarters of the learners were able to identify the Physical Sciences topic and concept depicted in the video successfully. Three-quarters of the learners were able to describe the real-life scenario in the AVS3 accurately and relate it to Impulse and Momentum in Physical Sciences. It was found that most of the learners were able to identify the topic and concept of the Fertilizer Industry represented in the AVS5, which demonstrated how fertilizers are manufactured in the industry correctly. However, more than two-thirds of the learners were able to describe the real-life scenario in the video correctly and relate it to Physical Sciences.

Learner Perceptions on the Use of Audio-visual Simulations and WhatsApp in Physical Sciences

The theme of learner perceptions emerged from the research question and was developed from the data obtained from the data collection instruments used in this study. Eight questions were addressed to give an in-depth understanding of the theme and learner perceptions. The names used in reporting the findings are pseudonyms. Figure 1 shows the conceptual network of learner perceptions.

In Question 1, learners were asked to indicate what they gained from using a WhatsApp group in Physical Sciences. The findings showed that learners gained a significant amount of knowledge during the intervention phase by using WhatsApp and expanding their knowledge beyond what the textbook covered. Asheel shared, "*I gained more knowledge by answering the questions on WhatsApp*." Ariv indicated, "[The] *AVSs and the WhatsApp group expanded our knowledge with what the textbook does not cover*." It was found that learners preferred working in small groups on WhatsApp because they found it simpler to communicate and comprehend the work with a smaller group of people. Junior said, "*It was easier to communicate and understand the work when conversing with a smaller group of people*."

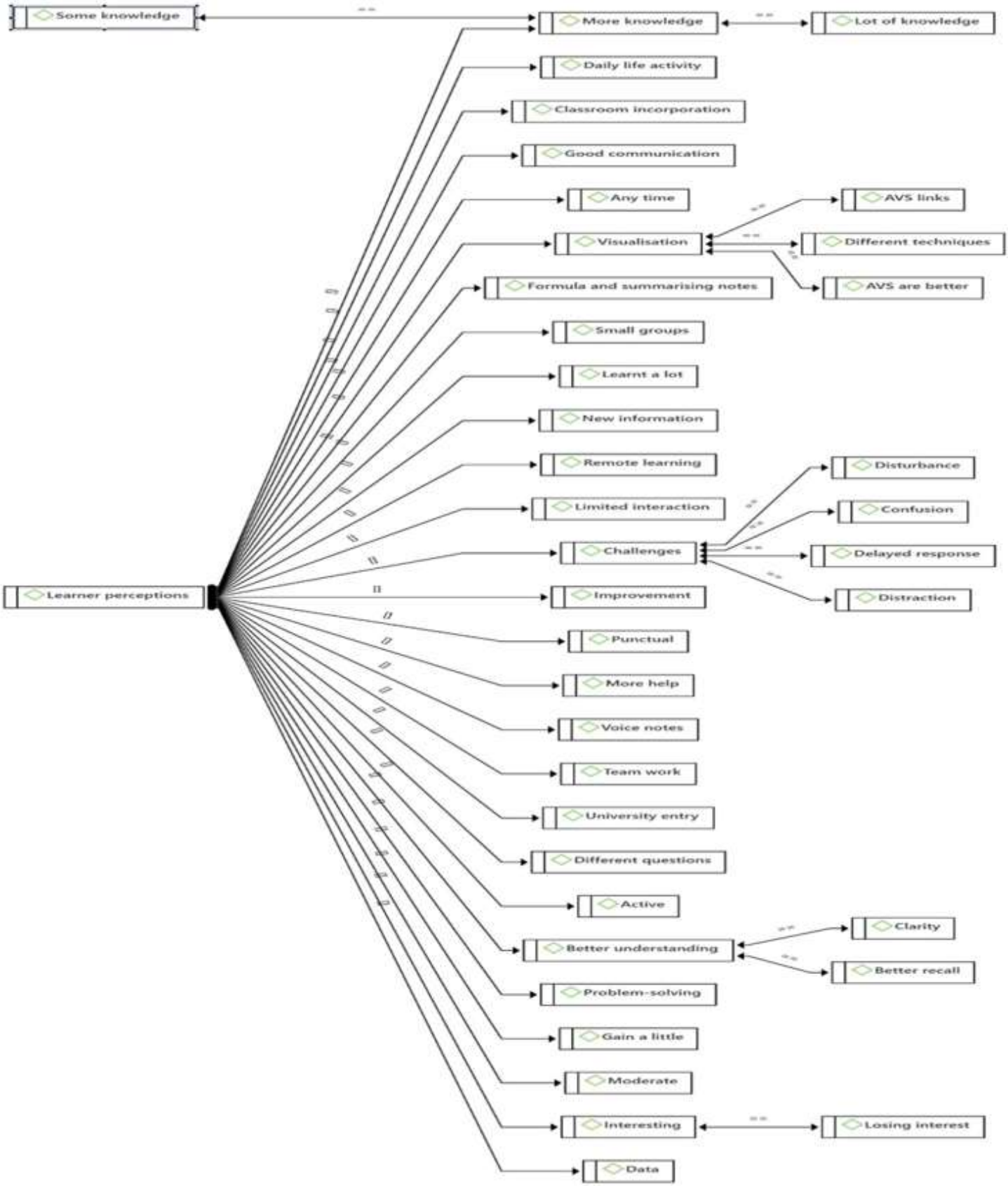

Figure 1. The conceptual network of learner perceptions

In Question 2, learners were asked to share what they had gained from using AVSs in Physical Sciences. The findings revealed that learners had become aware that physics was a part of their daily lives after watching various AVS videos that depicted real-life experiments and scenarios, making it easier for them to understand Physical Sciences concepts. Ariv mentioned, "*Margarine is made from an alkene to form an alkane, and ultrasound is used to scan a pregnant lady using the Doppler effect principle*." It was discovered that all the learners valued voice notes since they were a simpler and quicker way of transferring information in the WhatsApp group. Max indicated, "*Voice notes are faster when we make them on WhatsApp rather than typing out our questions; even when the teacher explains the work to us on WhatsApp by using voice notes, it was faster*."

In Question 3, learners were asked to explain their experiences using WhatsApp in learning and teaching. The study's findings revealed that learners used WhatsApp at any time to participate in activities and seek support from their teachers or peers. Asanda revealed, "*I got the help when I needed it at any time of the day, and it was wonderful, especially during the weekends, and if I was stuck with a question, I could ask for help quickly in the WhatsApp group*." It was found that through problem-based online learning, learners were able to solve Physical Sciences questions on the WhatsApp group by applying the teacher's formulas and summarizing notes. Max mentioned, "*WhatsApp helped a lot in physics, especially when it came to the application of formulas and summarizing notes; it helps to solve the problems*."

In Question 4, learners were asked to explain their experience of using AVSs in Physical Sciences. It was discovered that incorporating AVSs in teaching and learning enabled learners to visualise Physical Sciences concepts, resulting in a better understanding. Asanda responded, "*AVSs helped me to visualise Physical Sciences concepts much better and understand the situation better*." The learners also felt that AVSs were beneficial because they offered extra Physical Sciences learning and teaching support. Junior mentioned, "*I could watch the videos immediately and be able to remember a lot as there were pictures and supportive illustrations. Having the videos on my phone was very helpful because I could always refer to them anytime."*

In Question 5, learners were asked to state the benefits of using WhatsApp in the Physical Sciences class. The findings showed that learners could solve Physical Sciences-related problems on WhatsApp and use the AVSs shared by the teacher on the WhatsApp group throughout problem-based online learning. Sizwe stated, "*AVSs were able to provide different types of problems, and I learned how to solve them*." It was also found that learners thought WhatsApp was beneficial because it improved communication and interaction and encouraged discussions among learners. Asanda said, "*WhatsApp created a greater communication platform among learners, which helps us to get comfortable around each other and to ask questions when we do not understand*."

In Question 6, learners were asked to indicate the benefits of using AVS in the Physical Sciences class. The findings showed that learners obtained greater comprehension and retention of Physical Sciences concepts using the AVSs. Belinda responded, "*It is easier to remember and recall things from physics by using AVSs. When we watched the videos, we had fun, and they helped us remember physics better. We can play the AVS video repeatedly till we master the concept*."

In Question 7, learners were asked to indicate the disadvantages of using WhatsApp in the Physical Sciences class. It was also discovered that some learners were distracted by launching other apps on their phones or chatting privately with peers on WhatsApp instead of participating in Physical Sciences-related activities. Buhle indicated, "*I got tempted to open other apps on my phone and ended up multitasking and not focusing on the work*." Most learners stated that data bundles were expensive and quickly depleted while streaming AVS videos. Amy said, "*The disadvantage of using AVSs in the physics class was that the videos finished our data quickly*."

In Question 8, learners were asked to indicate the disadvantages of using AVS in the Physical Sciences class. The study's findings demonstrated that learners found some of the AVS videos confusing

since the AVSs on Physical Sciences were of an extremely high standard and unfamiliar to them. Ariv said, "*If the video is of a very high standard of physics that we are not familiar with, then we can get confused with some concepts*."

DISCUSSION

The relevance of the findings of this study in relation to the literature is discussed under the following headings: (1) Audio-visual Simulation Intervention and (2) Learner Perceptions on the use of Audio-visual Simulations and WhatsApp in Physical Sciences.

Audio-visual Simulation Intervention

The findings in this study concur with Padhi, who mentioned that AVSs are the key component in teaching and learning in that AVSs hold the learners' attention, bring clarity to numerous difficult and abstract concepts, and cultivate a scientific attitude among learners.[24] Studies conducted by Pellas revealed that AI-generated videos helped learners not only recall and remember information but also apply it to different situations.[25] The findings of Pellas concur with the findings of this study, where learners were able to recall the information presented in the AVSs and apply the information to key concepts in Physical Sciences.[26]

The researchers may argue that learners were able to recognise Physical Sciences in daily life and make the connection between real life and Physical Sciences after they watched the AVS videos. This implies that the AVS intervention phase supported learners' critical thinking skills. The findings in this study further concur with Pellas, who emphasised that the integration of AI-generated videos into teaching and learning develops critical thinking and real-world problem-solving skills.[27] It is evident that the incorporation of AVSs into teaching and learning positively impacted the learner's ability to solve higher-order problems. Astra et al. revealed that incorporating animation video effects (AVS) had a positive effect on the critical thinking ability of secondary school learners, where the learners showed improvements in their academic performance.[28]

Learner Perceptions on the Use of Audio-visual Simulations and WhatsApp in Physical Sciences

Learners expressed that the WhatsApp group played a key role in acquiring knowledge and expanding on knowledge beyond what their textbook offered. The literature demonstrated that learning through WhatsApp and AVS videos is beneficial because it allows learners to increase their cognitive level.[29] Furthermore, learners argued that working together in small groups via WhatsApp promoted effective communication and a better understanding of the classwork. These findings are consistent with those of Lewitzky, who argued that learners may be more likely to communicate, share ideas, receive feedback, ask questions, and co-construct the meaning of knowledge with one another in smaller groups.[30] The study findings correlate with those of Qiqieh et al., who reported that WhatsApp facilitates peer-to-peer learning communities, promotes group discussions, and shares resources.[31] Learners articulated that they were able to make clear connections

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[24] Gitanlaji Padhi, "Audio Visual Aids in Education," *International Journal of Emerging Technologies and Innovative Research* 8, no. 4 (2021): 242–49.

[25] Nikolaos Pellas, "The Impact of AI-Generated Instructional Videos on Problem-Based Learning in Science Teacher Education," *Education Sciences* 15, no. 1 (January 18, 2025): 102, https://doi.org/10.3390/educsci15010102.

[26] Pellas, "The Impact of AI-Generated Instructional Videos on Problem-Based Learning in Science Teacher Education."

[27] Pellas, "The Impact of AI-Generated Instructional Videos on Problem-Based Learning in Science Teacher Education."

[28] I. Made Astra, Dwi Susanti, and Wulandari, "The Effects of Active Learning Model Team Quiz Type Assisted by Animation Video on Critical Thinking Ability of High School Students," 2021, 020006, https://doi.org/10.1063/5.0037590.

[29] Kadek Adi Wibawa and I P Payadnya, "Learning Effectiveness through Video Presentations and Whatsapp Group (WAG) in the Pandemic Time Covid-19," *AKSIOMA: Jurnal Program Studi Pendidikan Matematika* 10, no. 2 (2021): 710–20.

[30] Rachael Lewitzky, "Creating Communities of Inquiry in Research and Scholarship Via Online Videos," *Scholarly and Research Communication* 13, no. 2 (August 23, 2022), https://doi.org/10.22230/src.2022v13n2a425.

[31] Sura Qiqieh, Elham Hussein, and Mohammed Abou Adel, "The Impact of WhatsApp on First-Year Students' Transition to University Life," *Frontiers in Education* 10 (June 19, 2025), https://doi.org/10.3389/feduc.2025.1552278.

between Physical Sciences and real-life experiences and have a better understanding of key concepts in Physical Sciences after watching the real-life AVSs. The use of short AVSs in teaching and learning enabled learners to acquire knowledge from real-life problems.[32] Learners viewed voice notes as a beneficial means to transfer information faster in their WhatsApp group. This finding was confirmed by Aryanata et al., who discovered that learners felt relaxed, enthusiastic, determined, confident, engaged, and motivated to use voice notes in online learning and that voice notes enabled them to improve their academic performance.[33] Nkanyani et al. mentioned that using voice notes in the WhatsApp group amplified the message conveyed to the learners.[34]

It was discovered that learners were able to participate in WhatsApp group activities and receive assistance from peers or teachers at any time and remotely from their homes. Sheth et al. stated that integrating WhatsApp with teaching and learning makes it easier to ask questions and address concerns immediately and remotely through WhatsApp conversations between the teacher and peers.[35] It became apparent that learners could successfully utilise the teacher's formulas and summarise their notes to effectively solve Physical Sciences problems in the WhatsApp group throughout the problem-based online learning intervention. This finding was supported by Wilujeng and Suliyanah, who stated that learners were given the opportunity to ask and answer questions in problem-based learning to encourage active learning and problem-solving skills throughout the learning process.[36] Learners expressed that watching the real-life Physical Sciences AVSs promoted visualisation, which improved their understanding of Physical Sciences concepts. Ewais et al. discovered that adopting mobile learning, including AVS videos, promotes visualisation, which aids learners in comprehending abstract concepts.[37] Furthermore, learners argued that AVSs offered extra support in Physical Sciences teaching and learning. According to Ngonso et al., 86.2% of Nigerian high school learners accepted that audio-visual material on social media has a greater influence over them.[38]

Learners were able to utilise the AVSs shared by the teacher on the WhatsApp group and solve problems in Physical Sciences throughout the problem-based online learning intervention. Wilujeng and Suliyanah confirmed that integrating the PBL model into online and offline learning enhances learners' problem-solving skills while studying Physical Sciences.[39] Learners expressed that WhatsApp improved their communication skills and encouraged peer discussions. Sobaih et al. discovered that WhatsApp assisted learners in articulating and presenting ideas and becoming confident in using information obtained from social network sites to solve problems.[40] The findings demonstrated that engagement with Physical Sciences AVSs helped learners to better understand and recall Physical Sciences concepts. Wibawa and Payadnya

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[32] João Alberto Arantes do Amaral and Felipe Fregni, "Fostering System Thinking Learning by Combining Problem-Based Learning and Simulation-Based Learning Approaches," *International Journal of Instruction* 14, no. 3 (July 1, 2021): 1–16, https://doi.org/10.29333/iji.2021.1431a.

[33] I Made Wahyu Aryanata Aryanata, Ni Nyoman Padmadewi, and I Gusti Ayu Lokita Purnamika Utami, "Implementation of Voice Note on WhatsApp for Teaching Speaking English," *Journal of Educational Study* 2, no. 1 (February 15, 2022): 54–64, https://doi.org/10.36663/joes.v2i1.221.

[34] Nkanyani, Mudau, and Sikhosana, "Teaching and Learning of Physical Sciences Grade 11 in Rural Schools through Rural Blended Learning Strategy."

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discovered that learning through AVS video presentations allowed learners to listen to explanations by replaying or watching the AVSs again if they failed to comprehend them the first time or had omitted, and required revision of the information.[41] Furthermore, Kahsay et al. mentioned that audio-visual resources used within educational settings are valuable assets that improve learner engagement, understanding, and knowledge retention, ultimately resulting in improved learning outcomes.[42]

Although learners perceived the integration of AVSs and WhatsApp into Physical Sciences teaching and learning to be fruitful and beneficial, a few drawbacks were also identified. Instead of engaging in tasks related to Physical Sciences, some learners were found to be distracted by opening other apps on their smartphones or procrastinating by having private conversations with classmates on WhatsApp. Petrucco and Agostini contended that learners who get distracted by their smartphones in class are more likely to be distracted by other people's smartphone activity, making them more susceptible to negative impacts throughout the class.[43] These study findings concur with those of Lukose and Agbeyangi, who reported that a significant number of learners felt that the usage of social network sites, namely WhatsApp, can cause distractions and lead them to procrastination.[44] Streaming AVSs also appeared to be a challenge since the majority of learners complained that data bundles were costly and soon ran out. Wibawa and Payadnya found that the cost of data packages or internet access had a negative impact on learners who participated in the WhatsApp group or watched the AVS videos.[45] Learners argued that some of the AVSs were at a very high level of Physical Sciences and created confusion. Wibawa and Payadnya asserted that AVS video presentations were challenging to comprehend since they lacked variation in the questions, and learners favored AVS videos created by their teachers over those developed by other teachers.[46] It could be argued that teachers in this study should create AVSs relevant to the context in South Africa rather than using pre-existing AVSs on YouTube created by others.

RECOMMENDATIONS

It is recommended that the DBE revise the curriculum to formally integrate AVSs as a core component of Physical Sciences education. This includes developing guidelines for teachers on how to create and implement AVSs that are contextually relevant to South African learners. It is crucial to implement mandatory continuous professional development for teachers focused on the effective use of AVSs and digital communication tools such as WhatsApp. This training should cover content creation, pedagogical strategies, and classroom management in a digital environment. Teachers should create AVSs that are relevant to the South African context rather than relying solely on pre-existing content from platforms like YouTube. This can help ensure that the material is relatable and comprehensible for learners. AVSs should be designed to be short, engaging, and impactful to help maintain learners' attention and enhance their understanding of key concepts. A further study could be conducted on the same phenomenon using a mixed-method approach to provide a more holistic understanding of the impact of AVSs and WhatsApp on learners' critical thinking and problem-solving skills. Future research can employ a larger and more diverse sample size that includes participants from various educational settings and demographic backgrounds.

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[41] Wibawa and Payadnya,"Learning Effectiveness through Video Presentations and Whatsapp Group (WAG) in the Pandemic Time Covid-19."
[42] Tewolde Tadele Kahsay, Goitom Gebreyohannes Berhe, and Gebrekidan Mebrahtu Tesfamariam, "The Extent of Audio-Visual Material Use in the Teaching and Learning of Chemistry in Secondary Schools," *African Journal of Chemical Education* 14, no. 2 (2024): 128–59.
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CONCLUSION

This study has established that AVSs and WhatsApp enhanced the critical thinking and problem-solving skills of Grade 12 Physical Sciences learners after learners were exposed to the intervention phase. It may be seen that learners' perceptions of learning and teaching in high school Physical Sciences provided the researchers with insight into the viability of incorporating 21st-century technologies such as AVS and WhatsApp to enhance the academic performance of learners. This was made possible by the challenges identified in the literature of surface and rote learning that are experienced in the Physical Sciences. The integration of AVS and WhatsApp helped researchers cultivate a culture of deep learning among the learners. This was the study's contribution to the body of knowledge regarding Physical Sciences learning and teaching. This was observed with the application of higher-order thinking questions that were used throughout the group discussion inside and outside of class. It may be seen that learners' use of WhatsApp and AVSs assisted in increasing their cognitive level and mastering the content. Furthermore, the learners were able to link the abstract concepts with real-life scenarios that put theory into practice. It may be observed that learners were able to understand Physical Sciences concepts, which improved their comprehension of concepts. Critical thinking and problem-solving skills were encouraged with AVSs and WhatsApp, which learners viewed as critical in Physical Sciences. The learners indicated that they encountered challenges with the use of WhatsApp as their phones distracted them, and they could not resist chatting with friends instead of focusing on the learning activities. It may be seen that some of the learners were confused by the AVS YouTube videos not developed by their teachers, as the concepts were explained differently.

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