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Extensiveness Use of Audio-Visual Technology in Enhancing Interactive Learning Among Teacher Trainees in Northern Zone Teachers' Colleges, Tanzania

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Abstract: The study intended to investigate the extensiveness use of audio-visual technology in enhancing interactive learning among teacher trainee in Norther Zone colleges, Tanzania. The study employed a convergent research design under a mixed methods research approach, and the Diffusion of Innovation Theory (DIT) by E. M. Rogers (1962) as a guiding theoretical framework. The study was guided by one research question focused on examining the extent to which audio-visual technology enhances interactive learning among teacher trainees in Northern zone teachers' colleges, Tanzania. The target population comprised 13 Teachers' Training Colleges, 3,446 Teacher Trainees, 397 Tutors, and 13 Principals, from whom a sample size of 389 was selected through stratified random and purposive sampling techniques. A pilot study was conducted in one Teacher Training College. The questionnaires' reliability for Likert-type items was ensured using Cronbach's Alpha Coefficient, whereby 0.73 for Teacher Trainees and 0.894 for Tutors was obtained, while reliability for qualitative data was verified through peer debriefing and triangulation. Data collection instruments were validated by MWECAU research experts in the field of curriculum and instruction. Data were collected using questionnaires, an interview guide and an observation guide. Quantitative data were collected using questionnaires and analysed using SPSS vision 22, while qualitative data from observations and interviews were analysed using thematic analysis. Ethical considerations were strictly upheld throughout the research. The study found that the integration of audio-visual technology in large extent enhances interactive learning among teacher trainees. Specifically, the use of audiovisual tools was observed to increase learner engagement, encourage active participation, and promote collaboration within the learning environment. The study concluded that audio-visual resources play a critical role in simplifying complex concepts, enabling creative lesson delivery, and fostering the development of essential teaching skills. These findings suggest that audio-visual technology is not only effective for content dissemination but also fundamental in establishing an interactive, learner-cantered educational setting that actively involves student-teachers in the teaching and learning process.

Keywords: *Audio-Visual Technology, Interactive Learning, Learner Engagement, Active Participation, Collaboration, and Teaching Skills.*

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I. INTRODUCTION

Interactive learning opens the way to active student involvement through hands-on tasks, group work, and real-time feedback. It transforms the classroom into a space for exploration, where students are encouraged to question, discuss, and solve problems together. Instead of passively receiving information, learners engage with content in meaningful ways, making the learning experience more dynamic, memorable and effective. UNESCO, (2015) defines quality education as education that ensures effective learning outcomes, relevant skills, and competent teaching. It

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emphasizes safe, inclusive, and supportive learning environments. Quality education also involves measuring educational attainment and learning achievement. It aims to develop both cognitive and non-cognitive skills essential for lifelong learning.

Vollmer et al. (2023) describes interactive learning as a co-construction process in which both the teacher and the learner collaboratively develop understanding and perform tasks by leveraging prior knowledge and shared experiences. This process, commonly seen in parent-infant interactions, uses scaffolding strategies that allow effective teaching with minimal demonstrations. Nicolaou et al. (2022) emphasized that audiovisual materials enhance interactive learning by engaging adult learners through dynamic, non-verbal communication that supports emotional and psychological well-being. They promote active participation, reflection, and collaboration during the learning process. Additionally, the integration of ICTs with audiovisual tools improves both instructional effectiveness and learners' mental health in adult education settings.

Intan et al. (2022) explains that audiovisual technologies are tools that combine both sound and visual elements such as videos, films, computer-based multimedia, and interactive platforms like Zoom or language learning apps to enhance learning and communication. These technologies make instruction more engaging, dynamic, and effective by stimulating multiple senses, which helps improve students' attention, understanding, and retention. Molenda, (2023) explains that audiovisual technology in education emerged in the early twentieth century with advances in optics and electricity, enabling the use of projected images, motion pictures, and audio recordings. Educators adopted these tools to enrich learning beyond verbal instruction. The growth of radio in the 1930s and television in the 1950s allowed educational content to reach wider audiences. By the 1960s, behaviourist teaching machines further combined psychological theories with audiovisual innovations to support teaching.

The integration of digital technologies in teacher education is increasingly emphasized worldwide, with a focus on enhancing both technical and pedagogical competencies among educators. In the European Union, the Digital Education Action Plan (2021–2027) promotes embedding digital pedagogy into initial teacher training through practical experience with digital tools and collaborative initiatives such as Erasmus+ and eTwinning (Massadikov, 2022). Similarly, Rwanda's ICT in education policy encourages teachers to integrate ICT into daily practice, although its implementation is challenged by limited infrastructure, access to digital devices, and insufficient technical support (Kwihangana, 2025; Nyirahabimana et al., 2022). In Kenya, education reforms have focused on ICT integration by revising policies, training teachers, distributing digital devices, and implementing systems like the Teacher Management Information System (TMIS) and the National Education Management Information System (NEMIS) (Kenya Institute for Public Policy Research and Analysis, 2019, as cited in Barasa, 2021). However, despite these efforts, many tutors continue to lack the pedagogical skills necessary for effective ICT use in teaching (Chemwei, 2022). In Tanzania, the application of audiovisual technology in teacher education remains underdeveloped, with ongoing challenges in technology integration and the training of pre-service teachers. Collectively, these contexts underscore the urgent need for sustained investment in digital infrastructure, continuous professional development, and institutional support to realize meaningful digital transformation in teacher education.

In Tanzania the National ICT Policy 2024 emphasizes the integration of ICT in teaching and learning across all educational levels. It aims to enhance digital skills, promote ICT-enabled learning environments, and support the use of emerging technologies (URT 2024). National digital education guidelines for schools and teacher colleges (2025) highlights that the Ministry of Education ensures ICT integration in all curricula to promote interactive learning through digital and subject-specific skills. Schools and teacher colleges must use ICT tools and activities such as virtual simulations, with regular curriculum reviews supporting flexible learning pathways. (URT 2025) Hassani & Kitula, (2023) shows that ICT was substantially integrated into curriculum implementation across teacher training colleges in northern Tanzania. Its use improved teaching efficiency, reduced tutors' workload, and increased student engagement and motivation. Despite policy support for technology use in teacher training colleges, the study investigated the extent use of audio-visual technology in enhancing interactive learning among teacher trainee in Northern teachers' colleges, Tanzania.

➢ *Statement of the Problem*

Quality teacher education is essential for producing competent educators and improving the overall standard of education in Tanzania. However, interactive learning among teacher trainees in the Northern zone teachers' colleges remains inadequate, limiting their ability to develop critical teaching skills necessary for effective classroom practice. Educational researchers, tutors, and the trainees themselves have expressed concern over the limited opportunities for engagement and active learning, which hinder the acquisition of competencies such as lesson planning, classroom management, and inquiry-based instruction. Mpate et al. (2023) highlight that teacher trainees shows limited skills in lesson planning and classroom management during teaching practice. Mkimbili & Kayima, (2022) highlights that science teacher trainees often lack the skills and knowledge needed for effective inquiry-based teaching. The study by Mgaiwa & Milinga, (2024), Kitula, (2023) and Bitegeko et al.(2024) examined the use of technology in teaching and learning in teachers colleges, highlighting its integration in curriculum implementation, its role in enhancing teaching effectiveness, and the varying digital competency levels of teacher trainee, emphasizing the need for tailored training to improve technology use in education. None of the reviewed studies has adequately addressed the extensiveness use of audiovisual technology in enhancing interactive learning among teacher trainees. Therefore, the current study was investigated the extensiveness use of audiovisual technology in enhancing

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interactive learning among teacher trainee in Northern zone teachers' colleges, Tanzania.

- *Research Question*

The study was guided by the following research question.

To what extent does the use of audio-visual technology enhance interactive learning among teacher trainees in Northern zone teachers' colleges, Tanzania?

- *Significance of the Study*

The significance of this study lies in its capacity to enhance educational outcomes at multiple levels within teachers' colleges in Tanzania's Northern Zone. The integration of audio-visual technology will promote interactive learning among teacher trainees, cultivate deeper engagement, and facilitate the acquisition of practical teaching competencies critical for contemporary classrooms. Tutors will benefit from access to innovative pedagogical tools that will enrich instructional delivery, address diverse learner needs, and improve overall teaching effectiveness. Principals will gain empirical insights into the strategic value of investing in educational technologies to elevate institutional performance and learner achievement. Policymakers will receive evidence-based guidance to inform policy formulation, strategic planning, and targeted resource allocation aimed at strengthening technology integration in teacher education. Theoretically, the research will contribute to the advancement of educational technology discourse, particularly concerning interactive learning and the adoption of instructional technologies in teacher training. Moreover, it will generate context-specific knowledge on the barriers and enablers of implementing audio-visual tools in resource-constrained environments, offering a valuable reference point for similar educational contexts globally.

II. THEORETICAL FRAMEWORK

- *Diffusion of Innovation Theory*

The study was guided by the Diffusion of Innovation Theory (DIT), proposed by Everett M. Rogers in 1962. Rogers, an American sociologist and communication scholar, developed this theory to explain how new ideas, technologies, and practices spread within a society.

Bruce, (2022) highlighted that Diffusion of Innovations theory offers a comprehensive lens for understanding how new ideas and technologies spread across populations. It identifies four central elements innovation, communication channels, time, and social systems as critical to the diffusion process. The theory emphasizes that the characteristics of an innovation, such as its relative advantage, compatibility, and complexity, significantly influence its adoption. Communication among individuals and within groups plays a key role in spreading awareness, while the passage of time and the structure of social systems help determine how and when innovations are adopted.

Despite its strengths, the theory has limitations, particularly when applied to complex fields such as education or public policy. Its general framework may overlook the specific cultural, institutional, and contextual factors that shape adoption in these environments. As a result, it may provide only a partial understanding of why innovations succeed or fail. Additionally, while the theory describes broad patterns of adoption, it often lacks the precision needed to predict the exact rate or trajectory of adoption in diverse settings (Hidayat & Mukminin, 2022).

In the context of audiovisual technology, the theory helps explain how teacher trainee adopts tools for enhancing interactive learning. Key factors influencing this process include the perceived usefulness and ease of use of the technology, it's fit with current teaching practices, and the influence of peers and respected figures. Successful adoption also depends on addressing barriers through adequate training, institutional support, and ongoing encouragement. Applying the theory in this context allows educators and policymakers to develop strategies that support effective integration of technology into teaching and learning environments.

III. REVIEW OF EMPIRICAL STUDIES

- *Extent to Which the Use of Audio-Visual Technology Enhance Interactive Learning Among Teacher trainee in Northern Zone Teachers' Colleges, Tanzania*

The use of audio-visual (AV) technology has become increasingly important in enhancing interactive learning in teacher education. AV tools offer engaging and practical ways to deliver content, making lessons more dynamic and participatory. The integration of visual and auditory elements helps simplify complex concepts and promotes deeper understanding. Such technology supports active involvement, collaboration, and improved learning among trainees.

Tawil and Dahlan, (2021) conducted a convergent research design on Application of Interactive Audio-Visual Media to Improve Students' Creative thinking skill in Indonesia. In this study 62 students from the Science study program were involved whereby they were divided into two groups: Group A (31 students: 15 females, 16 male) who learned using Interactive Audio Visual (IAVs) media, and Group B (31 students) who learned using PowerPoint (PPT) media. Data were collected through observations, tests, and questionnaires. The results show that, students who used IAVs media demonstrated higher creative thinking skills compared to those using PowerPoint (PPT). The study demonstrates that Interactive Audio Visual (IAVs) media effectively enhances students' creative thinking skills. Students actively engaged in learning, found the media easy to use, and responded positively to its clarity and interactivity. However, the study involved 62 students from a single college's science study Program, which limits the generalizability of the findings to other disciplines or institutions. The small and homogeneous sample may not represent diverse learner backgrounds, learning styles, or educational contexts Therefore, this study addressed this gap by employing a larger, stratified sample across 13 teacher training colleges, enhancing generalizability.

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Vishnupriya & Bharathi, (2022) conducted a qualitative study on effectiveness of audio and visual aids in enhancing learners' attention spans and learning abilities among teacher trainee at Puratchi Thalaivar DR MGR Arts and Science College in India. The study involved one college with sample size of 30 teacher trainee. The study used questionnaires for data collection. The findings revealed that audio-visual aids effectively enhanced learners' learning abilities. Nevertheless, the study's exclusive focus on teacher trainee limits the scope of insights by excluding tutors, who are also key stakeholders in the teaching-learning process. Their perspectives could have provided a more comprehensive understanding of how audio-visual aids influence learner engagement from both instructional and experiential viewpoints. Also, relying solely on interviews may have restricted the depth of data, as triangulating with classroom observations or tutors feedback could have enriched the findings. To fill these gaps the current study involved tutors and college administration in the study. Also, questionnaires interview guide and classroom observation were also used in data collection.

Bakare, (2024) conducted a descriptive research design on the use of Audio-visual technology in promoting the teaching and learning of French language in Nigeria. The sample of the study consisted of 60 French teachers. Data were collected by using questionnaires. The findings of the study revealed that the integration of audio-visual aids significantly enhances various aspects of teaching and learning French. Nonetheless, the study collected data from teachers only, which limited the triangulation of information from different key informants such as teacher trainee, heads of departments, and heads of schools. Moreover, the study used only questionnaires in data collection, which restricted the depth and breadth of the data gathered. In filling this gap, the study involved teacher trainees and principals to enhance the triangulation of information and employed multiple data collection instruments such as interviews, questionnaires, and observation guide to ensure a more comprehensive understanding of the research problem.

Makena (2022) conducted a qualitative study on the use of audio-visual resources to enhance language learning in Zambia. The study involved four English language teachers selected through convenience sampling. The study used semi-structured interviews in data collection. It found that audio-visual tools increased learner participation and improved speaking, reading, and writing skills. However, the study's limited sample size, excluded key stakeholders such as teacher trainees and administrators, restricting the depth of insights. It also relied solely on interviews, limiting the richness of data. To address these gaps, the current study included a broader range of participants such as teacher trainees, tutors, and principals. and adopts a mixed-methods approach using questionnaires, interviews, and classroom observations. This aims to provide a more comprehensive understanding of how audio-visual technology enhances interactive learning.

Hassani & Kitula, (2023) conducted a study on how integrating Information Communication and Technology (ICT) affects curriculum implementation in teacher training colleges in northern Tanzania. The study employed a mixed methods research design, and the sample included 62 tutors, 102 second-year teacher trainees and selected academic deans. The instruments used for data collection were questionnaires for tutors and teacher trainees, and interview guides for academic deans. The study revealed that integrating technology positively influenced teaching effectiveness and learner engagement in the teacher training colleges. The study provided insights through its mixed methods approach but could be strengthened by including observational data to capture actual technology use in classrooms. Additionally, excluding first-year teacher trainees limits the understanding of technology's impact across different stages of teacher training, and their inclusion could offer a more comprehensive perspective. In filling these gaps, the current study was designed to include observational data to directly assess the use of audiovisual tools and their influence, while also incorporating both first year and second-year teacher trainees to gain a more comprehensive understanding of how audiovisual integration impacts learners at different stages of their training in enhancing interactive learning.

IV. DEMONSTRATION OF RESEARCH GAPS

Studies reviewed provide valuable findings on extensiveness of audio-visual technology in enhancing interactive learning among student teachers. Despite scholars like Tawil and Dahlan, (2021), Vishnupriya & Bharath (2022), Bakare, (2024), Makena (2022) Hassani & Kitula (2023) provided their views on effectiveness of audio-visual tools in enhancing teaching, learning, and learner engagement across various educational contexts. None of the reviewed studies has investigate extent use of audio-visual technology enhances interactive learning among teacher trainee in teachers' colleges. Therefore, this study filled the gap by investigating on extent to which the use of audio-visual technology enhances interactive learning among student-teachers in Northern zone colleges, Tanzania.

V. RESEARCH METHODOLOGY

The study adopted a convergent research design under a mixed methods research approach. According to Creswell & Creswell (2018) In a convergent design, the researcher gathers both quantitative and qualitative data, analyses each type separately, and then compares the findings to determine whether they support or contradict one another. The target population comprised 13 teachers' colleges, 13 principals, 397 tutors and 3,446 teacher trainees from Northern zone teacher' colleges which making total of (N = 3856). The sample was obtained through stratified random sampling for colleges, total population purposive sampling for principles and stratified simple random sampling for tutors and teacher trainee, resulting in the selection of Four teachers' colleges, Four principals 40 tutors and 345 student-teachers. Quantitative data were collected using questionnaires, while qualitative data was collected through interview guide and observation guide. The data collection instrument was pilot tested in one teachers' college which was not included in the

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actual study. Reliability of the Likert scale items in the questionnaires was ensured using Cronbach's Alpha, with an acceptable coefficient of 0.775. Trustworthiness of the qualitative data were analysed using SPSS version 22. Data collection instruments were validated by research experts from department of educational psychology and curriculum studies. Qualitative data was analysed thematically according to Creswell and Creswell (2018). The study adhered to research ethical principles throughout the research process.

VI. FINDINGS AND DISCUSSION

The study aimed to examine the extent use of Audio-visual technology in enhancing interactive learning among teacher trainee in Northern zone colleges, Tanzania. The five-level Likert scale was utilized for data analysis, with 1= Very Low Extent (VLE), 2 = Low Extent (LE). 3 = Neutral (N), 4 = High Extent (HE), 5 = Very High Extent (VHE), F = Frequencies, % = Percentages, M = Mean. The frequency and percentage distribution of responses were categorized as follows: ≤ 20=extremely minority; 21 - 49=minority; 50 - 59 = moderate; 60-69 = majority; 70 - 89 = very high majority; 90-99 = extreme majority; 100 = overwhelming majority (Taherdoost, 2019). A mean score greater than 3 indicates that audiovisual technology enhances interactive learning among student-teachers in colleges, while a mean score below 3 suggests it does not (Hutchinson & Chyung, 2023). Responses from student-teachers and tutors are summarized in Table 1.

Table 1 Student-Teachers and Tutors' Responses on the Extent to Which the Use of Audio-Visual Technology Enhances Interactive Learning Among Student-Teachers in Northern Zone Teachers' Colleges, Tanzania (n 385)

S/N	Statements	Responses	VLE		LE		N		HE		VHE		Mean
			f	%	f	%	f	%	f	%	f	%	
i.	The use of audio-visual technology increases engagement during lessons	Students	6	1.7	8	2.3	42	12.2	156	45.2	133	38.6	4.17
		Tutors	0	0.0	0	0.0	4	10.0	19	47.5	17	42.5	4.17
ii.	Audio-visual materials help in understanding complex topics more easily	Students	2	0.6	18	5.2	46	13.3	131	38.0	148	42.9	4.17
		Tutors	0	0.0	0	0.0	1	2.5	27	67.5	12	30.0	4.17
iii.	Audio-visual technology facilitates collaboration among students during group activities	Students	10	2.9	15	4.3	60	17.4	133	38.6	127	36.8	4.02
		Tutors	1	2.5	0	0.0	7	17.5	16	40.0	16	40.0	4.02
iv.	The integration of audio-visual tools motivates students' active participation in a class	Students	1	0.3	11	3.2	29	8.4	120	34.8	184	53.3	4.38
		Tutors	0	0.0	1	2.5	4	10.0	18	45.0	17	42.5	4.38
v.	The retention of information is enhanced when audio-visual aids are used in a lesson	Students	9	2.6	25	7.2	64	18.6	146	42.3	101	29.3	3.88
		Tutors	0	0.0	0	0.0	5	12.5	16	40.0	19	47.5	3.88
vi.	Using audio-visual technology helps in developing essential teaching skills	Students	3	0.9	18	5.2	32	9.3	120	34.8	172	49.9	4.28
		Tutors	0	0.0	0	0.0	2	5.0	18	45.0	20	50.0	4.28
vii.	Audio-visual technology provides immediate feedback during learning activities	Students	7	2.0	23	6.7	47	13.6	129	37.4	138	40.0	4.08
		Tutors	0	0.0	3	7.5	3	7.5	16	40.0	18	45.0	4.08
iii.	Audio-visual resources make learning materials more accessible for all students	Students	9	2.6	28	8.1	57	16.5	126	36.5	125	36.2	3.96
		Tutors	0	0.0	2	5.0	5	12.5	19	47.5	14	35.0	3.96
ix.	The use of audio-visual technology encourages creativity in lessons delivery	Students	5	1.4	18	5.2	43	12.5	126	36.5	153	44.3	4.17
		Tutors	0	0.0	0	0.0	4	10.0	20	50.0	16	40.0	4.17
x.	The use of audio-visual technology positively impacts student's learning experience	Students	5	1.4	16	4.6	48	13.9	133	38.6	143	41.4	4.14
		Tutors	0	0.0	0	0.0	4	10.0	21	52.5	15	37.5	4.14
Average Total		**Students**											**4.12**
		Tutors											**4.13**

Key: Very Small Extent (VSE) = 1, Small Extent (SE) = 2, Moderate Extent (ME) = 3, Large Extent (LE) = 4, Very Large Extent (VLE) = 5

Source: Field Data, (2025)

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Data in Table 1 portrays that a very high majority (83.8%) of teacher trainee indicated that very high extent use of audio-visual technology increases engagement during lessons, while an extreme minority (4.0%) of teacher trainee indicated small extent use of audio-visual technology increases engagement during lesson. The mean score of 4.17 for teacher trainee implies that most teacher trainee view audio-visual technology as an effective means to increase interactive learning. This indicates that audio-visual tools are widely accepted for improving engagement during lessons. A small minority of teacher trainee do not support its effectiveness. Similarly, extreme majority (90.0%) of tutors rated large extent use of audio-visual technology increases engagement during lessons, while 10% remained neutral. The mean score was 4.17 for tutors. This implies that tutors strongly recognize the role of audio-visual technology in enhancing classroom engagement. This indicates that tutors are confident in the value of audiovisual technology in engaging teacher trainee during lessons. The data were supported by the arguments of the Principal of College "1" during face-to-face interviews, who shared these views:

Audio and video technology in education captures students' attention, fosters engagement, and supports diverse learning styles. By incorporating humour and emotional connection, it creates an enjoyable learning experience. These tools enhance memory retention and improve feedback quality, helping educators assess students' understanding more effectively through visual and auditory cues. (*The Principal College "1"; Personal Communication, 18 January 2025)*

Also, the Principal of College "3" gave this view.

Audio-visual technology engages multiple senses, helping students to learn through both sight and sound. It increases participation and motivation; it encourages curiosity and deeper interaction. Collaboration is enhanced through interactive tools such as tablets and computers. The technology also supports diverse learning needs, making education more inclusive *(The Principal College 3; Personal Communication, 21 January 2025)*

In addition, data from the observation guide show that tutors effectively utilized instructional technology in the teaching and learning process. Tools such as projectors, laptops and iPads were strategically integrated to present content clearly and engagingly. These technologies facilitated student interaction through visual demonstrations, and group discussions thus significantly enhancing interactive learning and maintaining active student participation.

The findings consistently show that audio-visual technology plays a key role in enhancing interactive learning, with a large majority of both teacher trainees and tutors reporting that its use significantly increases engagement during lessons. Views shared by College Principals emphasized how such technology captures attention, supports diverse learning styles, and promotes deeper student interaction. Classroom practices further reflected effective use of tools such as projectors and iPads to present content clearly and encourage participation. The findings are in line with those of the study by Vishnupriya & Bharathi, (2022) who found that audio-visual technology significantly increases student attention and participation. The study revealed that multimedia tools capture learners' attention and motivate them to participate actively in the learning process. It also showed that students found the lessons more enjoyable and creative when audio-visual elements were used.

Table 1 data show that, a very high majority (80.9%) of teacher trainees indicates that in large extent the use audio-visual materials help in understanding complex topics more easily, while an extreme minority (0.6%) of teacher trainee indicated in small extent the use of audio-visual materials helps in understanding complex topics more easily. The mean score was 4.17 for teacher trainee which implies that they widely acknowledge the usefulness of audio-visual technology in simplifying complex subject matter. This indicates that the integration of audiovisual technology plays a significant role in improving their understanding. A small minority of teacher trainees do not support the idea. The findings demonstrate that teacher trainees strongly support the use of audio-visual technology in enhancing comprehension.

Also, an extreme majority (97.5%) of tutors rated high extent that audio-visual technology help student teachers in understanding complex topics more easily, while an extreme minority (0.0%) of tutors rated small extent. The mean score was 4.17 for tutors. The data imply that tutors strongly support the use of audio-visual materials in aiding student teachers' understanding of difficult content. This indicates a clear recognition among tutors of the instructional value of such technology. The findings confirm tutors strong believe on the positive impact of audio-visual tools in teaching complex topics.

The findings were supported by the arguments of Principal of College "1" during face-to-face interviews who shared these views.

Audio-visual tools enable students to visualize complex topics, breaking them down into manageable parts. These tools help students to connect abstract concepts with real-world examples, making learning more engaging and interactive. They also encourage independent problem-solving by providing varied perspectives. Students can revisit content as needed, enhancing their understanding *(the principal college "1"; Personal Communication, 18 January 2025).*

In addition, the principal of college "4" gave these views, The use of audio-visual technology helps teacher trainees understand complex topics by engaging them more actively in the learning process. It encourages critical thinking, supports creativity in creating and selecting visual materials, and allows trainees to explore content interactively, especially through access to learning resources in computer

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labs (*the Principal of College "4"; Personal Communication, 14 February 2025).*

During observations, the researcher observed audio-visual technology enhancing teacher trainees' critical thinking and problem-solving skills. Complex teaching methodologies, such as problem-based learning, were effectively demonstrated through instructional videos and interactive presentations. These audio-visual tools helped simplify abstract pedagogical concepts, allowing trainees to better understand and visualize teaching processes. By engaging with such resources, teacher trainees were able to reflect on instructional strategies, analyse their components, and consider their practical applications.

Findings from interviews, and observations all point to the significant impact of audio-visual materials in making complex topics easier to understand. Educators highlighted that these tools help break down difficult concepts into manageable parts and engage learners actively, encouraging critical thinking, creativity, and meaningful interaction with the content. Observations revealed that audio-visual technology supports interactive learning and problem-solving by clearly demonstrating abstract teaching methods and allowing learners to explore ideas dynamically. This consistent agreement across different sources shows that audio-visual aids are valuable in simplifying challenging content, fostering interaction, and enhancing overall comprehension. These findings align with findings in a study by Mutiasari & Rusnilawati (2022) in Indonesia, which similarly emphasized that, audio-visual technology integrated with the Discovery Learning model significantly improved students' problem-solving abilities. It also fostered greater independence among learners. This engaging approach reduced boredom and enhanced critical thinking in the learning process.

Moreover, data in Table 1 shows that a very high majority (75.4%) of teacher trainees shows in large extent that use of audio-visual technology facilitates collaboration among teacher trainees during group activities, while an extreme minority (2.9%) of teacher trainees indicated that in small extent audiovisual technology facilitates collaboration among teacher trainees. The mean score was 4.02 for teacher trainees which implies that most teacher trainees perceive audio-visual technology as supportive in promoting teamwork and collaborative learning. This indicates that audiovisual technology enhances interaction and communication during group-based learning tasks. The findings highlight the perceived value of audio-visual tools in fostering student collaboration.

Furthermore, a very high majority (80.0%) of tutors indicated in high extent that audio-visual technology facilitates collaboration among teacher trainees during group activities, while an extreme minority (2.5%) of tutors rated that audiovisual technology facilitate collaboration among teacher trainee in a small extent. The mean score was 4.02 for tutors which implies that most tutors acknowledge the role of audio-visual technology in encouraging collaborative engagement among teacher trainees. This indicates that tutors view such technology to promote active group learning. The findings confirm tutors' favorable perception of the collaborative benefits of audio-visual technology in educational settings.

Moreover, during the interview, the Principal of College "4" had this to say,

Audio-visual technology enhances collaboration among teacher trainees by involving them in both the creation and selection of visual materials. This process actively engages teacher trainees in the learning experience, making them participants in the development of teaching tools. Audio-visual technology also promotes collaboration by encouraging group work, where teacher trainees can collaborate on tasks and explore various materials together (*The Principal College "4"; Personal Communication, 14 February 2025)*

Through the face-to-face interview, the principal of college "2" remarked, "*In my experience, audio-visual technology has greatly facilitated collaboration among teacher trainees by encouraging group discussions, shared learning activities, and teamwork through engaging and interactive educational content"* (*The Principal college "2"; Personal communication, 23 January 2025*).

In observation, the researcher noted that technology was effectively utilized to facilitate collaborative learning among teacher trainees. Group tasks were assigned, and trainees worked together using digital tools to share ideas and complete assignments. This approach encouraged peer interaction, teamwork, and joint problem-solving. Overall, the integration of technology supported an interactive and cooperative learning environment.

The findings consistently highlight that audio-visual technology plays a significant role in fostering collaborative learning. Responses from participants indicated strong support for its ability to enhance cooperation and interaction. This was reinforced by comments from institutional leaders, who emphasized how such tools promote active participation through group discussions, shared tasks, and the co-creation of learning materials. Observations in the classroom environment further confirmed that digital tools were effectively employed to support group activities, enabling learners to work together, exchange ideas, and solve problems collectively. Collectively, the perspectives and observations align to demonstrate that audio-visual technology is widely seen as an effective catalyst for collaborative engagement. These findings align with Bakare (2024), who noted that integrating technology in higher education promotes interaction, engagement, and teamwork among adult learners. Bakare also emphasized the need for institutional support in ICT infrastructure and training to sustain effective collaborative learning.

Data in Table 1 shows that a very high majority (88.1%) of teacher trainees indicated that audio-visual tools is motivating students' active participation in class to large extent, while an extreme minority (0.3%) of teacher trainees

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rated it to a very low extent. The mean score was 4.38 for student teachers which implies that high majority of teacher trainee believe audio-visual tools play a significant role in encouraging student engagement. This indicates that the integration of such tools is seen as highly effective in promoting active classroom involvement. An extreme minority of teacher trainees do not perceive this benefit.

Moreover, a very high majority (87.5%) of tutors showed in large extent that audio-visual tools motivate teacher trainee's active participation in class, while an extreme minority (12.5%) of tutors remained neutral. The mean score was 4.38 for tutors which implies that tutors believe in the motivational influence of audio-visual technology on teacher trainees. This indicates that tutors view these tools as valuable in increasing student teachers' participation during lessons. The findings affirm that tutors recognize the positive impact of audio-visual technology on classroom participation. Furthermore, through the face-to-face interview, the principal of college "3" had this to say,

Audio-visual technology boosts active participation by increasing engagement, collaboration, and critical thinking among teacher trainees. It activates multiple senses, enhancing comprehension, memory, and motivation. Tools like projectors, tablets, and internet-connected devices encourage self-directed learning and problem-solving skills. These technologies also promote collaboration between peers and tutors, while supporting independent learning *(The Principal of college "3"; Personal Communication, 21 January 2025)*

Also, during the face-to-face interview. the Principal of College "1" said "*I believe audio-visual technology enhances interaction among teacher trainees by encouraging collaboration and creativity. It helps trainees engage actively through group discussions and hands-on preparation of teaching aids, making learning more dynamic and effective*" (*Principal of college "1"; Personal communication, 18 January 2025*). During the observation, the researcher noticed teacher trainees actively were interacting with audio-visual technology, such as videos and animations in the lesson. Learners appeared attentive and responsive, showing increased involvement compared to traditional teaching methods. The audio-visual aids seemed to capture their interest and encouraged more interaction during the class. This demonstrated that the use of audio-visual technology enhanced active participation among student teachers.

Findings from educators, college principals, and classroom observations consistently show that audio-visual tools enhance participation, engagement, and critical thinking. Videos and animations make trainees more attentive, confirming through multiple sources that such tools foster deeper understanding and interactive learning environments. This aligns with findings by Haruna and Amos (2024), who reported that audio-visual tools significantly boost students' active participation by making lessons more engaging and encouraging contributions during discussions and activities.

Table 1 data shows that a very high majority (71.6%) of teacher trainees shows in large extent that audiovisual technology enhances information retention. In contrast, extreme minority (2.6%) of teacher trainee perceived that audiovisual tools contribute to retention to a low extent. The mean score of 3.88 further suggests that teacher trainees generally recognize audiovisual technology as an effective means of supporting memory retention. This indicates that such tools are widely viewed as beneficial in helping learners recall and understand lesson content more effectively. Although a few teacher trainees remain skeptical about its impact, the findings overall reinforce the use of audiovisual technology as a practical strategy to strengthen content retention among learners.

Moreover, a very high majority (87.5%) of tutors indicated that the use of audio-visual aids in large extent enhances information retention, while an extreme minority (12.5%) remained neutral. The mean score was 3.88 for tutors which implies that tutors largely recognize the effectiveness of audio-visual aids in supporting teacher trainees' memory and long-term learning. This indicates that they regard these tools as essential in helping students understand and remember key concepts. The findings confirmed tutors' confidence in audio-visual aids as tools that enhance retention in the learning process. The data was supported by the arguments from Principal of College "2" during face-to-face interviews has said that,

Audio-visual technology helps students retain information by making lessons more engaging. By using tools like projectors and videos, students can see and hear the content, which enhances their understanding. This interactive approach allows students to connect more deeply with the material, improving retention. Additionally, students are more likely to remember what they have seen and experienced visually in class (*The Principal of College "2"; Personal Communication, 23 January 2025)*

Also, during the face-to-face interview, the Principal of College "3" shared these views.

Audio-visual technology enhances retention among student-teachers by allowing them to see and hear information simultaneously, which strengthens their understanding and memory. As learners become more engaged, their curiosity grows—they start asking questions, contributing ideas, and actively participating in lessons, making learning more meaningful and lasting (*The Principal of College "3"; Personal Communication, 21 January 2025*).

In the observation, the researcher noted the use of instructional technology as having a positive influence on students' retention of content. Visual aids such as slides, videos, and diagrams were incorporated into the lesson, making the information more memorable and easier to understand. Students appeared more attentive and showed signs of recalling key points when asked follow-up questions, especially when the lesson involved multimedia elements. The instructor occasionally used interactive tools such as

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question-and-answer sessions, which reinforced understanding and supported memory retention.

The findings indicate a strong and consistent belief in the effectiveness of audio-visual aids in enhancing information retention during lessons. According to the respondents, these tools help make content more engaging and easier to understand, leading to improved memory and comprehension. Supporting this view, College Principals highlighted that when learners see and hear information simultaneously, their understanding and curiosity stimulation are strengthened, prompting greater participation and deeper learning. Classroom observations further confirmed that students were more attentive and able to recall key points when visual elements such as slides, diagrams, and videos were used, especially during interactive activities such as question-and-answer sessions. This combination of perspectives and observed behaviours underscores the powerful role of audio-visual tools in reinforcing learning and making educational content more memorable..The findings of the study are in line with that of Hassani & Kitula, (2023), who found that ICT tools such as projectors and videos enhance student engagement and improve information retention. By integrating audio-visual technology in curriculum delivery, students benefit from both visual and auditory stimuli, which reinforce learning. This interactive approach supports deeper understanding and sustained attention. The study confirms that such technologies simplify instruction and elevate learners' motivation and participation.

The findings revealed that the use of audio-visual technology enhanced interactive learning to a very large extent among teacher trainees in Northern zone teachers' colleges, Tanzania. Evidence from questionnaires, interviews, and classroom observations consistently showed that these tools increased learner engagement, simplified complex content, promoted collaboration, encouraged active participation, and improved information retention. The consistent and strong support across all data sources confirmed that audio-visual technology played a substantial role in creating an interactive and engaging learning environment, demonstrating its high impact in the teaching and learning process.

VII. CONCLUSION

Based on the findings, the study concludes that audio-visual technology enhances interactive learning among teacher trainees. It promotes greater engagement, collaboration, and active participation, which improves understanding and retention. The use of these tools contributes to a more dynamic and effective teaching and learning environment. Overall, audio-visual technology has a strong and positive impact on the educational process in teachers' colleges.

RECOMMENDATION

Based on the conclusion, it is recommended that teachers' colleges consistently integrate audio-visual technology to enhance interactive learning. Training programs should provide workshops and support to develop educators' pedagogical and technical skills for effective use of these tools. Educational institutions and policymakers should invest in infrastructure to ensure reliable access. Encouraging collaboration among educators to share best practices can maximize benefits. Promoting a culture where teacher trainees design and evaluate lessons using audio-visual materials will build competence and confidence. Institutionalizing these practices will prepare teacher trainees to create dynamic, technology-enhanced learning environments.

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