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### Influence of Teaching Technology on Academic Engagement of Students with Hearing Impairment in Inclusive Public Secondary Schools in Morogoro Municipality, Tanzania

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#### Abstract

The study used the Technological Acceptance Model to investigate the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality, Tanzania. The study adopted a pragmatic research philosophy and utilized a mixed research approach, employing a case study design with a target population of teachers, and heads of units for students with learning disabilities obtained through simple random and purposive sampling techniques. Data were collected by using questionnaires and interviews. Data were analyzed descriptively and thematically. Ethical guidelines were strictly adhered to throughout, prioritizing participant confidentiality and privacy. The study found a significant

positive impact of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools. The study also established educators' confidence that integrating these tools enhances communication, interactivity, and overall engagement, fostering an inclusive educational environment and providing tailored support for students with hearing impairments. Hence, the study recommended the respective educational organs put efforts into educator professional development, acquiring advanced technological tools, promoting collaboration among educators, and involving parents and the community to support these initiatives for sustained positive outcomes.

**Keywords:** Teaching Technology, Academic Engagement, Students with Hearing Impairment, and Inclusive Public Secondary Schools

#### 1. Background of the Study

In recent years, there has been a growing emphasis on applying 21st-century teaching technology to facilitate learning disabilities. Globally, personalized and adaptive learning technologies have garnered attention as they offer tailored instruction based on individual learners' needs. This approach utilizes algorithms and data analytics to adapt content, pacing, and instructional methods to accommodate students with learning disabilities (Hwang & Wu, 2019). Additionally, assistive technologies have played a crucial role in supporting individuals with learning disabilities. These technologies, including text-to-speech software and speech recognition tools, assist students in accessing information and participating in educational activities (Hassan & Alshamrani, 2020). Furthermore, gamification and immersive technologies, such as virtual and augmented reality, have been explored as engaging and interactive tools to motivate students with learning disabilities (Oktovianto *et al.*, 2018). Despite the potential benefits, it is important to consider factors such as accessibility, usability, and individual differences to ensure the effective implementation of technology in educational settings.

In Africa, the pursuit of inclusive education to ensure equitable access to quality learning opportunities for all, regardless of abilities, is gaining momentum. Despite the commendable goals, the practical application of inclusive education encounters formidable challenges. Mazuruse *et al.* (2021) highlight the prevalent issues of limited resources, insufficient infrastructure, and a dearth of specialized support for students with disabilities, which collectively impede the seamless integration of inclusive education practices. However, amidst these obstacles, a promising development emerges in the form of a growing acknowledgment of the transformative role that teaching technology can play in catering to the unique requirements of learners

with disabilities in Africa. The advent of innovative educational technologies holds the potential to mitigate some of the barriers, fostering a more inclusive and accessible learning environment for all.

Sub-Saharan Africa faces unique challenges in implementing inclusive education and addressing learning disabilities. A study by Hang'andu, *et al.*, (2023) highlights the scarcity of teaching resources, inadequate training for teachers, and cultural stigmas surrounding disabilities. These factors contribute to the exclusion and marginalization of students with disabilities. However, the study also highlights the potential of technology-based interventions in overcoming these challenges. Using assistive technology, mobile applications, and online learning platforms can provide personalized support and learning opportunities for students with disabilities in Sub-Saharan Africa.

In recent years, East Africa has witnessed a growing emphasis on inclusive education and the incorporation of teaching technology to address learning disabilities. A comprehensive investigation conducted by Mumbi (2011) looks into the challenges faced by the implementation of special needs education (SNE) in Nyeri. The study found out that SNE implementation in public primary schools in Nyeri town, Nyeri County was faced with numerous challenges and the most prominent challenges are socio-cultural, geographical, parental, and school-based factors. Socio-economic factors played a minimal role as an SNE barrier. This calls for concerted efforts between key educational stakeholders to conduct aggressive campaigns to sensitize the public on the importance of the SNE program. The government should increase funding to SNE. By leveraging these technological interventions, educational institutions can potentially establish inclusive learning environments tailored to the unique needs of each student, thus fostering a more equitable and effective educational landscape in East Africa.

In Tanzania, the government's commitment to fostering inclusive education faces persistent challenges, as outlined by Philip (2022). The study established that collaborative teaching was the most preferred model compared to consultative and coaching models. A bigger number of children with disabilities was one of the key challenges experienced in inclusive classrooms as teachers failed to provide sufficient support to cater to the needs of special needs learners. Other challenges included a lack of awareness of the Tanzanian Sign Language for Hearing Impairment and teachers' negative attitudes toward learners with special needs. Kisanga, *et al.*, (2022) emphasize the potential of assistive technology, educational apps, and online learning platforms in offering tailored support, boosting student engagement, and fostering independent learning for those with disabilities in Tanzania. By embracing these technological tools, Tanzania has the opportunity to bridge educational gaps and create a more inclusive learning environment, ensuring that all students, regardless of their abilities, have equal access to quality education.

## 2. Statement of the Problem

In today's rapidly evolving world, the integration of technology in education has become a necessity. With an increasing number of students diagnosed with learning disabilities, it is crucial to explore the application of modern

teaching technology to facilitate their learning. While inclusive education has gained significant attention in recent years, the specific utilization of 21st-century teaching technology for students with learning disabilities remains relatively unexplored. There is a significant knowledge gap regarding the practical application, benefits, challenges, and overall effectiveness of incorporating such technology in inclusive secondary schools. The study explored the potential benefits, challenges, and effectiveness of integrating technology-based teaching methods for students with learning disabilities. The findings of this study are expected to contribute to the existing body of knowledge and provide insights that can inform educational stakeholders, policymakers, and educators in enhancing inclusive educational practices for students with learning disabilities. This research study examined the application of teaching technology in facilitating learning disability in inclusive secondary schools within Morogoro Municipality.

## 3. Research Question and Research Hypothesis

**RQ:** What is the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality?

**H<sub>a</sub>:** There is a significant difference in confidence levels in integrating teaching technology to support students with hearing impairment across different levels of education.

## 4. Theoretical Framework

This was guided by the Technology Acceptance Model (TAM). TAM introduced in 1989 by Fred Davis and further developed by Richard Bagozzi, is a seminal framework in the field of information systems and technology adoption. The model revolves around two primary concepts: Perceived ease of use and perceived usefulness. These two factors are believed to shape users' attitudes and intentions toward adopting a particular technology.

**TAM focuses on understanding how individuals come to accept and use technology.** Perceived ease of use refers to the degree to which users believe that using a particular system would be free of effort, while perceived usefulness relates to the belief that the system enhances their job performance. By focusing on these psychological factors, TAM seeks to unravel the complexities of technology adoption.

One of the strengths of TAM is its systematic framework, which provides a structured approach to understanding technology adoption. By emphasizing perceived ease of use and perceived usefulness, it offers a clear lens through which researchers and practitioners can evaluate the factors influencing individuals' decisions to accept or reject a technology. Moreover, TAM facilitates the identification of potential barriers and facilitators, aiding in the successful integration of technology into various contexts.

However, TAM is not without its weaknesses. One notable limitation is its failure to consider external factors, such as social influences, that may significantly impact technology adoption. Human behavior is often influenced by social, cultural, and contextual factors that TAM does not explicitly account for. Additionally, the model assumes a rational decision-making process, which may oversimplify the intricate nature of real-world adoption scenarios where emotions, habits, and social pressures play a substantial role. Applying the TAM to education, particularly in the context

of teaching technologies, becomes highly relevant. Understanding how educators accept and perceive the usefulness and ease of use of certain technological tools is critical for their effective implementation. In the realm of inclusive education, where diverse learning needs must be addressed, TAM becomes a valuable tool to assess the readiness of educators to embrace technologies that can cater to students with disabilities.

### 5. Review of Empirical Studies

McNicholl *et al.* (2023) conducted a study on assistive technologies, educational engagement, and psychosocial outcomes among students with disabilities in higher education. The utilization of assistive technologies has been identified as a catalyst for positive psychosocial outcomes, particularly in the domains of competence, adaptability, and self-esteem. Individuals whose assistive technology requirements were comprehensively addressed demonstrated significantly elevated scores in academic self-efficacy, overall well-being, and across four out of the ten educational engagement subscales. In stark contrast, those with unmet assistive technology needs exhibited lower scores in these key areas. Surprisingly, the met or unmet status of assistive technology needs did not emerge as a predictive factor for educational engagement, suggesting that the mere presence of assistive technologies alone may not be as influential as the extent to which these technologies effectively cater to individual needs. This underscores the nuanced relationship between assistive technologies and psychosocial outcomes, emphasizing the importance of tailored and comprehensive support for maximizing their impact.

Koweru *et al.* (2015) examined the role of assistive technologies on quality educational outcomes of students with visual impairment in Kisumu County, Kenya. In the study, it was found that a substantial 80.2% of participants held negative attitudes towards inclusive education, with only 19.2% expressing positive sentiments. T-tests conducted on the data unveiled an interesting gender disparity, indicating that males exhibited a more positive stance toward inclusive education compared to their female counterparts, reaching statistical significance at the 0.05 level. Moreover, an intriguing correlation emerged concerning participants' contact with individuals with disabilities, revealing that those who reported having such contacts exhibited a notably more positive attitude towards inclusive education when compared to those without such experiences. This suggests that personal interactions and familiarity with individuals with disabilities may play a pivotal role in shaping one's perspective on inclusive educational practices.

Osam, *et al.* (2021) examined the use of assistive technologies among children with disabilities: The perception of parents of children with disabilities in Ghana. While participants in the study acknowledged the undeniable advantages that assistive technologies offer for the overall development and societal inclusion of their children, they candidly highlighted significant barriers hindering their children's access to these crucial tools. Foremost among these barriers was the financial constraint faced by parents, who expressed a genuine struggle to acquire the necessary funds to purchase assistive devices. The high costs associated with both assistive technologies and the accompanying rehabilitation services were particularly daunting for many families, posing a

considerable challenge to providing their children with the essential support they require. Despite the recognized benefits, the financial burden associated with these technologies emerged as a pervasive hurdle, underscoring the need for increased accessibility and affordability to ensure that all children can fully benefit from assistive technologies.

Mapunda *et al.* (2017) investigated challenges in identifying and serving students with special needs in Dodoma, Tanzania. The study's revelations underscore a significant deficiency in the implementation of special educational needs policies for pre-primary children within Dodoma municipality. The absence of dedicated policy frameworks has led to a pronounced disparity between the envisioned policy objectives and the practical execution at both the municipal and school levels. Consequently, the provision of special educational needs for pre-primary children primarily occurs within regular classrooms, devoid of specialized educators or essential assistive learning devices. This evident gap highlights a systemic challenge that hinders the effective delivery of tailored education, compromising the overall quality and inclusivity of the learning experience for pre-primary children in Dodoma. Addressing this discrepancy becomes imperative to ensure a more equitable and supportive educational environment for children with special needs in the region.

### 6. Methodology

The methodology aims to provide a systematic and rigorous approach to collect, analyze, and interpret data, ensuring the study's validity and reliability. The study employed an interpretive research philosophy and a mixed research approach, utilizing a case study research design. The target population comprised teachers, heads of units, and students with learning disabilities. A simple random sampling technique and purposive sampling technique were employed to select the respondents. Data were collected through questionnaires, and interviews. Measures were taken to ensure the validity and reliability of the research instruments. Collected data were analyzed by using descriptive statistics and thematic analysis. To ensure the validity and reliability of the study, rigorous methods including an extensive literature review to inform instrument development, pilot testing for refinement, and the Cronbach alpha method were employed, to contribute to the credibility and consistency of the research outcomes. The result for Cronbach's alpha was 0.890. Throughout the study, strict adherence to ethical guidelines was maintained to safeguard the confidentiality and privacy of participants.

### 7. Findings and Discussion of the Study

This section presents the findings from the study exploring the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality.

#### 7.1 Demographic Characteristics

The demographic characteristics of the participants in this study are crucial for understanding the context of the findings. Analyzing these demographic factors helps to identify patterns and correlations that might affect teacher motivation. The results are summarized in Table 1, which provides a detailed breakdown of the demographic profile of the study participants.

**Table 1:** Demographic Characteristics

Item	Frequency	Percent
<b>Gender</b>		
Male	6	37.5%
Female	10	62.5%
<b>Age</b>		
21-30	1	6.3%
31-40	7	43.8%
41-50	6	37.5%
51 and above	2	12.5%
<b>Teaching Experience</b>		
0-5	1	6.3%
6-10	6	37.5%
11-15	4	25.0%
16 and above	5	31.3%
<b>Highest Level of Education</b>		
Diploma	3	18.8%
Degree	9	56.3%
Masters or Others	4	25.0%

Source: Field Data (2024)

The demographic characteristics of the participants in this study provide essential context for interpreting the findings on the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality. The study involved a total of 16 participants, with a gender distribution of 37.5% male and 62.5% female. This indicates a higher representation of female teachers in the sample.

In terms of age, the majority of participants (43.8%) were between 31 and 40 years old, followed by those aged 41 to

50 years, who comprised 37.5% of the sample. Participants aged 51 and above accounted for 12.5%, while the youngest age group, 21 to 30 years, represented only 6.3%. This age distribution suggests that a significant portion of the teaching staff falls within the mid-career age bracket.

Regarding teaching experience, 37.5% of the participants had 6 to 10 years of experience, making it the most common range among the respondents. Those with 16 years or more of teaching experience constituted 31.3%, while 25.0% had 11 to 15 years of experience. Only 6.3% of the participants had 0 to 5 years of teaching experience, highlighting that the majority of the teachers in the study had substantial experience in the field.

The highest level of education attained by the participants varied, with the majority holding a degree (56.3%). Those with a master’s degree or other advanced qualifications made up 25.0% of the sample, while participants with a diploma represented 18.8%. This educational background reflects a well-qualified group of educators, which is pertinent to assessing the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools.

**7.2 Influence of Teaching Technology on Academic Engagement of Students with Hearing Impairment in Inclusive Public Secondary Schools**

This section presents findings on the influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality.

**Table 2:** Influence of Teaching Technology on Academic Engagement of Students with Hearing Impairment in Inclusive Public Secondary Schools (n = 16)

S. No	Statements	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1.	I feel confident in integrating teaching technology to support students with hearing impairment.	0 (0%)	0 (0%)	3 (18.8%)	6 (37.5%)	7 (43.8%)
2.	Teaching technology improves communication with students who have hearing impairments.	2 (12.5%)	3 (18.8%)	2 (12.5%)	8 (50%)	1 (6.3%)
3.	I believe teaching technology makes learning more interactive for students with hearing impairment.	0 (0%)	0 (0%)	4 (25%)	5 (31.3%)	7 (43.8%)
4.	Teaching technology helps in creating inclusive learning environments for students with hearing impairments.	1 (6.3%)	2 (12.5%)	4 (25%)	6 (37.5%)	3 (18.8%)
5.	Teaching technology facilitates a better understanding of content for students with hearing impairment.	0 (0%)	0 (0%)	1 (6.3%)	7 (43.8%)	8 (50%)
6.	I am comfortable using teaching technology to adapt lessons for students with hearing impairment.	1 (6.3%)	1 (6.3%)	3 (18.8%)	9 (56.3%)	2 (12.5%)
7.	I perceive teaching technology as an effective tool for addressing the unique learning needs of students with hearing impairments.	0 (0%)	1 (6.3%)	1 (6.3%)	6 (37.5%)	9 (56.3%)
8.	I believe that teaching technology motivates students with hearing impairment to actively engage in learning.	1 (6.3%)	1 (6.3%)	1 (6.3%)	8 (50%)	5 (31.3%)
9.	I see teaching technology as a valuable resource for creating accessible educational materials for students with hearing impairment.	0 (0%)	2 (12.5%)	1 (6.3%)	5 (31.3%)	8 (50%)
10.	Integrating teaching technology fosters collaboration and communication among students with and without hearing impairment.	0 (0%)	3 (18.8%)	0 (0%)	10 (62.5%)	2 (12.5%)

Source: Field Data (2024)

The majority of respondents (81.3%) expressed confidence in integrating teaching technology to support students with hearing impairment. This positive attitude is crucial as it indicates a readiness among educators to explore and utilize technological tools effectively, which can significantly enhance the learning experience for students with hearing impairment in inclusive settings. These findings support the study by Koweru *et al.* (2015) which reveals that those who

reported having such contacts exhibited a notably more positive attitude towards inclusive education when compared to those without such experiences.

A substantial number of respondents (56.3%) agreed that teaching technology improves communication with students who have hearing impairments. This finding stresses the importance of technology as a facilitator of communication, enabling better interaction and understanding between

teachers and students with hearing challenges. These findings were supported by the Head of Unit X who pointed out the following:-

*“Technology has become a crucial facilitator of communication in our classrooms, fostering improved interaction and understanding between teachers and students with hearing challenges, ultimately enhancing the learning experience for all.”* (HoU X, Personal Communication, May 20, 2024).

The majority of participants (75.1%) acknowledged that teaching technology makes learning more interactive for students with hearing impairment. This recognition of technology's role in fostering interactive learning experiences indicates a positive shift towards more engaging and participatory teaching methods. These results align with Oktovianto *et al.* (2018) who pointed out that, gamification and immersive technologies, such as virtual reality and augmented reality, have been explored as engaging and interactive tools to motivate students with learning disabilities.

While opinions were mixed, with 56.3% agreeing, there is a notable acknowledgment of teaching technology's role in creating inclusive learning environments. This suggests that educators recognize the potential of technology to level the playing field and ensure equal opportunities for all students, regardless of their hearing abilities. These results are in parallel with a study by Mazuruse *et al.* (2021) which observed that the advent of innovative educational technologies holds the potential to mitigate some of the barriers, fostering a more inclusive and accessible learning environment for all.

A significant majority (93.8%) agreed that teaching technology facilitates a better understanding of content for students with hearing impairment. This strong consensus highlights the effectiveness of technology in breaking down learning barriers and enhancing comprehension among students with hearing challenges. These discoveries are in agreement with TAM since suggest that perceived usefulness and ease of use of technology lead to its acceptance and adoption, which aligns with the positive impact observed in improving learning outcomes for students with hearing impairment through technology integration.

The majority of respondents (68.8%) expressed comfort in using teaching technology to adapt lessons for students with hearing impairment. This comfort level indicates a level of proficiency and confidence among educators in leveraging technology to cater to diverse learning needs effectively. These findings were supported by a Head of Unit X who expressed that: -

*“The ease with which our educators use technology demonstrates their skill and confidence in tailoring lessons to meet the varied learning requirements of our students.”* (HoU X, Personal Communication, May 20, 2024).

These results imply that a high level of digital proficiency and confidence is crucial for effectively personalizing lessons to accommodate diverse student needs. This capability enhances the learning experience by ensuring that

all students, including those with special requirements, receive tailored and accessible instruction.

An overwhelming majority (93.8%) perceived teaching technology as an effective tool for addressing the unique learning needs of students with hearing impairment. This high level of perceived effectiveness reflects a positive outlook on the potential of technology to support and enhance the educational experience of students with hearing challenges. These discoveries are in agreement with the study by Hang'andu, *et al.*, (2023) which suggested that the use of assistive technology, mobile applications, and online learning platforms can provide personalized support and learning opportunities for students with disabilities in Sub-Saharan Africa.

A majority (81.3%) agreed that teaching technology motivates students with hearing impairment to actively engage in learning. This finding focuses on the motivational aspect of technology, showing its ability to stimulate interest and participation among students with hearing difficulties. These results were supported by a Head of Unit X who pointed out the following: -

*“The engaging nature of technology significantly boosts students' interest and involvement, particularly those with hearing impairments.”* (HoU X, Personal Communication, May 20, 2024).

These results emphasized how technology effectively captures and maintains the attention of students with hearing challenges, encouraging their active participation in the learning process.

The majority (81.3%) recognized teaching technology as a valuable resource for creating accessible educational materials for students with hearing impairment. This acknowledgment of technology's value in accessibility highlights its importance in ensuring equal access to educational content for all students. These findings are in parallel with a study by Osam, *et al.*, (2021) which found that, despite the recognized benefits, the financial burden associated with these technologies emerged as a pervasive hurdle, underscoring the need for increased accessibility and affordability to ensure that all children can fully benefit from assistive technologies.

A significant majority (75.1%) agreed that integrating teaching technology fosters collaboration and communication among students with and without hearing impairment. This finding emphasizes technology's role in promoting inclusive interaction and teamwork among students, regardless of their hearing abilities. The TAM aligns with the finding, as it posits that users' perceptions of technology's usefulness and ease of use influence their acceptance and adoption of it, which can lead to positive outcomes like enhanced collaboration regardless of differences in abilities. TAM would likely predict that if students perceive technology as effective and easy to use for collaboration, they would be more inclined to accept and utilize it for inclusive interaction, supporting the result.

### 7.3 Testing of Hypothesis Results

This section presents results on the confidence levels of educators in integrating teaching technology to support students with hearing impairment across different educational backgrounds. The hypothesis tested ( $H_0$ ) posits

that there is no significant difference in these confidence levels based on the educators' highest level of education.

**Table 3: ANOVA Analysis**

Highest Level of Education					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.215	2	.608	1.380	.286
Within Groups	5.722	13	.440		
Total	6.938	15			

Source: Field Data (2024)

The ANOVA results for testing the hypothesis that there is no significant difference in confidence levels in integrating teaching technology to support students with hearing impairment across different levels of education indicate no significant difference between the groups. With an F-value of 1.380 and a significance level of 0.286, which is greater than the alpha level of 0.05, we fail to reject the null hypothesis (H<sub>0</sub>). This suggests that the confidence in using teaching technology is similar regardless of educators' highest level of education.

## 8. Summary of the Findings, Conclusion, and Recommendations

### 8.1 Summary of the Findings

The study's findings reveal a strong confidence among educators in using teaching technology to support students with hearing impairments, expressing readiness to integrate these tools, reflecting a positive attitude towards inclusive education. A significant majority also highlighted the technology's role in improving communication and making learning more interactive, aligning with previous research and expert opinions. The consensus on technology's effectiveness in facilitating understanding and fostering engagement underscores its value in creating inclusive and engaging learning environments, consistent with the Technology Acceptance Model's predictions about perceived usefulness and ease of use driving adoption.

### 8.2 Conclusion

The study observed the significant influence of teaching technology on the academic engagement of students with hearing impairment in inclusive public secondary schools in Morogoro Municipality. The findings demonstrate that educators are confident in integrating these tools, which enhances communication, interactivity, and overall engagement in the learning process. The positive perceptions and effective utilization of technology indicate its crucial role in fostering an inclusive educational environment, ensuring that students with hearing impairments receive tailored support and opportunities to actively participate and succeed academically.

### 8.3 Recommendations

Based on the findings, it is recommended that schools in Morogoro Municipality invest in continuous professional development for educators to enhance their skills in using teaching technology effectively. Additionally, schools should prioritize the acquisition and integration of advanced technological tools specifically designed to support students with hearing impairments. Establishing collaborative platforms for educators to share best practices and resources can further improve the efficacy of technology in fostering inclusive education. Lastly, engaging parents and the

community in understanding the benefits of teaching technology can help garner broader support for these initiatives, ensuring sustained positive outcomes for students with hearing impairments.

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