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Experiences with interactive video assessment in higher education to enhance teaching and learning

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TETFLE also publishes review articles and book reviews. The journal currently appears once in a year, with an additional special edition from accepted biennial conference papers, as applicable. The journal is the official journal of the Distance Education and Teachers' Training in Africa (DETA) biennial conference, hosted by the Faculty of Education, University of Pretoria, South Africa.

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Experiences with interactive video assessment in higher education to enhance teaching and learning

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Abstract

When designing quality educational experiences, decisions must be made based on the latest educational technologies available. Interactive videos are one of the most advanced digital information technology and multimedia content developments. Therefore, using interactive videos requires significant investment in technology and human resources, which could be challenging in countries experiencing socio-economic or digital inequalities. Using a four-phased sequential exploratory mixed-method research design, this study aimed to explore lecturers' (n=20) and students' (N=800) experiences with interactive videos in South Africa to discover the underlying drivers for adopting interactive videos and identify factors that could hinder adoption. During the exploration, the Community of Inquiry (CoI) framework informed the study on instructional design principles to consider when creating educational experiences (i.e., social presence, cognitive presence, and teaching presences) and the Technology Acceptance Model (TAM) provided insight into determinants (i.e., perceived usefulness; perceived ease of use; behavioural intention to use technology) that directly or indirectly could explain lecturers' behavioural intentions to adopt interactive videos. This study found that interactive videos have significant benefits and advantages that can positively impact teaching and learning experiences, making them a valuable application for lecturers and students. Findings also show the diverse possibilities for using interactive videos to promote a teacher and cognitive presence online. Findings from this study could help support and guide the adoption of interactive videos in higher education.

Keywords: Cognitive presence, Community of Inquiry model (CoI), experiences, higher education, interactive videos, social presence, teacher presence, technology acceptance model, technology integration.

Introduction

In the twenty-first century, instructional design, technology integration, and selecting Information Communication Technology (ICT) tools to create quality educational experiences within higher education have become a subject of debate. Various aspects, including Artificial Intelligence (AI), ICT, online and distance learning, blended and hybrid learning, digital literacy, and the use of flipped classroom pedagogy, have been central to this ongoing discussion. The COVID-19 pandemic further intensified the demand for technology integration during the instructional design process in higher education. Owing to this demand and significant technological advances, novel and innovative applications for teaching and learning have been introduced, such as interactive videos that offer students the opportunity to engage more meaningfully with the content that is being delivered (Althwaini & Mahmoud, 2021; Dart, 2020; Halupa & Caldwell, 2015). This study, therefore, explores *students' and lecturers' experiences with interactive videos in their educational context*. By examining recent developments and existing research, this study aims to address gaps in understanding and provide insights into the effective implementation of interactive videos in higher education, especially in South Africa.

Problem Statement, Background, and Research Contribution

Integrating technological advances, such as interactive videos, can potentially enhance students' teaching and learning experiences in higher education. However, adopting these advances often requires substantial investment and human resources, which can be challenging in socio-economically disadvantaged contexts (Research ICT Africa, 2020). In South Africa, socio-economic challenges, a digital divide and high data costs, as well as inadequate training for lecturers and teachers, hinder the effective implementation of technological advances, such as interactive videos. Only about 51% of the South African population has internet access, with those from low-income households facing additional barriers like high data costs (Research ICT Africa, 2020). These challenges often also lead to the underutilisation of technological advances which underscores the need to understand the factors influencing the adoption and use of interactive videos in this context.

There is a gap in the literature regarding the context-specific factors influencing the adoption and utilisation of interactive videos in higher education. This includes an

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understanding of lecturers' and students' educational experiences when being exposed to interactive videos. Therefore, the main research questions that drove this study were as follows: *How do South African students and lecturers experience using interactive videos in their educational context?*

Additionally, secondary research questions involve the exploration of (i) underlying drivers that could encourage or hinder the adoption of interactive videos; and (ii) how interactive videos can enhance teaching and learning experiences in a context marked by significant digital divides.

Technology Integration in Higher Education: Benefits, Challenges, and the Need for Behavioural Change

Technology integration in higher education is a multifaceted and evolving concept that lacks a clear and unified definition (Dziuban et al., 2018). This ambiguity stems from the complex, dynamic, and multidimensionality of educational environments and the rapid pace of technological advancement (Akcil et al., 2021; West & Malatji, 2021). Various scholars conceptualize technology integration differently, leading to inconsistencies in implementation and assessment across institutions.

Despite definitional disparities, Higher Education Institutions (HEIs) have, over the years, increased technology integration to enhance and sustain students' teaching and learning experiences with maximum efficiency using the infrastructures, applications, digital tools, and equipment available. Overwhelmingly positive results have been reported in recent literature, which has increased technology integration in teaching and learning (Du Toit & Verhoef, 2018; Waghid & Waghid, 2014; West & Malatji, 2021). Some of the advantages include flexibility in time and space for learning, superior learning outcomes compared to traditional pedagogy (Ma'arop & Embi, 2016; Ejikeme & Okpala, 2017), stimulating social interaction and critical thinking and improving the internationalisation of higher education (Adams Becker et al., 2017). Technology integration has furthermore been associated with students gaining ownership, being creative and becoming problem solvers in the fourth industrial revolution (Gardner, 2014; Skhephe et al., 2020; Wankle, 2011; West & Malatji, 2021).

However, these positive outcomes are not universally guaranteed and often depend on factors such as the quality of technological infrastructure, the digital literacy of both educators and students, and the pedagogical approaches employed (Du Preez & West,

2020). Challenges such as resistance to change, insufficient training, and the digital divide can hinder effective integration, potentially exacerbating existing educational inequalities (West & Malatji, 2021). Moreover, some studies suggest that technology can sometimes distract from learning objectives if not thoughtfully integrated (Adams Becker et al., 2017). Also, for lecturers and students to transition from traditional approaches to technologically advanced methods requires behavioural change (Ajzen, 1991, 2012, 2020; Mesuwini & Mokoena, 2024).

Given the complexities involved with behavioural change, there is a need for more nuanced research that explores not only the benefits but also the contextual challenges of technology integration in diverse educational settings.

Roles, Challenges, and Opportunities in the Integration of Videos and Interactive videos in Higher Education

Videos have become an indispensable part of both traditional face-to-face, online, and blended learning experiences (Cooper & Higgins, 2015; Nadelson et al., 2015; González-Gómez et al., 2016). Videos supply verbal and non-verbal stimuli, which make processing information for human cognition easier but also more engaging (Paivio, 1986; Shanmugasundaram & Tamilarasu, 2023). Videos provide students with flexible learning opportunities to engage with the learning content at their own pace (Leo & Puzio, 2016), as they can pause, replay, and rewind the learning content (Howard, Meehan, & Parnell, 2018). Owing to videos' pedagogical functions (Bétrancourt & Benetos, 2018), their popularity has recently increased in educational environments (de Koning, Hoogerheide, & Boucheix, 2018). With increased video-related technological developments (Bétrancourt & Benetos, 2018), interactive videos have emerged as a new way of watching videos. Unlike traditional videos limited to basic playback controls, interactive videos offer clickable spots that reveal information or questions (e.g. multiple choice, true or false, or essay questions) to be answered (Henrikson, 2024).

The literature reports on the benefits of using interactive videos for teaching and learning; for example, interactive videos positively impact students' understanding of information, concepts, and facts in an easy-to-understand manner (Althwaini & Mahmoud, 2021). They have also been described as stimulating active learning (Sinnayah at al., 2021), increasing motivation, engagement, interaction and excitement, and contributing to better knowledge communication and improved guidance (Bonafini,

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2017). A key benefit and driver of video learning over traditional classroom lectures or videos is its unrestricted nature and flexibility, as students can engage in learning at a place and time of their choosing (Althwaini & Mahmoud, 2021; Dart et al., 2020; Dziuban, et al., 2018; Sinnayah, et al., 2021). Furthermore, interactive videos increase students' agency by enabling them to self-pace and self-guide their learning by controlling the speed and pathway they take through content (Henrikson, 2019).

Interestingly, it has also been reported that student academic performance and pass rates improve, and withdrawal rates decrease when using video resources (Dziuban et al., 2018). Improved academic performance could be due to increased viewings since Pinder-Grover et al. (2011) found the number of web hits (in other words, number of viewings) on such videos correlated to higher test performance. Performance improvements are also attributed to active learning pedagogy, which strongly correlates with academic performance (Biggs, 1996; Deslauriers et al., 2019; Sinnayah et al., 2021). Findings related to active learning also align with inquiry-based learning principles since students work alongside the videos to answer questions and solve the presented problems (Barns et al., 2017; Martin, 2016; Onyema, 2019). A few factors need to be considered when discussing the effectiveness of using interactive videos to increase students' academic performance. For example, the quality, alignment with module objectives, and video length could also affect performance. Videos should tie directly to a module's objectives and curriculum. Videos should be interesting as well as engaging and should not convey information students can read in a text. Furthermore, a video's optimal length is four minutes (Hibbert, 2014). Guo (2013) notes that the videos should be 5-10 minutes at most. Therefore, lectures should shorten the length of lecture videos and provide the students with multiple short clips (Guo, 2013; Hibbert, 2014). However, caution must also be taken with the number of videos provided to students so that they are not inundated with so many additional resources that they cannot access all of them and feel overwhelmed (Halupa & Caldwell, 2015).

Although most researchers have found student attitudes toward videos positive, some factors can negatively impact their experiences (Dart, 2020; Martin, 2016; Henriksen, 2024), especially within low socio-economic environments and developing countries. Equality with regards to technological infrastructure (access to necessary devices, applications, electricity, and internet availability and speed), lack of technical support, and student ability and confidence with technology (Adams Becker et al., 2017), have all been reported as factors that have a detrimental impact on student satisfaction.

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Instructional design, associated with lecturers' ability, awareness, skill, and technological and digital literacy, has also been reported as a possible challenge. Lecturers' instructional design is often affected by the complex and time-consuming nature of integrating instructional materials, such as interactive videos (Halupa & Caldwell, 2015; Mesuwini & Mokoena, 2024).

Furthermore, students' concentration, mindfulness and focus have also been listed as possible challenges when using interactive videos, as learning via video necessitates audio and visual information processing, which can result in cognitive overload (Shanmugasundaram & Tamilarasu, 2023). Interactive video learning also requires active and self-directed learning, which requires a shift from passive delivery formats and can make students resistant (Shekhar et al., 2015). Resistance to active learning approaches can also be due to students taking greater responsibility for their learning, often requiring increased engagement and participation (Dart et al., 2020). Students with limited exposure to active learning pedagogy might also not recognise the benefits thereof at first and can therefore also become anxious and develop self-doubt around their abilities when engaging with active learning approaches, such as interactive videos (Dart et al., 2020; Deslauriers et al., 2019; Shekhar et al., 2015).

Another possible factor that could negatively impact students is related to video-recorded lectures. Often, lecturers use their own video-recorded lectures as a central feature of their online learning platforms (Breslow et al., 2013). Considerable research has indicated that students overestimate their learning from video-recorded lectures, which makes them overly confident about their performance (Choi & Johnson, 2005; Means et al., 2010). Overconfidence can harm long-term retention (Szpunar et al., 2014).

Finally, students' cognitive load when engaging with videos requires careful consideration (Polat, 2020). Lecturers should pay attention to issues relating to the design of videos to reduce extraneous cognitive load and facilitate essential processing during learning (Shanmugasundaram & Tamilarasu, 2023). The cognitive theory of multimedia learning (CTML) and cognitive load theory (CLT) provide several strategies to make videos more suitable for human cognitive architecture (Fiorella & Mayer, 2018; Sweller et al., 2019). However, little is known about students' cognitive load when engaging with interactive videos. With all this in mind, it is evident that although interactive videos have many benefits, various factors could negatively affect students' experiences with interactive videos and hinder or prevent lecturers from adopting them as part of

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their instructional design (Key & Paskevicius, 2015; Shanmugasundaram & Tamilarasu, 2023).

Contextualisation of the study and the research sites

This study was a scholarship of teaching and learning (SoTL) project that focused on students' and lecturers' experiences with interactive videos. As part of this study, two HEIs in a metropolitan area in South Africa participated, one public and one private. The public HEI was used a hybrid module of delivery, whereas the private HEI used only an online mode of delivery. Across the two HEIs, interactive videos were used in five official languages and over 800 students were involved in this project as well as 20 lecturers.

Theoretical framework

Two theoretical frameworks helped shape this study, namely the Community of Inquiry (CoI) developed by Garrison et al. (2010) and the Technology Acceptance Model (TAM). The CoI offers structure when designing educational experiences using online applications such as interactive videos (Garrison et al., 2010). The CoI framework model, rooted in Dewey's educational philosophy and social constructivism (Garrison, 2017), is a research-based and process-focused approach (Zehra et al., 2009), which informs lecturers' decision-making when designing educational experiences (Du Preez & West, 2022). When designing an educational experience, the CoI model posits that three elements called presences—cognitive presence (CP), social presence (SP), and teaching presence (TP)—need to be integrated in a meaningful way for a successful higher education learning experience. A cognitive presence refers to how learners can construct knowledge and confirm understanding through collaboration and reflection. A social presence refers to the ability to do collaborative online learning where one can establish personal and purposeful relationships. A teaching presence refers to the ability to design and facilitate content engagingly and satisfactorily to maintain a sense of community (Castellanos-Reyes, 2020; Garrison et al., 2010). The CoI has received critique which argues for including more presences such as a learner, emotional, and autonomy presence. However, these presences have not been validated yet and are therefore not included (Castellanos-Reyes, 2020).

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The CoI was initially meant to act as a model in an online learning environment but has recently also been used to facilitate learning experiences in hybrid and blended models where technology also plays a crucial part. In this study, how the use of interactive videos supports each CoI element in an entirely online as well as hybrid learning environment is explored to make recommendations on enhancing teaching and learning in higher education.

During instructional design of educational experiences, there are other factors to consider especially when using or introducing new and novel technological applications. Various theoretical models have been developed and adapted to understand the acceptance and use of technology within education, especially when considering the dilemma of selecting appropriate teaching and learning technologies (Dwivedi et al., 2020). The TAM, initially developed by Davis (1989), is one of the most widely used theoretical frameworks for explaining the adoption of technology in educational contexts (Sivo et al., 2018). The TAM considers perceived usefulness and ease of use of technology to be the main determinants that directly or indirectly explain behavioural intentions to adopt new technology. Bandura's extensive research (1982) on self-efficacy (i.e., perceived ease of use), defined as "judgments of how well one can execute courses of action required to deal with prospective situations" (p. 122) and "outcome beliefs" (p. 140) (i.e., perceived usefulness) supports the theoretical underpinnings of the TAM. The TAM was also built on other theoretical grounds, such as the cost-benefit paradigm, expectancy theory, behavioural decisions theory, diffusion of innovations, marketing, and human-computer interaction to establish why ease of use and usefulness are important determinants of behaviour.

Methodology

This study used a four-phased exploratory sequential mixed-method approach. Mixed-methods research, frequently referred to as the 'third methodological orientation' (Teddlie & Tashakkori, 2008), draws on the strengths of both qualitative and quantitative research. Sequential exploratory mixed-method research design refers to a research approach with multiple datasets that purposefully build on one another (Ivankova et al., 2025). A pragmatist paradigm guided this study which provided a more comprehensive ontology and epistemology which supports a pluralistic stance to address the multiplicity and complexity of all human experiences (Dawadi, 2021). The pragmatist paradigm

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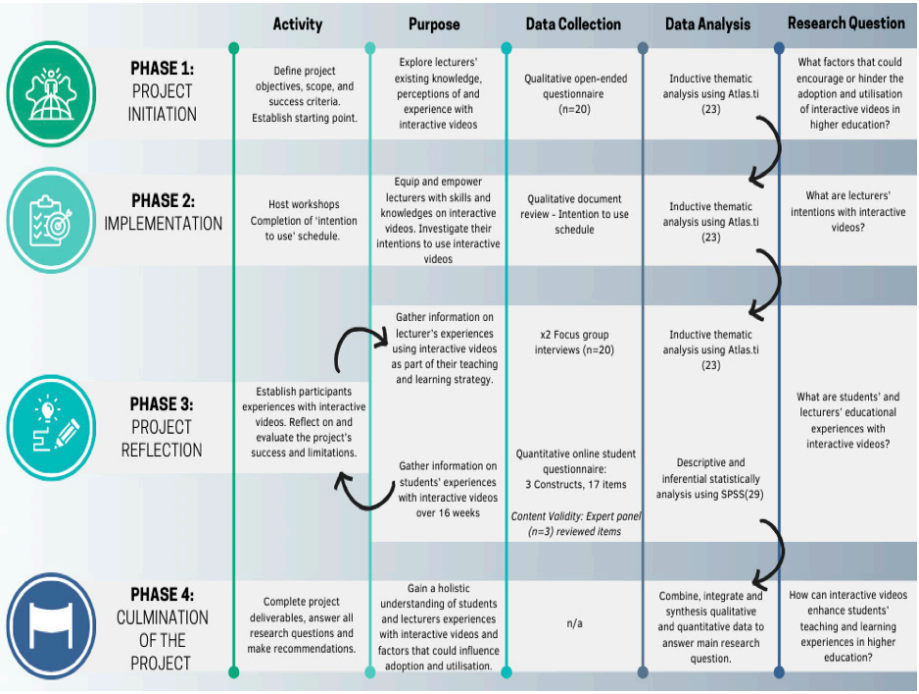
also supported using an exploratory sequential mixed-method research approach to investigate the complexities of a research problem from both a qualitative and a quantitative design (Creswell & Plano Clark, 2018; Ivankova et al., 2025). Combining quantitative and qualitative research designs led to gaining "synergistic value" (Lieberman, 2005, p. 435) in the study that assisted in answering complex, real-life research questions that a singular research approach would be unable to do (Ivankova et al., 2025).

Data was collected using various methods to achieve data saturation and methodological triangulation. Owing to the exploratory nature of this study, only qualitative data were collected in the first two phases, which were then used to inform the third phase, where both qualitative and quantitative data were collected. In the final phase (4), the qualitative and quantitative data findings were combined, integrated, and synthesised to answer the research questions and draw comprehensive conclusions. See Figure 1 for an outline of the research process of this study.

Figure 1: Four-phased exploratory sequential mixed method approach



Important to note from Figure (1) is that only lecturers were involved in the first two phases. Only in phase 3 were the students of the lecturers who were exposed to interactive videos over +16 weeks invited to voluntarily and anonymously complete an online quantitative questionnaire that focused on three variables: their experiences with interactive videos (1), technology integration within modules (2), and their experiences with the LMS (3). The questionnaire consisted of 17 items in total.

The design of the quantitative questionnaire was informed by existing literature on technology integration and interactive videos as well as the two theoretical frameworks, the CoI and TAM. Furthermore, experts reviewed the survey items to increase the questionnaire's face and content validity. Furthermore, this study also used quantitative data, such as student analytics provided by the LMS on student progression and participation.

Atlas.ti (23), a qualitative analysis software package was used to conduct inductive thematic analysis on all three qualitative datasets gathered over three phases. Statistical analyses were conducted in SPSS (29), a quantitative data analysis software package on the responses from the student questionnaire in phase 3, such as descriptive statistics and inferential statistics such as Exploratory Factor Analysis (EFA); correlational analysis and Wilcoxon Two-Sample Tests were conducted to establish if significant differences exist in the sample. Finally, in phase 4, the qualitative and quantitative data were combined, compared, and contrasted to answer the research questions comprehensively and holistically.

Sampling

Non-probability, purposive sampling was used by purposefully inviting specific lecturers (n=20) and their students (N=800) to participate voluntarily. Nieuwenhuis and Jacobs (2025) state that purposive sampling requires critical considerations regarding the parameters of the population of interest and choosing participants based on these criteria. In this study, the lecturers and students were purposefully selected from two HEIs (one public and one private). The purpose of sampling lecturers from two different HEIs was to get a diverse view on using interactive videos in different contexts. The one HEI's students were only exposed to online learning, whereas at the second HEI, students were exposed to hybrid learning. All of the purposively selected lecturers were from the faculty of education but with different specialisations, however, of the total

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population of lecturers, 50% (n=10) were in Early Childhood Education. Furthermore, 80% of the total sample of lecturers were female, which is common in South Africa (Wills & Böhmer, 2023). The student population included 1st to 4th year Education students studying towards a four-year degree. A few of the students who participated have extended their four-year degree with a year or two.

Ethical Considerations

The universities involved in this study provided ethical clearance before the study commenced. All aspects of ethical standards and scientific integrity were adhered to by offering full disclosure regarding the research design, regulation, procedures and processes; ensuring non-maleficence; obtaining informed consent; protecting participants' anonymity; confidentiality; and proper storing of data.

Results

Owing to the sequential nature of the study, the qualitative findings of phases 1 to 3 will be discussed first using inductive thematic analysis. For every direct quotation, an Atlas.ti (23) code will be reported in brackets representing the number of the question and the document number in which the code was identified as an attempt to increase the credibility and trustworthiness of the study. After the qualitative results, the quantitative student research questionnaire's (phase 3) descriptive and inferential statistics are reported. Finally, in the discussion section, the qualitative and quantitative data are combined, integrated, and synthesised.

Qualitative results

Although copious research supports the use of interactive videos, the research question of this study focused on how students and lecturers experience interactive videos in the South African context that struggle with various socio-economic circumstances. Furthermore, another study objective was to establish how interactive videos could enhance students' teaching and learning experiences in higher education through the lens of the CoI. It was also necessary to explore the factors that could encourage or hinder lecturers' behaviour in adopting interactive videos, such as perceived ease of use

and perceived usefulness, as described by the TAM (Davis,1989).

In the qualitative data sets of both phases 1 and 2, lecturers made it overwhelmingly clear that they enjoy using interactive videos. For example, the word "fun" was coded 32 times. One lecturer said, "*I got really good feedback from the students that asked for some more, so I'll definitely implement that more in the future*" (5:4). Other lecturers said, "*it makes the work more understandable and it's so much fun!*" (6:134) and "*I love using interactive videos*" (6:19). One lecturer believed that using interactive videos led to students being "*more enthusiastic*" (5:186) about learning.

Although it was clear that high levels of enjoyment created a positive experience for lecturers with interactive videos, it was necessary to delve deeper into how their students were experiencing it. Furthermore, it was also necessary to explore which factors could encourage or hinder lecturers' and students' behaviour in adopting or using interactive videos. When delving deeper into the qualitative data, five themes emerged that assisted in meeting these objectives.

Theme 1: Interactive videos promote a cognitive presence owing to interactive and inquiry-based learning

The first theme, associated with three categories, represents the lecturers' and students' experiences with interactive videos. The categories include interactive and inquiry-based learning as well as cognitive presence. The data showed that an increased cognitive presence can be ascribed to the interactive and inquiry-based learning that occurs when using interactive videos. For example, students described the use of interactive videos as "interactive" (6:11, 5:31), "active" (6:18), "engaging" (6:1), "interesting" (6:130), "not easily forgettable" (6:50), and "refreshing" (6:97). The students explained that the interactive videos contributed positively to their learning experience because of the inquiry-based nature of interactive videos. For example, the students said that questions in the interactive videos "*keep me engaged*" (6:54), "*help me engage more with my learning*" (6:115), "*encourages participation*" (5:58), and "*I enjoy the interaction with the videos… It allows me to understand better*" (6:11). One student explained: "*I interact more with the content and tend to understand my work better*" (6:14). Another student said: "*It allows me to think logically about the content and engage with the work*" (6:169). The students also mentioned that interactive videos "*… is a good way of challenging my concentration*" and that "*it grabs your attention*" (6:56). One student explained that interactive videos promote concentration

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and attention because they "*keep me focused and it is different than just a boring presentation*" (6:19).

The benefit of interactive videos using different questioning techniques that align with inquiry-based learning principles also emerged from the data. For example, one student said, "*you can answer questions whilst the content you have consumed is still fresh in your mind. Everything is easier to remember*" (6:90). Another student explained that "*they help me to pay attention to what is being taught in the video as there are questions asked. If I do not pay attention I will not be able to answer questions*." (6:42). Furthermore, students also felt that "*it is easy to learn from questions*" (6:3).

The lecturers also believed interactive videos promote a cognitive presence since "*it allows students the opportunity to internalise content rather than regurgitate information that might not be remembered after a set amount of time*" (6:48). One lecturer explained that "*it solidifies the content we are busy learning about*" (6:73). Correspondingly, another lecturer explained that it "*concretises learning*" (6:172). Furthermore, the lecturers believed that interactive videos promote a cognitive presence online as it supports learning by providing students with opportunities to "*experience success*" (5:194). The students and the lecturers also made it clear that interactive videos can serve as a "*form of revision…*" (5:193) and "*exam preparation*" (5:96), which could also promote a cognitive presence.

Furthermore, when analysing the learner analytics that the LMS of both HEIs provided, it was evident that participation spiked in the weeks that the students engaged in interactive video activities which could also indicate an increase in cognitive presence. The purple line in Figure 2 indicates how participation peaked in two modules during the weeks when interactive video was used.

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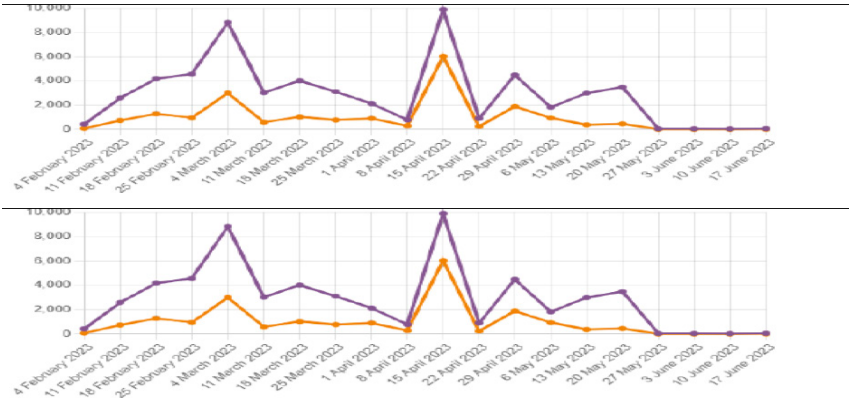
Figure 2: Examples of learner analytics and increased participation



Apart from interactive videos promoting interactive engagement and a cognitive presence, it was also evident from the data that it increases a teacher's presence; see theme 2 for further elaboration and evidence regarding this finding.

Theme 2: Interactive videos increase teacher presence owing to continuous assessment and self-reflection

The second theme is associated with four categories. The categories include teacher presence, continuous assessment, progress tracking, and self-reflection. The data showed that using interactive videos promoted a teacher's presence by providing students with immediate feedback continuously, which helped students self-reflect on their learning and track their progress and understanding within the different modules. For example, one student said: "*you can see how far you are and how much you need to improve on while using the interactive videos*" (6:27). Other students said: "*I enjoy using the interactive videos because they allow me the opportunity to check my own progress*." (6:138) and "*figure out where I might have gone wrong*" (6:7).

Here are a few examples of quotes from students, highlighting the benefit of using interactive videos as part of continuous assessment and self-reflection:

- *"I am able to identify my weaknesses when it comes to the content of the module and what I have to focus on more" (6:6)*
- *"they allow me to see myself where I'm lacking on a continuous basis" (6:30).*

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- *"it helps me know where my knowledge level is with certain concepts" (6:33).*
- *"they help me evaluate how much I have learnt and understood …" (6:59).*
- *"it helps me to be accountable to do better in my studies" (6:62)*

The lecturers also pointed out the usefulness of interactive videos in tracking student progress. For example, one lecturer said it is helpful because you can "*see how many students are productive*" (6:170) and another said, "*it helps them see with what content they are struggling with*" (6:188). It was also evident that further investigation is necessary into lecturers' perceptions of interactive videos regarding their usefulness and ease of use. Based on the TAM, perceived ease of use and usefulness could encourage or hinder their adoption of interactive videos. Theme 3 provides insight into the lecturers' perceived usefulness of interactive videos and how they are directly related to a cognitive presence and perceived ease of use.

Theme 3: Perceived usefulness of interactive videos is associated with diverse applications and perceived ease of use

The third theme emerged from data collected from the lecturers. This theme is associated with three categories. The categories include perceived usefulness, perceived ease of use, and diverse pedagogical approaches and subject matter. The data showed that perceived usefulness is directly related to interactive videos owing to the diverse pedagogical approaches that can be used when incorporating interactive videos in a module. It was also evident from the data that interactive videos can be used in diverse subject matter. The lecturers listed various ways in which they used interactive videos. One lecturer said she used it "*theoretically and practically*" (5:30). Another lecturer said she used it academically to teach postgraduate students "*How to craft a research problem*" (5:25).

The participants clarified that they believe interactive videos are useful and easy to use owing to their "*flexible*" (6:121) nature. One lecturer said, "*you can easily integrate any learning outcome into the video assessment approach*" (5:88). Some lecturers explained that they used interactive videos as a "*pre-lecture activity*" (5:33, 39), others used it "*during a lecture*" (5:38), and others used it after a lecture (5:49). For example, one lecturer explained: "*We discussed the approaches to teaching phonics in class and then they went to do the video assessment*" (5:49). Five lecturers mentioned that they used it as part of a "*flipped classroom approach*" (5:35, 41, 78, 81), so it "*encourages participation because after watching a video, they have an idea of what the lecture will be about when coming back to class*" (5:57).

Owing to the diverse pedagogical approaches that can be used, lecturers also found interactive videos useful because "*you're accommodating different learning styles*" (6:181, 6:177). Finally, perceived usefulness was also increased owing to the asynchronous nature of interactive videos where students can decide to do it at their "*own time*" (6:18) and "*own place and space*" (6:188) to complete the video activity.

It was also evident that perceived usefulness is directly related to perceived ease of use as the lecturers noted numerous times it was "*easy*" (6:3, 6:36, 6:64, 6:7) "*to use nature and navigate"* (6:74) which motivated them in adopting it in their modules. The lecturers also noted that the automation of grading students' work makes grading easier and increases its usefulness. Using interactive videos or continuous assessment "*saves time*" (6:173) by not having to "*grade by hand*" (6:167) or "*grade each student's work individually*" (5:70), "*the lecture does not have to waste time or struggle marking each student as the interactive video automatically grade students' answers*" (6:173).

However, four lecturers in the study did not use interactive videos because they felt that they still needed more training and did not find the H5P application easy to use. In the following theme (4), the issue of training is elaborated on, as well as how it could influence lecturers' and students' perceived ease of use.

Theme 4: To increase perceived ease of use, comprehensive training is essential

The fourth theme is associated with two categories. The categories include perceived ease of use and comprehensive training. The data showed that training influences perceived ease of use regarding interactive videos. For example, the lecturers noted that training is important (5:97, 5:99, 5:103). One lecturer said, "*I think if we didn't receive training, then I would have continued just putting my normal videos up*" (5:104).

However, when unpacking the need for training, it was evident that training does not only refer to using the H5P platform or creating interactive. Training has to be more comprehensive. For example, one lecturer explained that "*we don't just need training on technical issues, we need training on how to shoot a video… and editing software*" (5:151). Other lecturers said they need training on "*video quality*" (5:136), "how long the video should be" (5:116, 5:117), "how to distribute your questions" (5:122) and "*how to have your multimedia speak to your learning outcomes*" (5:127). One lecturer said she needed a "*quality assurance training session*" (5:155).

One central question that the lecturers raised was regarding "*how you choose videos*"

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(5:139). The lecturer said: "*I think one of my fears is that how do you pick your video?*" (5:113). This is a valid question as the lecturers explained that "*there's a lot of videos available*" (5:112) and "*there was tons of information, you know that's available on the Internet … I would have loved to use them all*" (5:105). "*How do you select the right video and what quality control measures should be in place before picking a video?*" (5:115).

It is therefore important to note that encouraging the use of interactive videos requires not only "technical support" (5:148) and training, but a more comprehensive understanding of different aspects related to using interactive videos, such as shooting and editing of videos, quality assurance criteria, choosing the right content, the appropriate length of videos, different pedagogical approaches, etc.

Theme 5: The adoption of interactive videos requires careful consideration and planning

The fifth theme emerged from data collected only from the lecturers and can be associated with three categories: (1) careful considerations, (2) perceived ease of use, (3) perceived usefulness. During data analysis, it became clear that certain aspects regarding the implementation of interactive videos require careful consideration before implementation as they could influence lecturers' perceptions regarding interactive videos' ease of use and usefulness. For example, "careful planning to use interactive videos" was a prominent code that was identified. Many of the lecturers who ended up not using interactive videos or did not use them as often as they intended indicated that the training took place after they had completed their instructional design plans. The lecturers said, "*it wasn't really part of my plan*" (5:7) or "*we already had set teaching activities which we had planned for…*" (5:22).

When analysing and comparing the schedules the lecturers completed during the workshop on how they intended to use interactive videos (phase 2) and the feedback they provided during the focus group interviews (phase 3), it became clear that training workshops are necessary well in advance to allow lecturers to plan for the use of interactive videos from "the beginning of the module" (5:6). Planning and training in advance was also highlighted as important due to time constraints and workload issues that lecturers listed as factors that could hinder the adoption of interactive videos. One of the lecturers mentioned that using interactive videos is "*time consuming*" (5:16). Similarly, other lecturers complained that they "*struggled a bit with time*" (5:8), "*time was*

just suddenly against us" (5:21) and "*it took me a lot of time to search for the appropriate video …for the lesson*" (5:130).

A final consideration that is needed when using interactive videos is related to module-specific requirements, "*terminology and the cultural relevance*" (5:144) that relates to the Africanisation of learning content. The lecturers mentioned that Afrocentric videos are not always easily accessible and that open-access videos are not always culturally relevant or only available in English. Therefore, an intention-behaviour gap was identified in the data because lecturers intended to use interactive videos but then struggled to find videos appropriate for the South African context or videos produced in languages other than English. One lecturer explained, "*something that's difficult in our African context… is that we don't always have African language video material*" (5:47). Other lecturers elaborate "*we find a lot of videos from a Western perspective or from an American perspective and they use terminologies that are familiar to students from America or from Europe*" (5:145) ..."*those videos and those contexts are not always, you know, familiar to our students*" (5:146).

The importance of careful planning and being mindful of factors such as time constraints, workload issues, and access to relevant videos was highlighted in this study. In the following section, findings from the post-research questionnaire completed by the students will be presented.

Quantitative findings

The quantitative results are based on the online student questionnaire that was voluntarily completed by 168 students (response rate of 21%) (N=800) at the two HEIs. It was hypothesised that there would be a significant correlation between three scales: (1) interactive videos, (2) technology integration within modules, and (3) the experiences with the HEI's LMS. It was also hypothesised that significant differences exist for students according to their year of study (1-2 years vs 3+ years), frequency in use of interactive videos (0-3 vs 3-5 times), and if they received training or not.

Reliability and Validity of the Student Questionnaire

Three scales were developed to investigate the experiences students have during teaching and learning, with a specific focus on the use of interactive videos, technology integration within modules, and their HEIs' LMS.

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An investigation was conducted into the construct validity of the three scales in the questionnaire through exploratory factor analysis (EFA). Sets of EFA were done on the following three scales: Experiences with interactive videos, experiences with technology integration within modules, and experiences with the HEI's LMS.

To extract the factors in the EFA, principal axis factoring extraction, with a quartimin (oblique) rotation, was conducted. To determine the number of factors, the following criteria were used: Eigenvalues greater than or near 1, the Scree plot, and the cumulative percentage of variance.

In interpreting the rotated factor pattern, an item was said to load on a given factor if the factor loading was 0.40 or greater for that factor and less than 0.40 for the other (Field, 2018).

Set 1: Experiences with interactive videos

The KMO of 0.88 and a significant Bartlett's test of Sphericity indicated that a factor structure exists, and it is viable to conduct EFA. EFA was applied to responses to the nine items related to the "Experiences with interactive videos" scale in the questionnaire. The findings showed that only one factor existed, accounting for 53% of the total variance. See Table 1 for the factor loadings. Items extracted had factor loadings above 0.4. All nine items were found to load on the factor, which was subsequently labelled "Experiences with interactive videos".

Table 1: Factor loadings for the factor "Experiences with interactive videos"

To what extent do you believe interactive videos can increase your productiveness	0.81
Beliefs regarding the usefulness and value of interactive videos for teaching and learning purposes	0.78
Confidence level in using interactive videos	0.74
To what extent you believe interactive videos can save you time and allow you to do more work	0.70
To what extent you believe interactive videos can increase your performance (marks)	0.69
Level of enjoyment when using interactive videos	0.63
Knowledge regarding interactive videos	0.62

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How easy you believe it is to complete or use interactive videos	0.61
To what extent you believe your fellow students value the use of interactive videos in modules	0.60

Set 2: Experiences with technology integration within modules

The KMO of 0.79 and a significant Bartlett's test of Sphericity indicated that a factor structure exists, and it is viable to conduct EFA. EFA was applied to responses of the four items related to the "Experiences with technology integration within modules" scale in the questionnaire. The findings showed that only one factor existed, accounting for 53% of the total variance. See Table 2 for the factor loadings. The items extracted had factor loadings above 0.4. All four items were found to load on the factor, subsequently labelled "Experiences with technology integration within modules".

Table 2: Factor loadings for the factor "Experiences with technology integration within modules"

Confidence level in using technology in your modules	0.87
Level of enjoyment when using technology in your modules	0.84
Knowledge regarding the use of technology in your modules	0.83
Beliefs regarding the importance of using technology in your modules	0.75

Set 3: Experiences with the HEI's LMS

The KMO of 0.88 and a significant Bartlett's test of Sphericity indicated that a factor structure exists, and it is viable to conduct EFA. EFA was applied to responses to the nine items related to the "Experiences with interactive videos" scale in the questionnaire. The findings showed that only one factor existed, accounting for 53% of the total variance. See Table 1 for the factor loadings. Items extracted had factor loadings above 0.4. All nine items were found to load on the factor, which was subsequently labelled "Experiences with interactive videos".

The KMO of 0.89 and a significant Bartletts' test of Sphericity indicated that a factor structure exists, and it is viable to conduct Exploratory Factor analysis. Exploratory Factor analysis was applied to responses of the five-items related to the "Experiences with the HEI's LMS" scale in the questionnaire. A Scree Plot and Principal axis factoring, followed by a quartimin (oblique) rotation shows that only one factor exhibited

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Eigenvalues greater than or near 1; accounting for 53% of the total variance. See table 3 for the factor loadings. Therefore, only one factor was retained for rotation. All four items were found to load on the factor, which was subsequently labelled "Experiences with the HEI's LMS".

Table 3: Factor loadings for the factor "Experiences with the HEI's LMS"

Your level of activeness and engagement on the university's LMS?	0.90
Confidence level in using the university's LMS	0.88
Level of enjoyment when using the university's LMS	0.84
Knowledge regarding the use of the university's LMS	0.83
Beliefs regarding the importance of being active on the university's LMS	0.80

Further investigations were conducted on the reliability of the questionnaire's internal consistency using the post-research questionnaire. Internal consistency of responses of the scales was assessed by Cronbach's alpha coefficient. Reliability estimates were 0.88, 0.90, and 0.93 for responses to "experiences with interactive videos", "experiences with technology integration within the module" and "experiences with HEI's LMS" respectively. This indicated good reliability.

Scale scores were calculated by taking the average of the items that loaded onto that factor for each participant. The score must be interpreted as follows: a mean score towards 0 indicates poor experience and a score towards 100 indicates an excellent experience. For example, the scale score for the first scale was calculated by taking the average of nine item responses for each participant.

Descriptive statistics

For the sample of 168, descriptive statistics were calculated for the three scales. When investigating the histograms of the different scales, there was apparent skewness with a tail to the left. The skewness was also outside of the range of -1 to +1 (Field, 2018). Since the data was not normally distributed, both the mean and median are reported, and the median is used to measure location. See Table 4 for the descriptive statistics and measures of the distribution.

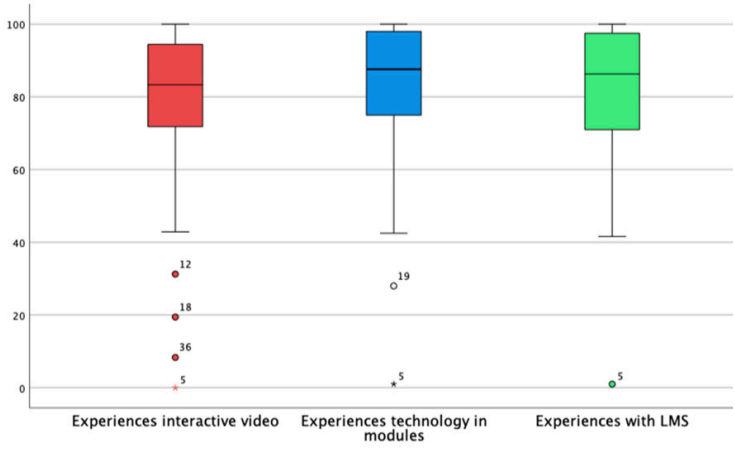
Table 4: Descriptive statistics of student's responses

	Experiences with interactive videos	Experiences with technology integration within modules	Experiences with HEI's LMS
Median	83	88	86
Mean	78	83	81
Std Devn	19.04	17.05	18.47
Skewness	-1.57	-1.53	-1.40
Kurtosis	3.51	3.31	2.71

Assessing the experiences of the students

Considering the Boxplot below (figure 2), when assessing the experiences of the students, the students showed overwhelmingly positive experiences with interactive videos (Mn=83), technology integration (Ms 88), and the LMS (Ms 86), with a few outliers.

Figure 2: Distribution of scores for all three factors



Assessing related experiences

To determine if their experiences with interactive videos and technology integration

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within modules and the LMS were related, a nonparametric correlation analysis using Spearman's ρ was conducted. Spearman's ρ was used to measure the strength and direction of association between the scales. Statistical significance was determined from a calculated p-value smaller than 0.05. In the following table (5), it is evident that there is a strong, positive and significant correlation between the scales.

Table 5: Spearman's ρ analysis of the three factors

Variable	by Variable	Spearman ρ	Prob>|ρ|
Experiences with technology integration in modules	Experiences interactive video	0.52	<.0001*
Experiences with LMS	Experiences interactive video	0.53	<.0001*
Experiences with LMS	Experiences technology in modules	0.59	<.0001*

Assessing the differences in experiences

To assess the difference in experiences, a nonparametric Wilcoxon Two-Sample Tests were conducted to establish if significant differences exist for students' years of study (1-2 years vs 3+ years), frequency in use of interactive videos (0-3 vs 3-5 times), and if they received training or not.

When investigating students' experience with interactive videos, no statistically significant differences were found between the first- and second-year students (Mn 84.7) and the 3+-year students (Mn 80.5) (Z= -0.09; p= ,0.93). When comparing how often students used interactive videos, no statistically significant differences were found between using it 0-3 times (Mn 86.1) and 3-5 times (Mn 81.9) (Z= 0.76; p= 0.44). Furthermore, no statistical difference was found between their experience with interactive videos and whether they received training (median 86) or not (Mn 82) (Z= 0.597; p= 0.55).

When investigating students' experience with technology integration in modules, no statistically significant difference was found between 1-2nd year students (Mn 87) and 3+-year students (median 91) (Z= 1,23; p= 0.22) or how often they used interactive

videos, 0-3 (median 87.8) and 3-5 (median 87.5) (Z= 0.02; p= 0.98). However, a statistically significant difference was found between students who received training (Mn 86) and those who did not (Mn 82) (Z= -2.17; p= 0.03, r= 0.18). Nonetheless, the effect size shows that the difference is small.

When investigating students' experience with the LMS, no statistically significant difference was found between 1-2nd-year students (median 82.9) and 3+-year students (Mn 89.8) (Z= 1.73; p= ,0.08). Furthermore, no statistically significant differences exist between how often they used interactive videos, 0-3 (Mn 88.7) and 3-5 (Mn 84.6) (Z= 0.76, p= 0.44) or if they received training (Mn 82) and those who did not (Mn 89) (Z= -1.03, p= 0.30).

Discussion

To gain a deeper understanding of students' and lecturers' experiences with technological advances such as interactive videos to enhance teaching and learning in higher education, it is crucial to use a mixed-method approach to corroborate findings from both datasets. For example, both the qualitative and quantitative findings showed that the students and lecturers had overwhelmingly positive experiences with interactive videos. However, it was also necessary to explore how interactive videos could enhance students' teaching and learning experiences and establish factors that could encourage or hinder lecturers' behaviour in adopting or using interactive videos which required a more qualitative approach. Based on the qualitative findings analysed using the CoI and TAM frameworks, in themes 1 and 2, there is strong evidence suggesting that interactive videos not only support but promote cognitive, as well as teacher presence. This finding aligns with widespread literature reports (Althwaini & Mahmoud, 2021; Dart, 2020; Halupa & Caldwell, 2015; Green Pinder-Grover & Millunchick, 2012) on the positive impact videos have on students' understanding and processing of information, concepts, and facts (Paivio, 1986). However, interactive videos are different from passive videos as students work alongside the videos to answer questions (Martin, 2016; Barns et al., 2017; Onyema, 2019). The promotion of a cognitive presence when using interactive videos is ascribed to the interactive nature of the videos (Castellanos-Reyes, 2020; Sinnayah et al., 2021). Cognitive overload, concentration, and attention are listed by Shanmugasundaram & Tamilarasu (2023) as possible challenges when using interactive videos, which was not a concern raised by either the students or lecturers.

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Moreover, theme 2 suggests that interactive videos support or even increase a teacher presence owing to continuous assessment with immediate feedback resulting in self-reflection and progress tracking by the students. This is interesting, as Dart et al. (2020) and Shekhar et al. (2015) found that the requirements of continuous assessment and self-reflection, such as increased engagement, active participation, and self-directed learning, can lead to students being resistant, which was the opposite in this case. Similar to Henrikson's (2019) findings, the students in this study experienced more agency and "success" when engaging with interactive videos especially since they could track their learning. One limitation of interactive videos that were reported is that it does not necessarily support social presence. Therefore, lecturers cannot solely rely on interactive videos as a teaching and learning strategy.

Furthermore, keeping the TAM in mind, it was evident in theme 3 that the perceived usefulness of interactive videos is associated with its diverse and flexible application possibilities (Bétrancourt & Benetos, 2018; Leo & Puzio, 2016; Polat, 2020), pedagogical functions, and perceived ease of use. However, comprehensive training is essential to increase the perceived ease of use (theme 4). The quantitative findings also corroborated this finding by indicating that students who received training had a better experience with technology integration within modules.

In theme 5 of the qualitative findings, it was also found that adopting interactive videos as part of instructional design requires careful consideration and planning as it can be time-consuming (Halupa & Caldwell, 2015), which could influence lecturers' perceptions regarding the ease of use and usefulness of interactive videos. The quantitative findings elaborated on this finding by showing a strong positive correlation between students' experiences with interactive videos, technology integration within modules, and the LMS, which indicates the importance of also considering students' experiences with technology integration in general and their experiences with the HEIs LMS.

From the qualitative and quantitative findings, the argument can, therefore, be made that students and lecturers overall positively experience interactive videos, but that training for all users is required to ensure their perception regarding the ease of use and perceived usefulness remains positive. Lectures should also be mindful of how they use interactive videos and ensure that it is not their own teaching and learning approach.

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Insights from the CoI and TAM Frameworks

The benefits of students' and lecturers' experiences with interactive videos in higher education are related to the CoI and TAM frameworks. The qualitative analysis, guided by the CoI framework, revealed that interactive videos effectively enhance both cognitive and teaching presence which can be supported by existing literature (Althwaini & Mahmoud, 2021; Dart, 2020). The interactive nature of these videos promotes cognitive presence by encouraging active participation and meaningful interaction with the content (Castellanos-Reyes, 2020; Sinnayah et al., 2021). Additionally, the videos foster teaching presence by providing continuous feedback and allowing students to self-assess their progress, contrasting with findings from Dart et al. (2020).

The TAM framework helped elucidate how students and lecturers perceive interactive videos. In this study, the perceived usefulness of these videos was associated with their flexibility and pedagogical value, which is also supported by existing literature (Bétrancourt & Benetos, 2018; Leo & Puzio, 016). The ease of use improved with adequate training, confirming TAM's assertion that perceived ease of use influences technology adoption (Polat, 2020). The study additionally highlighted that the perceived usefulness and ease of use significantly influence the behavioural intention to use the technology. Students and lecturers who view interactive videos as both valuable and easy to use demonstrated a higher intention to incorporate these tools into their educational practices. Despite the overall positive reception of interactive videos, the study also uncovered challenges related to their adoption. The qualitative data highlighted the time-consuming nature of incorporating these videos, influencing lecturers' perceptions of their usefulness and ease of use (Halupa & Caldwell, 2015).

Overall, integrating the CoI and TAM frameworks provides a nuanced understanding of how interactive videos impact educational practices and highlights the importance of training and thoughtful integration in maximizing their benefits.

Conclusions

To conclude, interactive videos enhance teaching and learning in HEIs as they could increase students' academic performance by supporting a cognitive and teacher presence in an online environment. Interactive videos have also been found to enhance students' teaching and learning experiences because they align with active learning and inquiry-

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based learning principles that increase engagement, motivation, interaction, and agency. Although interactive videos were found to be mostly beneficial, it is important to note that a lack of comprehensive training (for lecturers and students) and insufficient consideration of aspects such as time management and planning could hinder the adoption and use of interactive videos. Without comprehensive training, lecturers might use videos that are too long, culturally irrelevant or of poor quality, which could negatively affect students' educational experience. It is also crucial that lecturers receive comprehensive training on not only the use of interactive videos but also on different aspects related to using interactive videos, such as shooting and editing of videos, quality assurance criteria, choosing the right content, the appropriate length of videos, different pedagogical approaches, etc.

The adoption of interactive videos is recommended as they are perceived to be valuable and easy to use by both lecturers and students. However, interactive videos do not seem to support a social presence online, which is a limitation of interactive videos. Therefore, when interactive videos are used in an online, blended, or hybrid-mediated environment, lecturers should be cognisant of how a social presence will be accommodated. Future research must establish how interactive videos can incorporate a social presence within the online classroom.

Overcoming existing challenges and limitations and harnessing the benefits of interactive videos, require further research. More research is also needed to establish best practices when adopting interactive videos in an online, blended, and traditional classroom environment. Moreover, research should be done on using different types of videos, i.e. volumetric, holograms, and 3D videos. Furthermore, research should also investigate students' cognitive load by considering the cognitive theory of multimedia learning (CTML) and cognitive load theory (CLT). Finally, research regarding students' understanding of the content and later performance must also be established.

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References

Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C. & Ananthanarayanan,V. (2017). *NMC Horizon Report: 2017: Higher Education Edition*. The New Media Consortium. https://eric.ed.gov/?id=ED582134

Ajzen, I. (1991). The theory of planned behavior. *Organisational Behavior and Human Decision Processes*, *50*(2), 179–211.

Ajzen, I. (2012). The theory of planned behavior. In P. A. M. Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology,* (pp. 438–459), Sage.

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior & Emerging Technologies*, 2(4), 314-324. DOI:10.1002/hbe2.195

Akcil, U., Uzunboylu, H., Kinik, E. (2021). Integration of technology to learning-teaching processes and GoogleWorkspace tools: A literature review. *Sustainability*, *13*(9), 5018. https://doi.org/10.3390/su13095018

Althwaini, S.N., & Mahmoud, S.M. (2021). The effect of the number of hints accompanying content in interactive videos on achieving some learning outcomes for female students in Hail schools. *International Journal of Advanced and Applied Sciences, 8*(3), 120-129.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147.

Barns, S., Pickering, E., & Dawes, L. (2017). Worked example videos as a valuable blended learning resource in undergraduate engineering units, in 28th Annual Conference of the Australasian Association for Engineering Education. Manly, New South Wales. p. 1093-1100.

Beach, L.R., & Mitchell, T.R. (1978). A contingency model for the selection of decision strategies. *Academy of Management Review*, *3*(3), 439-449.

Bétrancourt, M., & Benetos, K. (2018). Why and when does instructional video facilitate learning? A commentary to the special issue "developments and trends in learning with instructional video." *Computers in Human Behavior*, *89*(August), 471-475. DOI:10.1016/j.chb.2018.08.035

Biggs J. (1996). Enhancing teaching through constructive alignment. *Higher Education, 32*, 347–364.

Cooper, D., & Higgins, S. (2015). The effectiveness of online instructional videos in the acquisition and demonstration of cognitive, affective and psychomotor

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rehabilitation skills. *British Journal of Educational Technology*, *46*(4), 768-779.

de Koning, B. B., Hoogerheide, V., & Boucheix, J.-M. (2018). Developments and trends in learning with instructional video. *Computers in Human Behavior*, *89*, 395-398. DOI:10.1016/j.chb.2018.08.055

Du Toit, J., & Verhoef, A.H., (2018). Embodied digital technology and transformation in higher education. *Transformation in Higher Education*, *3*(1), 1-8.

Bonafini F.C. (2017). The effects of participants' engagement with videos and forums in a MOOC for teachers' professional development. *Open Praxis, 9*(4), 433-447. DOI:10.5944/openpraxis.9.4.637

Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *American Journal of Distance Education, 19*, 215–227.

Dart, S., Cunningham-Nelson, S. & Dawes, L. (2020). Understanding student perceptions of worked example videos through the technology acceptance model. *Computer Applications in Engineering Education*, *28*(5), 1278-1290. DOI:10.1002/cae.22301

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*. *35*(8), 982-1003.

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*, *2*(2), 25-36. DOI:10.46809/JPSE.V2I2.20

DeSanctis, G. (1983). Expectancy theory as an explanation of voluntary use of a decision support system. *Psychological Reports*, *52*, 247-260.

Deslauriers, L., McCarty, L.S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences, 116*(39), 19251-19257. DOI:10.1073/pnas.1821936116

Du Preez, H., & West, J. (2022). Early childhood student-teachers' experiences of blended learning using Community of Inquiry as theoretical framework. *Perspectives in Education, 40*(4), 135-151. DOI:10.38140/pie.v40i4.6186

Dwivedi, Y.K., Rana, N.P., Tamilmani, K., & Raman, R. (2020). A meta-analysis based

on a modified unified theory of acceptance and use of technology (meta-UTAUT): A review of emerging literature. *Current Opinion in Psychology*, *36*(1), 13-18.

Dziuban, C., Graham, C.R., Moskal, P.D., Norberg, A. & Sicilia, N. (2018). Blended learning: tThe new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(3),1-16.

Ejikeme, A.N., & Okpala, H.N. (2017). Promoting children's learning through technology literacy: challenges to school librarians in the 21st century. *Education and Information Technologies, 22*(1), 1163-1177. DOI:10.1007/s10639-016-9481-1

Feldman, S. (1966). *Cognitive consistency: Motivational antecedents and behavioral consequents.* Academic Press.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Fishbein, M. (1963). An investigation of the relationship between beliefs about an object and the attitude toward that object. *Human Relations, 16*(1), 233-240.

Fishbein, M. (1966). The relationship between beliefs, attitudes and behaviour. In S. Feldman (Ed.), *Cognitive consistency: Motivational antecedents and behavioral consequents* (pp. 200-222). Academic Press.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Addison-Wesley.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Psychology Press.

Fiorella, L., & Mayer, R. E. (2018). What works and doesn't work with instructional video. *Computers in Human Behavior, 89*(4), 465-470. DOI:10.1016/j.chb.2018.07.015

Garrison, D.R., Anderson, T. & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education*, *13*(1–2), 5-9. DOI:10.1016/j.iheduc.2009.10.003

Ghani, M.T.A., Hamzah, M., Ramli, S., Daud, A.W., Romli, T.R.M., Mokhta, N.N.M. (2019). A questionnaire-based approach on technology acceptance model for mobile digital game-based learning. *Journal of Global Business and Social Entrepreneurship, 5*(14), 11-21.

Gardner, H., (2014). *Multiple intelligences: New horizons*. (Rev.ed.). Perseus.

Garrison D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18–33.

Garrison, D. (2017). *E-learning in the 21st century: A community of inquiry framework for*

CONTACT: Joyce West - Joyce.west@up.ac.za

research and practice (3rd ed.). Routledge. https://doi.org/10.4324/9781315667263

González-Gómez, D., Jeong, J. S., Airado Rodríguez, D., & Cañada-Cañada, F. (2016). Performance and perception in the flipped learning model: An initial approach to evaluate the effectiveness of a new teaching methodology in a general science classroom. *Journal of Science Education and Technology*, *25*(3), 450-459. DOI:10.1007/s10956-016-9605-9

Green, K. R., Pinder-Grover, T. & Millunchick, J. M. (2012). Impact of screencast technology: Connecting the perception of usefulness and the reality of performance. *Journal of Engineering Education, 101*(4), 717-737. https://doi.org/10.1002/j.2168-9830.2012.tb01126.x

Guo, P. (2013). *Optimal length for student engagement*. EdX Blog. [Online] https://www.edx.org/blog/optimal-video-length-student-engagement#.VM_igWjF-UY

Guo, P.J., Kim, J., & Rubin, R. (2014). *How video production affects student engagement: An empirical study of MOOC videos,* in 1st ACM conference on Learning @ Scale, ACM: Atlanta, Georgia. p. 41-50.

Halupa, C.M., & Caldwell, B.W. (2015). A comparison of a traditional lecture-based and online supplemental video and lecture-based approach in an Engineering statics class. *International Journal of Higher Education, 4*(1), 232-240.

Henriksen, E. (2024). *Synthesia: Everything you need to know about interactive video.* Available online:https://www.synthesia.io/post/interactive-video#:~:text=Unlike%20traditional%20videos%20limited%20to,Clickable%20links%20to%20web%20pages

Henrikson, R. (2019). Using online lectures to promote engagement: Recognising the self-directed learner as critical for practical inquiry. *Journal of Open Flexible and Distance Learning, 23*(1),17-32.

Hibbert, M. (2014, April 7). *What makes an online instructional video compelling.* Educause Review. [Online] http://www.educause.edu/ero/article/what-makes-online-instructional-video-compelling

Howard, E., Meehan, M., & Parnell, A. (2018). Live lectures or online videos: Students' resource choices in a first-year university mathematics module. *International Journal of Mathematical Education in Science and Technology*, *49*(4), 530-553. DOI:10.1080/0020739X.2017.1387943

Ivankova, N.V., Creswell, J.W., & Plano Clark, V. L. (2025). Foundations and approaches to mixed methods research. In K. Maree (Ed.), *First steps in research* (4th ed., pp. 370-399). Van Schaik.

Johnson, E.J., & Payne, J.W. (1985). Effort and accuracy in choice. *Management Science*, *31*(4), 395-414.

Key, J. & Paskevicius, M. (2015). Investigation of video tutorial effectiveness and student use for general chemistry laboratories. *Journal of Applied Learning Technology, 5*(4), 14-21.

Leo, J., & Puzio, K. (2016). Flipped instruction in a high school science classroom. *Journal of Science Education and Technology, 25*(5), 775-781. DOI:10.1007/s10956-016-9634-4

Lieberman, E. S. (2005). Nested analysis as a mixed-method strategy for comparative research. *The American Political Science Review, 99*(3), 432-452.

Ma'arop, A.H., & Embi, M.A. (2016). Implementation of blended learning in higher learning institutions: A review of the literature. *International Education Studies, 9*(3), 41-52. DOI:10.5539/ies.v9n3p41

Martin, P.A. (2016). Tutorial video use by senior undergraduate electrical engineering students. *Australasian Journal of Engineering Education*, *21*(1), 39-47.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: Meta-analysis and review of online learning studies*. U.S. Department of Education.

Mesuwini, J., & Mokoena, S. (2024). Exploring online teaching and learning challenges for the technical and vocational education and training lecturer. *Journal of Education and e-Learning Research 11*(1),193-202. DOI:10.20448/jeelr.v11i1.5423

Nadelson, L. S., Scaggs, J., Sheffield, C., & McDougal, O. M. (2015). Integration of video-based demonstrations to prepare students for the organic chemistry laboratory. *Journal of Science Education and Technology, 24*(4), 476-483. DOI:10.1007/s10956-014-9535-3

Nieuwenhuis, J., & Jacobs, L. (2025). Qualitative research designs and data gathering techniques. In K Maree (Ed.), *First steps in research* (4th ed., pp. 96-135). Van Schaik.

Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford University Press.

Pilette, C. (2021). *NortonLifeLock*. [Online] https://us.norton.com/blog/how-to/digital-generations#

Pinder-Grover, T., Green, K., & Millunchick, J.N. (2011). The efficacy of screencasts to address the diverse academic needs of students in a large lecture course. *Advances in Engineering Education,* 2(2). [Online] http://advances.asee.org/vol02/issue03/09.cfm

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Polat, H. (2020). Investigating the use of text positions on videos: An eye movement study. *Contemporary Educational Technology, 12*(1), 1-18. https://doi.org/10.30935/cedtech/7628

Research ICT Africa (2020). Digital futures: *South Africa's digital readiness for the 'fourth industrial revolution'*. [Online] https://researchictafrica.net/wp/wp-content/uploads/2021/01/021220_Digital-Futures_SAs-Digital-Readiness-for-4IR_01.pdf

Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (Ed.). *The handbook of research in teacher education* (2nd ed., pp. 102-119). Macmillan.

Rogers, E. M. (1962). *Diffusion of innovations* (1st ed.). Free Press of Glencoe. .

Rogers, E.M. (2003). *Diffusion of innovations* (5th ed.). Free Press

De Bruin, L. (2020). *Crossing the chasm in the technology adoption life cycle.* [Online] https://www.business-to-you.com/crossing-the-chasm-technology-adoption-life-cycle/

Shanmugasundaram, M., & Tamilarasu, A. (2023). The impact of digital technology, social media, and artificial intelligence on cognitive functions: A review. *Frontiers in Cognition* (2),01-11. DOI:10.3389/fcogn.2023.1203077

Shekhar, P., Demonbrun, M., Borrego, M., Finelli, C., Prince, M., Henderson, C., & Waters, C. (2015). Development of an observation protocol to study undergraduate engineering student resistance to active learning. *International Journal of Engineering Education*, *31*(2), 597-609.

Sinnayah, P., Salcdo, A., & Rekhari, S. (2021). Reimagining physiology education with interactive content developed in H5P. *Advances in Physiology Education, 45*(1), 71-76. DOI:10.1152/advan.00021.2020

Sivo, S.A., Ku, C.H., & Acharya, P. (2018). Understanding how university student perceptions of resources affect technology acceptance in online learning courses. *Australasian Journal of Educational Technology*, *34*(4), 72-91.

Skhephe, M., Caga, N.P. & Boadzo, R.M.K. (2020). Accounting teachers' readiness for e-learning in the Fourth Industrial Revolution: A case of high schools in the Eastern Cape, South Africa. *Perspectives in Education, 38*(1), pp.43-57. DOI:10.18820/2519593X/pie.v38i1.4

Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. *Educational Psychology Review, 31*(2), 261-292. DOI:10.1023/a:1022193728205

Szpunar, K. K., Helen G., Jing, & Schacter, D. L. (2014). Overcoming overconfidence in learning from video-recorded lectures: Implications of interpolated testing for online education. *Journal of Applied Research in Memory and Cognition 3*(3),161–164.

Teddlie, C., & Tashakkori, A. (2008). *Foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioral sciences*. SAGE Publications.

Vroom, V.H. (1964). *Work and motivation*. Wiley.

Waghid, Z., & Waghid, F. (2016). Examining digital technology for (higher) education through action research and critical discourse analysis. *South African Journal of Higher Education, 30*(1), pp.265-284. DOI:10.20853/30-1-562

Wankel, C. (2011). *Teaching arts and science with new social media*. Cutting-edge technologies in higher education, vol. 3. Emerald Group Publishing.

Wills, G. & Böhmer, B. (2023). Male managers, female teachers: The South African case of gender imbalances in school leadership and management. Research on Socio-Economic Policy (RESEP), Stellenbosch University. [Online] https://tdd.sun.ac.za/downloads/notes/Note%2012%20-%20Male%20Managers,%20Female%20Teachers%20(TDD%2010%20July%202023).pdf

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