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Utilizing Multimedia Technology to Enhance Teaching in the Classroom: Implications for Teacher-Trainers

Kakeeto David[1], Josephine Najjemba Lutaaya[2], Harriet Uwineza[3], Nakintu Rukia[4], Kakinda Teresphorous[5]

[1,3,4]Victoria University, Kampala Uganda
[2,5]School of Education, College of Education and External Studies, Makerere University

Abstract
The study was aimed at establishing how utilization of multimedia technology enhances teaching in the classroom at Victoria University. Objectives were to: establish the effect of pedagogical utilization of multimedia technology on the classroom teaching and also find out specific challenges faced by teacher-trainers in utilizing multimedia technology in teaching. A sample of (n = 36) respondents was selected randomly from two faculties which offer modules to teacher trainees: Faculty of Humanities and Social Sciences, and Faculty of Science and Technology, from whom data were collected using a self-administered questionnaire. Testing of hypothesis was done using Pearson's Correlation Coefficient. Findings indicated that: multimedia technology significantly and positively correlated with classroom teaching with **r = 0.915**, and probability value **(p = 0.002)** which is less than **α = 0.01**. Teacher trainers were positive towards using multimedia resources, self-efficacy is important in using multimedia resources, teachers' ICT background knowledge was found to be fundamental for technology integration, subject content knowledge was also found very influential for ICT integration, curriculum design, institutional ICT policies and leadership styles are all equally important in technology integration. In conclusion; multimedia technology promotes learner-centered approach, it was also concluded that, much as the benefits of multimedia technologies are enormous, it stands both internal and external challenges. It was recommended that, teacher-trainers need to invest more time in developing or identifying relevant multimedia resources for their students, but also institutions must develop appropriate policies for multimedia technology integration.

Keywords: Multimedia Technology, Classroom Teaching, Teacher-Trainers, Technology Integration and Learner-Centered Learning

Introduction

Utilization of multimedia technology in teaching and learning is one of the most exciting innovations in the 21st Century. Multimedia technology has become an increasingly important tool in education, allowing teachers to incorporate various forms of media such as images, videos, and audio recordings into their teaching practices. Numerous studies have examined the effects of multimedia technology on teaching and learning outcomes, highlighting its potential to enhance student engagement, motivation,

and learning outcomes. Studies have found that multimedia content can capture students' attention and maintain their interest, leading to greater engagement and participation in the learning process (Vogel, Reichelt, & Womser-Hacker, 2020; Chen & Hung, 2018). For example, incorporating videos and images into lectures can help illustrate complex concepts and make them more relatable and understandable for students (Tazbir & Grudzien, 2019). Additionally, interactive multimedia tools such as educational games and simulations can provide students with an immersive and engaging learning experience (Bieglmayer & Friedrich, 2021).

Study Background

Since time inertia, ICT has been looked at as multipurpose tool which greatly improves and simplifies human life and activity. The use of multimedia technology in the classroom to enhance teaching has a long history that dates back to the 19th century when educators first began experimenting with visual aids like charts, maps, and pictures to support instruction (Mayer, 2014). With the advent of new technologies such as films, television, and computers, multimedia became an increasingly popular tool in education. In the 1950s, television programs were used in classrooms to supplement instruction, with shows like "The French Chef" and "Watch Mr. Wizard" gaining popularity (Cavanaugh, 2005). The use of multimedia continued to grow in the 1960s and 1970s, with the introduction of slide projectors, overhead projectors, and filmstrips (Clark, 1994). In the 1980s and 1990s, the use of computers in the classroom led to the development of multimedia software programs like HyperCard and PowerPoint, which allowed teachers to create and present interactive multimedia lessons (Mayer, 2014). A meta-analysis study conducted by Mayer (2003) found that the use of multimedia can lead to higher levels of student achievement compared to traditional classroom instruction. Other studies have found that the use of multimedia can increase student engagement, motivation, and interest in learning (Cavanaugh, 2005; Clark, 1994).

In the 1990s and early 2000s, the advent of the internet and digital technologies revolutionized the use of multimedia in education. Online courses, web-based tutorials, and interactive multimedia resources became more widely available, and teachers began to integrate these tools into their classroom instruction (Cavanaugh, 2005). One of the most notable examples of multimedia in education during this time was the development of educational video games. Games like "Oregon Trail" and "Where in the World is Carmen Sandiego?" were popular in schools and helped to teach students about history, geography, and other subjects (Prensky, 2001). More recently, the rise of mobile technologies like smartphones and tablets has further expanded the use of multimedia in the classroom. Teachers can now use different mobile applications and other mobile resources to supplement instruction and engage students in new ways (Roschelle & Teasley, 2014). Research on the use of multimedia in education has also evolved in recent years. For example, studies have explored how virtual reality and augmented reality can be used to create immersive learning experiences (Dunleavy et al., 2009; Klopfer et al., 2009).

The advent of social media platforms like Facebook and Twitter began to change the landscape of multimedia in education. Teachers started using social media to create online communities for their students, to share resources and assignments, and to facilitate discussions and collaboration (Manca & Ranieri, 2016). The use of multimedia has also been shown to be effective in supporting students with diverse learning needs. For example, studies have found that the use of multimedia can benefit students with dyslexia by providing alternative ways to access and process information (Gulikers et al., 2009).

More recently, the use of artificial intelligence (AI) and machine learning in education has opened up new possibilities for the use of multimedia. AI-powered tools can analyze student data to provide personalized feedback and support, and can even create custom multimedia resources based on students' individual learning needs (Baker & Inventado, 2014).

Theoretically, this study was based on constructivism theory by (Jean Piaget, 1970) a theory that was later advanced by Vygotsky, (1978). Constructivism is a learning theory that emphasizes the role of learners in constructing their own understanding of knowledge and learning through active participation and engagement with their environment (Jonassen & Land, 2012). The theory suggests that learners construct meaning through their interactions with the world around them, rather than simply receiving information passively from external sources. In the constructivist view, learning is an ongoing process of constructing and revising mental models or frameworks that organize and interpret information. This process is influenced by prior knowledge, personal experiences, and social and cultural contexts (Piaget, 1970; Vygotsky, 1978). In the context of using multimedia technology in teaching, constructivism theory highlights the importance of creating learning environments that are learner-centered, interactive, and reflective. According to constructivist theory, learners construct their own understanding of knowledge by actively engaging with their environment, which includes various forms of multimedia such as video, audio, and graphics (Mayer, 2014).

In the conceptual sense, multimedia refers to the use of different media such as text, graphics, audio, video, and interactive elements to deliver information or enhance learning. Islam et al. (2016), define multimedia as "the integration of multiple media elements including text, graphics, audio, video, and animation into a single system, in order to present information in an interactive and engaging way to learners". According to Al-Turki (2016), multimedia technology in education is defined as "the use of various digital media, such as text, graphics, animation, audio, and video, to enhance the teaching and learning process." The UNESCO (United Nations Educational, Scientific and Cultural Organization) Institute for Information Technologies in Education defines multimedia in education as "any combination of text, graphic art, sound, animation, and video that is delivered interactively to communicate a message" (UNESCO, 2011). Other researchers such as; Kaur and Singh (2016), Raza and Adrees (2018), Zhang and Fulford (2019), Cai and Zhu (2016) also define multimedia technology as "a combination of text, images, audio, video, and animation to provide an interactive learning environment to enhance the teaching and learning process." This definition emphasizes the interactive and immersive nature of multimedia technology, and its potential to provide a more engaging and dynamic learning experience.

The use of multimedia in classrooms has become increasingly popular in recent years, with many educators recognizing the potential benefits of integrating such a technology into the teaching and learning process. In Uganda, there has been a growing interest in using multimedia to enhance teaching and learning, particularly in light of the Country's focus on improving educational outcomes and expanding access to education. A study by Nalunkuma and Naluwooza (2018) explored the use of multimedia in teacher training programs in Uganda. The researchers found that the integration of multimedia, such as instructional videos and online learning resources, helped to enhance the quality of teacher training and improve the skills and competencies of teachers. Namagembe et al. (2019) also explored the use of multimedia as a means of improving the accessibility and quality of education in rural areas of Uganda. The researchers found that multimedia, such as educational videos and online learning platforms, are an effective tool for bridging the educational divide between urban and rural

areas and improving access to high-quality educational resources. A study by Nakayiwa and Kibirige (2021) explored the impact of multimedia on the teaching and learning of mathematics in secondary schools in Uganda. The researchers found that the use of multimedia, particularly interactive simulations and virtual manipulatives, helped to enhance students' understanding of mathematical concepts and improve their problem-solving skills. The Uganda Ministry of Education and Sports has developed a number of multimedia resources to support teaching and learning, including the "e-Learning Solutions" platform, which provides online access to textbooks, videos, and interactive learning activities, however the practical benefit of this is still lacking especially in teacher training institutions within the Country.

Problem statement

Multimedia technology has got the potential to enhance teaching and learning in the classroom by providing students with engaging and interactive learning experiences (Rajendra and Sudana 2018). However, there is limited empirical evidence on effective utilization of multimedia technology in teaching at universities in Ugandan classrooms. Namala and Mukiibi (2018) indicate that one of the reasons for limited multimedia use is due to limited access to technology infrastructure, whereas Kibirige and Nsubuga-Kyobe (2017) noted that the professional development of teachers in Uganda has not adequately addressed the integration of technology in teaching and learning. As a result, many teacher trainers lack the necessary skills and knowledge to effectively use multimedia technology in their classrooms. This research was aimed at establishing effective mechanisms for utilizing Multimedia Technology to enhance teaching in the Classroom within the teacher training institutions in Uganda, taking a case of Victoria University.

Objectives

The study was guided by the following objectives:

1. To establish the effect of pedagogical utilization of multimedia technology on the classroom teaching at universities.
2. To find out specific challenges faced by teacher-trainers in utilizing multimedia technology in teaching at universities.

Significance

This study intended to provide a new framework to the teacher-trainers on how best to utilize multimedia technology in classroom to improve teaching and learning at universities. But again, **s**ince employers and other stakeholders are demanding for quality education today which promotes personal soft skills as well as the discipline competence, students attain fundamental ICT knowledge and skills.

Review of the Related Literature

Pedagogical utilization of multimedia technology in a classroom

One of the ways multimedia technology influences teaching is by increasing student engagement. Studies have found that multimedia content can capture students' attention and maintain their interest, leading to greater engagement and participation in the learning process (Vogel, Reichelt, & Womser-Hacker, 2020; Chen & Hung, 2018). For example, incorporating videos and images into lectures can help illustrate complex concepts and make them more relatable and understandable for students (Tazbir & Grudzien, 2019). Additionally, interactive multimedia tools such as educational games and

simulations can provide students with an immersive and engaging learning experience (Bieglmayer & Friedrich, 2021). Another way multimedia technology influences teaching is by enhancing student motivation. Studies have shown that multimedia content can help motivate students by making learning more enjoyable and appealing (Zhao, Zhang, & Wang, 2018; Hsiao & Chen, 2019). For instance, gamification elements such as badges and rewards can motivate students to complete tasks and assignments (Liu, Lee, & Lin, 2021). Moreover, multimedia technology can help cater to students' diverse learning styles and preferences, thereby increasing their motivation to learn (Chen & Hung, 2018).

Multimedia technology can also influence teaching by improving learning outcomes. Studies have demonstrated that multimedia content can improve students' understanding and retention of information (Tazbir & Grudzien, 2019; Bieglmayer & Friedrich, 2021). For example, videos and animations can help students visualize abstract concepts and processes, leading to better understanding and recall (Khalid, 2019). Additionally, multimedia tools such as digital storytelling and augmented reality can provide students with a more interactive and immersive learning experience, leading to better retention and application of knowledge (Chen & Hung, 2018; Wang, Li, & Feng, 2021). Chen and Chen (2018), it was found that the use of multimedia resources significantly increased students' motivation and engagement in the learning process. Similarly, a study by Sutirna and Wahyuni (2020) found that multimedia technology enhanced students' understanding and retention of course content, leading to improved academic performance. Other studies have explored the benefits of specific multimedia tools, such as videos and interactive simulations. For example, a study by de Araújo et al. (2021) showed that the use of videos as a teaching tool improved students' comprehension and retention of course material. Similarly, a study by Lin et al. (2017) found that interactive simulations were effective in helping students understand complex scientific concepts.

Challenges faced by teacher-trainers in utilizing multimedia technology

There are challenges faced by teacher-trainers when using video technology in the classroom. Firstly, video technology can enhance student engagement and promote active learning, but can also be challenging for teachers who lack technical skills and training (Klassen, S., 2011). One of the primary challenges faced by teacher-trainers in utilizing multimedia technology in teaching is technical challenges is due to lack of I.T hardware, software, and network infrastructure (Shroff and Vogel, 2013). Yuen and Ma (2008) found that teacher-trainers face significant pedagogical challenges in integrating multimedia technology into their teaching practice. Lack of ICT training is another significant challenge faced by teacher-trainers. Many teacher-trainers may not have received adequate training on how to use multimedia technology in teaching. This can lead to a lack of confidence and competence in utilizing multimedia technology effectively. In their study, Mamlok-Naaman and Kali (2008) found that teacher-trainers require more training and support to integrate multimedia technology effectively into their teaching practice. Teacher-trainers may face resistance to change from their colleagues, students, or institutions when trying to integrate multimedia technology into their teaching practice. In their study, Ho and Hsieh (2017) found that teacher-trainers faced resistance to change from colleagues and students, which hindered their integration of multimedia technology into teaching.

Teacher-trainers may face time constraints when trying to integrate multimedia technology into their teaching practice. The process of creating multimedia materials can be time-consuming, and teacher-trainers may not have the necessary time to invest in creating high-quality multimedia resources. In their

study, Robertson et al. (2018) found that time constraints were a significant barrier to the effective use of multimedia technology in teaching. The other paramount challenge of using multimedia technology in teaching cognitive overload, where the amount of information presented exceeds the cognitive processing capacity of learners. Teacher-trainers need to be aware of this and design their multimedia materials to avoid cognitive overload. In their study, Sweller et al. (2019) found that cognitive overload was a significant challenge faced by teachers when integrating multimedia technology into teaching.

Hypothesis

H_1:

The study hypothesized that, Pedagogical utilization of multimedia technology has an effect on the classroom teaching at universities.

Methodology

A case study design was used and the researcher targeted teacher-trainers in the Humanities and Social Sciences and Faculty of Science and Technology, Victoria University and a total of 36 teacher trainees were randomly selected, these included both male and female lecturers handling the following modules: curriculum design and development, educational technology, computer applications, Geographical Information systems, Economics education, philosophy, comparative education and Educational psychology. Data were collected using a self-administered questionnaire, thematic content analysis was used to analyze qualitative data, descriptive statistics and Pearson's Correlation Coefficient were applied to analyze the quantitative data.

Results and Discussion

Table1: Participants' Level of education

Level	Frequency	Percent	Cumulative Percent
Masters	30	83.3	83.3
PhD	6	16.7	100.0
Total	36	100.0	

Majority of participants (83%) were at the level of master's degree. However, to establish whether the level of education influenced their ability to use multimedia technology in classroom teaching,

Independent samples t-test results on how lecturers' level of education influences use of multimedia technology in classroom

Table2: One-Sample Statistics showing mean values for both lecturers' level of education and Use of multimedia Technology in classroom

Level of Education	N	Mean	Std. Deviation	T-Test	P-Value
Masters	30	38.47	4.29	**-.55**	**0.4013**
PhD	6	40.00	2.00		

The means depicted in the above Table show that both Master's and PhD lecturers on average have different means values for the indicators of the dependent variable which stood at mean =38.47±4.29 and 40.00±2.00 respectively, which were insignificant (.4013 > 0.05). This suggests that the responses on the

aspects of use of multimedia technology in classroom was not influenced by lecturers' level of education.

Relevance of multimedia in classroom teaching

Further, it was reported that, multimedia technology enhances engagement and retention, supports active learning, enhances accessibility, used to create interactive learning experiences that encourage students to actively participate in the learning process, multimedia can make learning more accessible for students with different learning needs, as it can provide alternative ways of presenting information such as captions for videos and audio descriptions for images, facilitates collaboration among students, as it allows for the sharing of content and ideas in different formats. Multimedia technologies enable flipped classroom models, can be used to create instructional videos that students can watch at home, which can free up class time for more interactive and collaborative learning activities. This is known as the flipped classroom model, which has been shown to be effective in improving student learning outcomes. Multimedia use also increases students' creativity, enhances memory retention, provides real-world context but also improves digital literacy skills.

Table3: Descriptive Statistics indicating participants' responses on use of multimedia technology in classroom

Test Item	N	Min	Max	Mean	Std. Dev.
I am positive towards using multimedia resources to enhance my teaching.	36	4.00	5.00	4.805	.40139
I do think self-efficacy is a key aspect in using multimedia resources to enhance teaching.	36	4.00	5.00	4.750	.43916
I think teachers' ICT background knowledge is fundamental in influencing its use and integration in teaching.	36	3.00	5.00	4.166	1.00000
I do think, subject disciplinary background (academic disciplines) has also influenced teachers' potential to use ICT in teaching.	36	4.00	5.00	3.194	.30139
I am of the view that teacher educators in the humanities have been very practical in using multimedia in teaching as compared to their counterparts in Science.	36	1.00	3.00	1.805	.52478
The way our curriculum is designed supports teachers' ability to use multimedia to support teaching.	36	1.00	4.00	3.027	1.15847
The current ICT policies in the University greatly promote teachers' potential to use multimedia in teaching	36	1.00	5.00	3.777	1.56955
The available ICT structures in the University greatly support teachers to integrate multimedia in teaching	36	1.00	5.00	3.888	1.50765
Leadership styles are a key factor in promoting use of multimedia in teaching	36	3.00	5.00	4.416	.60356

Basing on the above descriptive statistics, respondents clearly indicated that, they were very positive towards using multimedia resources to enhance teaching, self-efficacy is a key aspect in using

multimedia resources, teachers' ICT background knowledge is fundamental in influencing its use and integration in teaching, subject disciplinary background might influence teachers' potential to use multimedia technology, although participants revealed that there is no major gap between Faculty staff from science and humanities. Lecturers believed that curriculum is design affects use of multimedia technology in teaching, and that institutions' ICT policies also greatly affect teachers' potential to use multimedia in teaching, ICT structures were considered very important when it comes to utilization of multimedia in teaching, but also leadership styles are a key in promoting use of multimedia in teaching.

Table 4: Pearson's Correlation Co-efficient the pedagogical utilization of multimedia technology on the classroom teaching

Test Variables		Multimedia Technology	Classroom Teaching
Multimedia Technology	Pearson Correlation	1	R=.915**
	Sig. (2-tailed)		.000
	N	36	36
Classroom Teaching	Pearson Correlation	R= .915**	1
	Sig. (2-tailed)	.002	
	N	36	36
**. Correlation is significant at the 0.01 level (2-tailed).			

Pearson's Correlation Coefficient for multimedia technology and classroom teaching was **r = 0.915**, which was positive with probability value **(p = 0.002)** less than **α = 0.01** suggesting a significant correlation, implying that multimedia technology significantly and positively correlated with classroom teaching at universities at the one percent level of significance.

Challenges of utilizing multimedia technology in teaching

Teacher trainers raised a number of challenges faced while trying to integrate multimedia technology in classroom teaching and these included but not limited to the following: Technical Challenges which include issues of; hardware, software, and network infrastructure management; pedagogical challenges relate to the effective utilization of multimedia in teaching, so many teacher trainers failed to understand, at what point and to when to use multimedia in teaching; lack of training is another factor that was raised by a few teacher trainers who indicated that, since technology keeps on changing, they often need to be trained especially on the new technological advances; lack of resources especially new gadgets like computers, which can match with the new software; time constraint was also raised as one of the key challenges to teacher trainers who end up with teaching overload. Teacher trainers claim that, preparation for teaching requires a lot of time, so identifying or even development relevant materials is usually constrained by time. Attitude was also mentioned as a critical challenge in promoting utilization of multimedia technologies in classroom teaching, many teachers want to do things in the traditional mode. Lastly, many teachers lack confidence in using multimedia technology.

Discussion

The utilization of multimedia in the classroom has become increasingly prevalent in recent years, and for good reason. Multimedia can provide a range of benefits for both students and teachers, including increased engagement, enhanced learning outcomes, and more effective instruction. Study findings

revealed that, there is no doubt that multimedia technology enhances teaching/learning by creating active learning environment, motivating learners, promoting collaboration. These results do not differ from those of Tazbir & Grudzien, (2019) who found that, incorporating videos and images into lectures can help illustrate complex concepts. But also, Bieglmayer & Friedrich, (2021) revealed that, use of multimedia in classroom enhances learner motivation. Study findings are in agreement with Zhao, Zhang, & Wang, 2018; Hsiao & Chen (2019) who found that multimedia content motivates students by making learning more enjoyable and appealing. Also Liu, Lee, & Lin, (2021) are in agreement with findings when they reveal that, gamification elements such as badges and rewards can motivate students to complete tasks and assignments. One of the challenges raised in the study is time factor which is also in agreement with Robertson et al. (2018) who found that time constraints were a significant barrier to the effective use of multimedia technology in teaching.

Conclusion

In conclusion, the utilization of multimedia in the classroom can have a range of benefits, including increased engagement, enhanced learning outcomes, and more effective instruction. Multimedia tools such as videos, animations, simulations, and interactive quizzes can help to illustrate complex concepts and reinforce learning in ways that traditional verbal or written instruction may not be able to achieve. However, it is important to approach the use of multimedia with careful consideration and to develop strategies to address potential challenges. By doing so, teacher-educators can effectively leverage the power of multimedia to create a more dynamic and engaging learning environment that supports the success of all students.

Recommendations

1. Teacher trainers should ensure that multimedia content is relevant and aligned with the curriculum, the content should be carefully selected to align with the learning objectives and outcomes of the curriculum.
2. Teacher trainers should provide guidance and support for students in using multimedia content effectively, such as by providing instructions or resources for accessing and using the content.
3. Teacher trainers should stay up-to-date with new technologies and multimedia trends, to ensure that they are using the most effective and engaging multimedia content in the classroom.

References

1. Bieglmayer, A. M., & Friedrich, F. (2021). Gamification and multimedia: A systematic literature review. Computers & Education, 166, 104147.
2. Chen, Y. L., & Hung, H. T. (2018). The effects of multimedia technology on learning effectiveness: A meta-analysis. Journal of Educational Technology & Society, 21(4), 207-222.
3. Clark, R. C., & Mayer, R. E. (2008). E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons.
4. Guo, L., Chen, I., & Lin, J. (2018). The effectiveness of using multimedia materials in English language teaching. International Journal of Learning, Teaching and Educational Research, 17(10), 179-191.
5. Hsiao, H. S., & Chen, W. L. (2019). Using multimedia learning to enhance learning motivation and learning performance: A meta-analysis. Computers & Education, 129, 119-133.

6. Khalid, M. (2019). Use of multimedia in teaching and learning: A systematic review. Journal of Educational Technology & Society, 22(4), 137-151.
7. Kibirige, H., & Ssentanda, M. (2019). Impact of Multimedia on Primary School Pupils' Learning Outcomes in Uganda. Journal of Education and Practice, 10(12), 42-51.
8. Liu, E. Z. F., Lee, C. K. E., & Lin, C. P. (2021). The effects of gamification on student engagement and learning outcomes: A meta-analysis. Educational Research Review, 34, 100405.
9. Mayer, R. E. (2014). Multimedia learning: Second edition. Cambridge University Press.
10. Mayer, R.E., 2003. The promise of multimedia learning: using the same instruction design methods across different media. Learning Instruction, 13, 2, p. 125–39.
11. Namagembe, I., Nalumansi, N., & Namyalo, S. (2019). Using Multimedia to Enhance Access and Quality of Education in Rural Areas of Uganda. International Journal of Emerging Technologies in Learning, 14(24), 157-171.
12. Namala, M. S., & Mukiibi, B. M. (2018). Challenges faced by teachers in the utilization of multimedia resources in the classroom: A case study of selected secondary schools in Uganda. International Journal of Education and Research, 6(1), 121-138.
13. Rajendra and I Made Sudana 2018 J. Phys.: Conf. Ser. 953 012104.
14. Shroff, R. H., & Vogel, D. R. (2020). Technology in teacher education: A study of the use of multimedia technology by teacher educators. Journal of Digital Learning in Teacher Education, 29(4), 112-121.