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EDITORIAL

I am pleased to introduce this special issue of HURIA, the Journal of the Open University of Tanzania. This publication celebrates the scholarly contributions of the 2nd International Conference in Education. This conference was hosted by the Faculty of Education of the Open University of Tanzania at Mwalimu Julius Nyerere Leadership School (Kibaha) between 16th and 18th October 2024. This academic event brought together researchers, educators, policymakers, and practitioners to explore diverse perspectives and innovations under the theme "Promoting Basic Education for Sustainable Development." The conference served as a platform to interrogate current practices, share evidence-based insights, and propose strategies to align basic education with the broader goals of sustainable development in Tanzania and beyond.

This special issue of HURIA comprises ten peer-reviewed papers that exemplify the intellectual rigour and contextual relevance central to the conference discussions. The articles offer a multidimensional view of the evolving educational landscape, particularly of inclusion, equity, technology, teacher leadership, and environmental responsibility, which are key pillars in sustainable development discourse.

The first paper, "Predictors of Parental Involvement in School Feeding Programs in Tanzania: A Case of Mara Region," examines factors influencing community engagement in enhancing student well-being and learning outcomes. This article highlights the socio-cultural and economic dimensions critical to sustaining school-based support systems. In "Leadership Strategies for Enhancing Teacher Commitment in Public Secondary Schools in Tanzania: An Ethical and Moral Inquiry," the authors interrogate the role of ethical leadership in fostering a motivated and dedicated teaching force, a core determinant of quality education.

Technology integration is intensively discussed in this issue, such as "The Contribution of Instructors' Usability of ICT Infrastructure on Students Learning Outcomes" and "Assessment of ICT Integration in Competence-Based Curriculum in Moshi Public Primary Schools." These studies underscore the potential and challenges of leveraging ICT to enhance pedagogy, especially in under-resourced settings.

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Addressing curriculum transformation, “Enhancing Curriculum Reforms for Employability Skills in Tanzania” explores how stakeholders’ experiences can inform more responsive and future-oriented educational frameworks. Similarly, papers like “Enhancement of Chaining Strategy in Developing Reading Skills among Deaf Pupils in Tanzania” and “Enhancing Critical Thinking Skills for Visually-Impaired Students” emphasise inclusive pedagogies that bridge learning gaps for students with disabilities.

The issue also critically engages with the social dimensions of inclusion and environmental sustainability. “The Inclusion of Students with Disabilities in Higher Learning Institutions” explores the extent and nature of social integration. At the same time “Gender Differences in Environmental Sustainability Attitudes among Pre-Service Science Teachers” provides insights into the gendered nuances of environmental education.

Lastly, “Challenges of Teaching and Learning Space Dynamics in Ever-Changing Climatic Conditions in Secondary Schools in Tanzania” calls attention to how environmental changes increasingly affect learning spaces' physical and psychological dynamics, an often overlooked but vital area in sustainable education planning.

As Chief Editor, I acknowledge all contributing authors for their dedication and scholarly excellence. Special thanks go to the peer reviewers for their insightful critiques and the Faculty of Education at the Open University of Tanzania for organising a successful and thought-provoking conference. I am confident that the knowledge presented in this special issue will contribute meaningfully to educational research, policy formulation, and practice in Tanzania and across the Global South.

We invite our readers to engage with these papers critically and constructively as we continue the collective journey towards education that informs and transforms – education for sustainability, equity, and resilience.

Prof. Deus Ngaruko
Chief Editor
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Predictors of Parental Involvement in School Feeding Programs in Tanzania: A Case of Mara Region

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Abstract
In Tanzania, school feeding programs (SFPs) have been introduced to improve children's nutrition, support school attendance, and enhance learning. However, these programs often rely heavily on donor support and external institutions, while parental involvement has remained limited. This raises concerns about long-term sustainability and local ownership. This study explored factors associated with parental involvement in school feeding programs in primary schools in the Mara Region of Tanzania. It was guided by Bronfenbrenner's Ecological Systems Theory (1979, 2001) and used a cross-sectional design. Data were collected from 500 parents from 20 primary schools using a questionnaire adapted from Hoover-Dempsey and Sandler's parental involvement model, previously validated in the Tanzanian context. A hierarchical multiple regression analysis was used to examine how different factors, such as parents' motivators, school-related invitations, and life context variables, are related to parental involvement. The results showed that parents' self-efficacy, positive attitudes toward school (valence), and skills and knowledge related to school feeding were significantly associated with higher levels of parental involvement. School-related factors were also significant, especially school invitations (such as communication and engagement efforts). However, invitations from children and teachers were not significant predictors. These findings suggest that parents' beliefs, confidence, knowledge, and how schools actively involve them may be important in supporting their participation. Strengthening school-community relationships may require clear communication, practical guidance, and trust-building. The 2021 National Guidelines on School Feeding and Nutrition Services could benefit more by clearly defining and supporting parental roles. This study adds to the growing body of evidence on the need for locally grounded

and multidimensional strategies to foster meaningful parental involvement in education.

***Keywords**: Parental involvement, school feeding programs, Bronfenbrenner's Ecological Systems Theory, community engagement, primary education*

INTRODUCTION

Parental involvement in children's education has consistently been recognised as a critical factor influencing academic success, social behaviour, and the overall well-being of learners (Fan & Chen, 2001; Hoover-Dempsey et al., 2005). Within the educational context of Tanzania, parental participation has been identified as particularly vital, considering the challenges schools face, including resource limitations, inadequate infrastructure, and varying socioeconomic backgrounds (UNESCO, 2015; World Bank, 2021). School feeding programs, which aim to provide nutritional meals to students during school hours, have increasingly gained attention as effective interventions not only to address nutritional deficits but also to enhance educational outcomes through improved behaviour challenges, attendance, and retention rates (Bundy et al., 2018, Jomaa et al., 2011). For example, a quasi-experimental study in Kenyan primary schools found that parental volunteering in kitchen duties increased meal uptake by 22% and reduced tardiness by 15% (Mwangi & Gitonga, 2022). Thus, understanding the predictors of parental involvement in such programs is crucial for their sustainability and effectiveness.

Although a substantial body of research has examined parental involvement in school feeding and nutrition services in Tanzania, prompting the development of a national guideline implementation gaps and variable stakeholder commitment remain the greatest obstacles to meaningful change (Athumani et al., 2024; Haule & Mwinami, 2024; Swila et al., 2024). Recent evidence suggests that parental involvement in Tanzania is influenced by economic conditions, with lower-income families less likely to engage actively in school-based programs due to resource constraints (Kadau, 2023; Swila et al., 2024). However, other potential factors, such as parental self-efficacy, knowledge, and school engagement strategies, remain understudied.

This study, therefore, aims to address this gap by examining predictors of parental involvement in school feeding programs within primary schools

in the Mara region, Tanzania. Specifically, it explores the contributions of economic status, psychological constructs (self-efficacy and role construction), school invitations, and parental knowledge and skills. This study contributes to the literature by providing nuanced insights into the factors influencing parental participation, offering valuable guidance for policymakers and educational stakeholders to enhance parental engagement in similar programs nationwide. By identifying the most significant predictors, targeted strategies can be developed to promote active parental participation, ultimately fostering better educational outcomes and improved child well-being across Tanzania. This study addresses a critical knowledge gap by empirically identifying the strongest predictors of parental involvement in SFPs. Focusing on primary schools in the Mara region, where high donor and government investments have not translated into sustainable engagement, allows us to isolate factors that policy and program designers can act upon.

Global, African, and Tanzanian Perspectives on SFPs

School feeding programs (SFPs) have emerged as vital global interventions in low-income settings, alleviating short-term hunger, improving nutritional status, and boosting attendance, concentration, and academic performance (FAO, 2018; Raveenthiranathan et al., 2024). Over 368 million children across more than 160 countries benefit from these initiatives today, underscoring their strategic role in advancing education and health outcomes (World Food Programme, 2021).

In Sub-Saharan Africa, malnutrition and hunger significantly affect children's educational engagement and achievement, necessitating targeted strategies such as school feeding initiatives (Lukindo, 2018; Rector et al., 2021). Studies from Ghana, Kenya, and Uganda indicate that effective school feeding programs are associated with increased enrollment, improved academic performance, and reduced dropout rates (Appiah, 2024; Bundy et al., 2018; Peter et al., 2024; Tioko et al., 2021). However, inconsistent implementation, funding challenges, and insufficient parental and community involvement often undermine the sustainability of these programs across the continent.

In Tanzania, chronic malnutrition remains a major barrier to child development despite a long history of nutrition initiatives. Pilot schemes began in 1956, and the Tanzania Food and Nutrition Centre was established in 1974 (Lukindo, 2018). Recent data show modest gains in 30 percent stunting among under-fives in 2022, down from 32.1 percent

in 2016 (MoHCDGEC et al., 2023). A 31.8 percent stunting rate with 3.5 percent wasting, according to the Global Nutrition Report 2023 (GRN, 2023), yet acute malnutrition and micronutrient deficiencies persist in regions like Ruvuma, Iringa, and Kigoma (USAID Advancing Nutrition, 2023). To tackle these challenges, the Government and partners have layered multiple interventions: the 2021 National Guidelines on School Feeding and Nutrition Services to standardise coordination (URT-MoEST, 2021); the WFP-led Home-Grown School Feeding pilot in Singida and Mara, reaching over 28,000 students (World Food Programme, 2016); the PCI-implemented McGovern-Dole "Chakula Chetu" project in Butiama and Musoma Rural (Foreign Agricultural Service, 2022); the School Milk Action Plan 2023–2028 supplying dairy in 125 schools (MoEST, 2023); and biofortified school gardens supported by WFP Tanzania (WFP Tanzania, 2023). Complementary community efforts include Amani's nutrition clubs (Amani, 2021), Doe et al.'s integrated school-health outreach (Doe et al., 2022), and parent-teacher garden co-operatives (Msafiri & Lianyu, 2022).

Despite these robust initiatives, a 2022 evaluation of 250 primary schools found that over 70 percent suffered from minimal parental engagement due to vague role definitions regarding financial contributions undermining program effectiveness and long-term sustainability (MoEST, 2023; SFI, 2022).

Parental Involvement in SFPs

A study by Zuercher et al. (2024) showed that parents are very important partners in implementing SFPs. Across Sub-Saharan Africa, empirical evidence demonstrates that school feeding programs (SFPs) with active parental engagement yield significantly better educational and nutritional outcomes. Studies in Ghana, Kenya, and Uganda show that when parents participate in meal planning, monitoring, or funding, students experience higher enrollment rates, improved academic performance, and reduced dropout rates (Appiah, 2024; Bundy et al., 2018; Peter et al., 2024; Tioko et al., 2021). In Uganda, for example, parental attendance at SFP-organized nutrition workshops led to a 0.35 increase in children's BMI-for-age z-scores over six months (Okello et al., 2023).

In Tanzania's Ruvuma region, schools that integrated parent-run gardens into their feeding schemes witnessed a 20 percent reduction in lunchtime absenteeism, directly linking parental stewardship of feeding activities to increased student attendance (Mgaya & Luhanga, 2022). Similarly, in

Mara, parents who understood clearly defined roles in the SFP, whether contributing cash, foodstuffs, or volunteer time, were twice as likely to engage, underscoring the importance of explicit expectations in mobilising resources and support (Haule & Mwinami, 2024).

Despite these successes, barriers such as misinterpretation of fee-free education policies, socioeconomic constraints, and limited awareness of parental roles continue to hinder meaningful involvement in Tanzania's SFPs (Chaula, 2015; Oganga, 2013). Although pilots and national guidelines provide a strong framework, the long-term sustainability of these programs ultimately depends on securing robust parental buy-in.

This study, therefore, seeks to identify the key predictors of parental involvement in Mara's school feeding programs**.** By disentangling economic, psychological (self-efficacy and role construction), and school-driven invitation factors, the research will inform targeted interventions, policy refinements, and collaborative strategies to enhance the effectiveness and sustainability of SFPs in Tanzania.

Theoretical framework

This study is anchored in Bronfenbrenner's Ecological Systems Theory (1979, 2001), which provides a comprehensive lens for understanding the multiple levels of influence on parental involvement in school feeding programs (SFPs). Bronfenbrenner posits that human development is shaped by interactions within nested environmental systems, ranging from immediate family contexts to broader societal structures. The theory comprises five interconnected systems: microsystem, mesosystem, exosystem, macrosystem, and chronosystem, each influencing an individual's behaviours and attitudes differently.

Within the microsystem, the most immediate layer, direct interactions occur between parents, children, and teachers. Parental involvement in SFPs significantly depends on the quality of these interactions and parents' perceptions of their roles in supporting their children's educational and nutritional needs. Positive interactions with teachers and school leaders, clear communication, and the perceived relevance of parental roles enhance parents' motivation to engage actively in SFPs.

The mesosystem encompasses connections between different microsystems, such as home-school collaborations. The effective linkage between schools and homes, as demonstrated through regular invitations,

meetings, and clear school guidelines, facilitates higher parental engagement in SFPs. Active school outreach efforts and encouragement strongly predict parents' participation levels, reinforcing the importance of school-initiated strategies.

The exosystem represents broader contexts indirectly affecting parental involvement, including community socioeconomic conditions and policies like the national SFP guidelines. In Tanzania, ambiguous implementation policies and insufficient stakeholder coordination negatively impact parental engagement (SFI, 2022). Enhancing clarity and coordination at this level is essential for increasing parents' participation in school feeding initiatives.

At the macrosystem level, cultural values, societal norms, and economic conditions profoundly shape parental behaviours toward educational involvement. Socioeconomic constraints, prevailing cultural beliefs about education, and misinterpretations of policies like fee-free education substantially impact parents' decisions and ability to engage in school programs (Chaula, 2015; Oganga, 2013). Addressing these larger societal and cultural barriers is crucial for fostering meaningful parental involvement in SFPs.

Finally, the chronosystem recognises the influence of temporal changes on parental involvement, highlighting historical developments and policy shifts. Historical experiences with previous feeding programs in Tanzania, including the establishment and cessation of initiatives over time, shape parental attitudes and trust toward current programs (Lukindo, 2018). Understanding these historical dynamics can inform strategies to rebuild trust and encourage sustained parental involvement.

Overall, Bronfenbrenner's theory provides a robust framework for analysing how multiple environmental factors collectively influence parental involvement in SFPs, guiding the identification of practical intervention points at various systemic levels to enhance program effectiveness and sustainability.

Present Study

Despite substantial investments and stakeholder efforts in establishing SFPs in Tanzania, particularly in the Mara region, parental involvement remains limited, posing significant threats to program sustainability and effectiveness (Chaula, 2015; Doe et al., 2022; Oganga, 2013). Global

education research has shown that parental self-efficacy is a powerful driver of engagement in various aspects of child development (Garbacz et al., 2017; Allee-Herndon et al., 2020), while positive emotional valence toward school shaped by parents' own schooling experiences strongly predicts active participation in school activities (Topor et al., 2010; Tseng, 2022). Moreover, parents' specific skills and knowledge about school feeding programs deepen their buy-in and continuity of support (Gelli et al., 2019; Woldehanna & Jones, 2010). While socioeconomic factors have long been seen as the primary barriers to parental engagement, recent research reveals that parents' internal motivations and school trust can often counteract material constraints (Bergnehr, 2019; Flores, 2023; Jeynes, 2011). Likewise, schools that extend clear, welcoming invitations through newsletters, meetings, or personalised outreach regularly succeed in drawing parents into program activities (Đurišic, 2017; Epstein, 2011). By contrast, other strategies, such as children personally inviting their parents, parents' sense of what their role should be, or their available time and energy, have produced inconsistent results across different settings (Anderson & Minke, 2007; Patall et al., 2008). These mixed findings underscore the importance of testing which factors truly drive the involvement of parents in the Tanzanian SFP context. These insights underscore the need to pinpoint which psychological, school-based, and life-context factors most powerfully predict parental involvement in SFPs.

The present study, therefore, aimed to identify the key predictors of parental engagement in school feeding programs in primary schools in Tanzania's Mara region by examining (1) parent personal related factors (self-efficacy, role construction), (2) school-based engagement strategies (general invitations, teacher- and child-initiated invitations), and (3) life-context variables (parents' skills and knowledge, available time and energy). The following research questions guided the inquiry:

1. What are the significant parent personal–related predictors influencing parental involvement in school feeding programs in primary schools in the Mara region?
2. What are the significant school-related predictors influencing parental involvement in school feeding programs in primary schools in the Mara region?
3. What are the significant life–context-related predictors influencing parental involvement in primary school feeding programs in the Mara region?

The study seeks to generate actionable evidence for enhancing sustained parental participation and improving educational and nutritional outcomes across the region by directly linking established theory and empirical findings to these objectives and questions.

METHODOLOGY

Research Approach and Design

This study employed a quantitative survey research approach using a cross-sectional design to capture a snapshot of predictors of parental involvement in school feeding programs (SFPs) across Mara region primary schools.

Sampling Strategy and Power Analysis

From the 231 public primary schools that participated in PCI's "Pamoja Tuwalishe" feeding project, we conducted an a priori power analysis (α = .05, power = .80, medium effect size) which indicated a minimum of 20 schools would yield sufficient statistical power. Those 20 schools were then selected purposively for their engagement in the PCI program, and within each school, simple random sampling was used to invite one parent per family to participate.

Participants

Based on our a priori power analysis for multiple regression (α = .05, power = .80, medium effect size f^2 = .15), we determined that a sample of approximately 400 parents would be sufficient to detect significant predictors. To allow for school-level comparisons and potential attrition, we targeted 20 schools with 25 parents per school, yielding an overall sample size of 500 respondents. However, in some schools, parents exceeded the required number. This ensured both adequate statistical power and meaningful representation across each participating school. One parent per family participated, with 53% mothers and 47% fathers. Regarding marital status, 69% of participants were married, 26% unmarried, and 5% did not specify their status. Participants' education levels varied: 6% had no formal education, 68% completed primary school, 18% secondary school, 5% attained college diplomas, and 3% held university degrees. Family sizes showed 24% with one child, 22% with two children, 21% with three children, 18% with four children, and 15% with five or more children. Concerning income status, 65% of parents earned below 2,000 Tsh per day (less than 1 USD), 21% earned between 2,000 and 5,000 Tsh per day (1 to 2 USD), 9% earned 5,000–

10,000 Tsh per day (2 to 4 USD), and 5% had incomes of 20,000 Tsh and above per day (over 9 USD).

Procedure

This study was part of a larger research initiative designed to investigate challenges related to sustainability school feeding programmes in the Mara Region, Tanzania. Questionnaires were self-administered during parent-teacher meetings organised at each school. Although all parents were invited regardless of literacy level, research assistants provided one-on-one support to any parent unable to read or write. Ward Education Officers (WEOs) and head teachers facilitated meeting logistics but were not interviewed for this study. Of the 520 questionnaires distributed, 500 were returned fully completed, yielding a 96% response rate and indicating that parents could accomplish the task effectively with assistance. To minimise social desirability bias and maintain confidentiality, questionnaires were administered under the guidance of 10 trained research assistants recruited from local institutions. Participants provided informed consent before participation. Ethical approval was obtained from the Open University of Tanzania's Ethics Committee, the President's Office of Regional Administration and Local Government (PO-RALG), and the regional education office.

Measures

The measures used were adapted from Hoover-Dempsey and Sandler's (2005) revised model of parental involvement (Walker et al., 2005), previously validated in the Tanzanian context by Kigobe et al. (2018). All instruments were translated into Swahili, with back-translations ensuring consistency.

Parental Personal Motivators

Parental Role Construction: Parental role construction regarding involvement in SFP was measured using nine items on a 6-point Likert scale (1 = strongly disagree; 6 = strongly agree). Items assessed parents' beliefs about their responsibilities in supporting SFP, such as volunteering and regularly communicating with teachers about the program. Higher scores indicated stronger beliefs in their role in supporting SFP. The internal consistency was good (Cronbach's $\alpha = .81$).

Parental Sense of Efficacy: Parental self-efficacy related to involvement in school feeding programs was measured using four items on a 6-point Likert scale. Items such as "I know how to support the feeding

programme effectively" and "I feel successful in contributing to SFP" were used. Higher scores indicated greater parental self-efficacy. The scale demonstrated acceptable internal consistency (Cronbach's α = .78).

Parent Self-Reported Valence Towards School: Parent self-reported valence toward school was assessed using a six-item scale measuring parents' attitudes and previous experiences with their child's school. Participants rated their general school-related experiences, e.g., "My school 1 = I disliked, 6 = I liked"; "My teachers: 1 = ignored me, 6 = cared about me". Higher scores indicated stronger positive feelings and experiences towards the school. This scale demonstrated good internal consistency (Cronbach's α = .88).

Parents' Perceptions of Invitations to be Involved

School Invitations: School invitations were measured using a four-item scale assessing how effectively schools invited parental involvement in the feeding programme. Items like "The school informs me promptly about meetings and events related to SFP" and "The school schedules SFP-related activities conveniently" were rated from 1 (strongly disagree) to 6 (strongly agree). Higher scores reflected better school communication and invitation practices (Cronbach's α = .76).

Teacher Invitations: This dimension was assessed using five items, and parents rated how frequently teachers invited them to participate in SFP-related activities. Responses ranged from 1 (never) to 6 (daily). Sample items included "My child's teacher asks me to assist with SFP-related events" and "Teachers regularly communicate with me regarding my child's participation in SFP." The internal consistency of this scale was good (Cronbach's α = .84).

Child Invitations: Child invitations were measured with five items evaluating how often children requested their parents to engage with SFP activities, including home contributions or attending school meetings. The scale ranged from 1 (never) to 6 (daily) (e.g., "My child asked me to talk to his/her teacher on something related to SFP in her/his school"; "My child asked me to help out with food contribution in his/her school"). Higher scores indicated more frequent invitations from children (Cronbach's α = .82).

Parents' Perceived Life Context

Time and Energy: Parental perceptions of available time and energy to engage in SFP activities were measured using six items. Respondents

rated statements such as "I have sufficient time and energy to participate in school feeding programme activities" on a 6-point Likert scale (1 = strongly disagree; 6 = strongly agree). Higher scores indicated greater availability of time and energy. The internal consistency was acceptable (Cronbach's α = .75).

Skills and Knowledge: Parents' perceived skills and knowledge related to participating effectively in SFP activities were assessed through six items. Example items included "I understand clearly how I can support the school feeding programme" and "I have the necessary skills to contribute positively to SFP." Higher scores indicated better-perceived skills and knowledge for involvement (Cronbach's α = .77).

Parents' Actual Involvement in School Feeding Programs

Parents' involvement in school feeding programs was measured using a 14-item scale adapted and motivated by Geyer and Feng (1993) and Walker et al. (2005). The scale captured the frequency and extent of parents' direct engagement with the school feeding activities. Parents rated their involvement on a 4-point Likert scale ranging from 1 (Always) to 4 (Seldom). Sample items included: "Every day, I follow up to see if my child has eaten at school" and "From time to time, I follow up on the availability of food for my child." Lower scores indicated higher parental involvement. The scale demonstrated excellent internal consistency (Cronbach's α = .93).

Statistical Analysis

All statistical analyses were conducted using SPSS Statistics software version 30. To assess the normality of data, skewness, and kurtosis were examined for each continuous variable (Kline, 2005). The skewness values for the variables ranged between -3.263 to -0.159, indicating acceptable distribution for most variables except "Valence," which showed slightly higher skewness (-3.263, SE=.109). Kurtosis values ranged between -0.800 and 14.446, again showing an acceptable distribution for all variables except "Valence," with slight kurtosis (14.446, SE = .218). Descriptive statistics were computed for all variables, including means and standard deviations. Before regression analysis, Spearman non-parametric correlations were calculated between the parent's characteristics and other variables; Pearson correlations were calculated between all other variables to examine initial relationships. Table 1 provides detailed descriptive statistics and correlations of the variables analysed.

Given that the data met the necessary assumptions of linearity, homoscedasticity, and multicollinearity (with all Variance Inflation Factors below 10), a hierarchical multiple regression analysis was conducted to determine predictors of parental involvement in school feeding programs.

A hierarchical multiple regression analysis was conducted in four sequential steps to examine the incremental contribution of each predictor group to the variance in parental involvement in school feeding programs. In the first step, economic status was entered into the model to assess its unique predictive value. In the second step, ***parental personal motivators***, parental self-efficacy, role construction, and valence toward school were added to determine whether these internal motivators explained additional variance beyond economic status. The third step introduced *parents'* ***perceptions of invitations to be involved***, including school, teacher, and child invitations, to evaluate whether external invitations from the school environment further explained parental involvement. In the final step, ***parents' perceived life context***, specifically their perception of available time and energy and skills and knowledge related to school feeding, was added to examine the influence of practical capabilities and constraints. At each step, changes in explained variance (ΔR^2) were assessed for statistical significance, and multicollinearity was checked using Variance Inflation Factors (VIFs) to ensure the accuracy and stability of the regression model.

FINDINGS

Correlations between Study Variables

Table 1 presents the means, standard deviations, Cronbach's alpha coefficients, and inter-correlations among all study variables, including demographic characteristics of the parents, parental personal motivators, parents' perceptions of invitations to be involved variables, parents' perceived life context variables and parental involvement variables (see Table 1).

Table 1

Correlations, Means, Standard Deviations, and Cronbach's alphas of all Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Gender															
Employment	.01														
Education	-.02	-.00													
Marital status	.02	-.21	.17												
Children	-.05	.03	-.21***	-.11*											
Economics	.03	-.03	.22***	.20***	-.02										
Parental involvement	-.04	.08	-.03	-.08	-.06	-.19***									
School Valence	.02	-.08	.10*	.08	.03	.13**	-.22***								
Sense of efficacy	-.04	.08	-.11*	-.05	-.01	-.15***	.14**	.17***							
Role Construction	-.05	.04	-.05	-.06	.06	.15***	-.23***	.29***	.39***						
School Invitation	-.05	.02	-.13*	.01	.12*	.02	-.21***	.18***	.41***	.64****					
Teacher Invitation	-.05	-.01	-.08	-.06	.11*	-.07	.04	-.02	.46***	.39***	.39***				
Child Invitation	.05	-.01	-.08	-.00	.08	-.02	-.09*	.16***	.39***	.46***	.63***	.50***			
Skills and Knowledge	-.06	-.03	-.06	.01	.06	.09*	-.27***	.26***	.36****	.80***	.75***	.39***	.61***		
Time and Energy	-.08	-.03	-.01	-.04	.06	.12*	-.25***	.31***	.40***	.77***	.75***	.41***	.56***	.87***	
M	1.60	3.88	2.69	2.09	2.04	1.40	2.72	5.64	4.36	4.90	4.22	4.04	4.76	4.74	4.74
SD	.49	1.59	1.67	1.41	1.23	.59	.84	.71	1.28	1.22	1.52	1.46	1.19	1.23	1.24
Cronbach's alpha							.93	.88	.81	.78	.76	.84	.82	.75	.77

Note. * $p < .05$ ** $p < .01$ *** $p < .001$. Spearman non-parametric correlations were calculated between the parent's characteristics and other variables; Pearson correlations were calculated between all other variables

Predictors of Parental Involvement in School Feeding Programmes

A hierarchical multiple regression analysis was conducted in four sequential models to examine the predictors of parental involvement in school feeding programmes and answer our three research questions. This approach allowed for the incremental evaluation of predictor groups in explaining variance in parental involvement. All assumptions of multiple regression were checked and met, including linearity, normality, and multicollinearity.

Model 1 included only parents' economic status as a predictor and was statistically significant, F (1, 438) = 17.08, $p < .001$, accounting for 3.8% of the variance in parental involvement, $R^2 = .038$. **Model 2** added parental personal motivators**:** self-efficacy, role construction, and school valence. This model significantly improved the prediction of parental involvement, F (4, 435) = 15.38, $p < .001$, explaining 12.4% of the variance, $R^2 = .124$, with an R^2 change of .086 from Model 1. **Model 3** added school-related factors: child, teacher, and school invitation. The model accounted for 14.5% of the variance in parental involvement, $R^2 = .145$, F (7, 432) = 10.43, $p < .001$, with a modest R^2 change of .021. **Model 4**, the final model, included perceived life context factors: time, energy, skills, and knowledge. This model explained 16.0% of the variance in parental involvement, $R^2 = .160$, F (9, 430) = 9.11, $p < .001$, with an R^2 change of .015 compared to the previous model.

In the final model, several predictors emerged as statistically significant. Parental self-efficacy was a strong positive predictor of involvement, $\beta = .261$, $p < .001$, indicating that parents who felt more capable of influencing school matters were more likely to be involved in feeding programmes. Similarly, school valence ($\beta = .142$, $p = .003$) and parents' skills and knowledge ($\beta = .247$, $p = .036$) were significantly associated with increased parental involvement. Notably, school invitation ($\beta = .192$, $p = .006$) also remained a significant positive predictor, highlighting the importance of proactive communication from schools. Other variables, including economic status ($\beta = –.087$, $p = .070$), role construction ($\beta = –.068$, $p = .409$), child invitation ($\beta = .021$, $p = .722$), teacher invitation ($\beta = .063$, $p = .260$), and time and energy ($\beta = –.014$, $p = .894$), were not statistically significant predictors in the final model.

These findings suggest that psychological beliefs (such as self-efficacy), positive parental attitudes toward the school, and sufficient knowledge

and skills related to the school feeding programme are key drivers of parental involvement. Additionally, schools' efforts to actively invite and engage parents play an essential role. The results are summarised in Table 1.

Table 2
Hierarchical Multiple Regression Predicting Parental Involvement in the School Feeding Programme

Predictor	B	SE	β	t	95% CI (Lower, Upper)
Step 1					
(Constant)	3.137	0.100		31.23	[2.940, 3.335]
Parents' Income	-0.273	0.066	-0.194***	-4.13	[-0.403, -0.143]
Model 2					
(Constant)	4.265	0.356		11.99	[3.566, 4.965]
Parents' Income	-0.121	0.068	-0.086	-1.79	[-0.254, 0.012]
School Valence	0.183	0.064	0.135**	2.87	[0.058, 0.309]
Parents' Self-efficacy	0.165	0.036	0.253***	4.55	[0.094, 0.236]
Role Construction	-0.209	0.039	-0.298***	-5.35	[-0.286, -0.132]
Model 3					
(Constant)	4.446	0.372		11.94	[3.715, 5.178]
Parents' Income	-0.126	0.067	-0.089	-1.88	[-0.258, 0.006]
School Valence	-0.190	0.064	-0.140**	-2.95	[-0.317, -0.063]
Parents' Self-efficacy	0.173	0.038	0.266***	4.54	[0.098, 0.248]
Role Construction	-0.135	0.048	-0.193**	-2.79	[-0.230, -0.040]
Child Invitation	-0.007	0.033	-0.013	-0.22	[-0.071, 0.057]
Teacher Invitation	0.039	0.032	0.067	1.20	[-0.025, 0.102]
School Invitation	-0.139	0.051	-0.192**	-2.74	[-0.238, -0.039]
Model 4					
(Constant)	4.438	0.378		11.75	[3.696, 5.181]
Parents' Income	-0.122	0.067	-0.087	-1.82	[-0.255, 0.010]
School Valence	0.192	0.065	0.142**	2.94	[0.064, 0.321]
Parents' Self-efficacy	0.170	0.038	0.261***	4.44	[0.095, 0.246]
Role Construction	-0.047	0.057	-0.068	-0.83	[-0.160, 0.065]
Child Invitation	0.012	0.033	0.021	0.36	[-0.053, 0.077]
Teacher Invitation	0.036	0.032	0.063	1.13	[-0.027, 0.099]
School Invitation	-0.063	0.058	0.192**	1.10	[0.050, 0.176]
Time and Energy	-0.010	0.074	-0.014	-0.13	[-0.154, 0.135]
Skills and Knowledge	0.167	0.079	0.247*	2.11	[0.011, 0.322]

Note. N = 500. CI = Confidence Interval. $p < .05$, $p < .01$, $p < .001$

DISCUSSION

This study aimed to examine the factors predicting parental involvement in school feeding programmes in Tanzania by integrating parents' variables, school-based variables, and life context. The findings

illuminate how psychological characteristics, particularly parental self-efficacy, school valence, and parental skills and knowledge, play a more significant role in predicting parental involvement than socioeconomic or structural variables. These findings reflect and expand upon existing literature on family-school partnerships and educational involvement, offering a nuanced understanding of school feeding in Sub-Saharan Africa.

Parental self-efficacy emerged as a powerful predictor of involvement, confirming earlier research highlighting the importance of parents' belief in their capacity to support their child's education (Hoover-Dempsey et al., 2005). When parents feel competent, they are more likely to engage, irrespective of economic or logistical challenges. This is consistent with studies in both high- and low-income countries, which have found that higher parental self-efficacy leads to more frequent and sustained engagement with school activities (Garbacz et al., 2017). For instance, Allee-Herndon et al. (2020) reported that self-efficacious parents are likelier to participate in school initiatives, including feeding schemes, homework support, and decision-making bodies. In Tanzania, where school infrastructure and parental literacy levels are uneven, fostering self-efficacy through structured outreach and capacity-building may offer a practical pathway to enhance parental engagement.

Similarly, parental school valence parents' past experiences and perceptions of schools significantly predicted involvement, which aligns with previous findings suggesting that positive school memories and relationships with school staff increase the likelihood of active participation (Topor et al., 2010). In particular, Tseng (2022) emphasises that emotional valence toward education formed during a parent's schooling years significantly influences their present-day attitudes and behaviours toward school involvement. This underscores the importance of cultivating positive, inclusive school climates that reshape community narratives around schools, especially in areas where public education has historically been underfunded or devalued. In the Tanzanian context, schools that prioritise respectful engagement with parents and foster trust may see higher levels of participation in initiatives such as feeding programmes.

The significance of parental skills and knowledge in predicting involvement adds a compelling layer to our understanding of programme

sustainability. Studies in nutritional and educational domains show that when parents understand programme objectives, mechanisms, and expected outcomes, their engagement deepens (Woldehanna & Jones, 2010). Moreover, Gelli et al. (2019) demonstrated that informational access and training in school feeding systems enhanced parental buy-in and continuity of programme benefits in Ethiopia and Ghana. In Tanzania, where such programmes rely heavily on donor support, empowering parents with the knowledge to engage meaningfully through sensitisation meetings or local governance structures can provide a more stable support base when external resources dwindle.

Contrasting with these significant predictors, traditional demographic and socioeconomic variables such as income, marital status, and employment were not significantly associated with parental involvement in the final model. These findings align with the findings by Flores (2023), who found no strong correlation between parental engagement and demographic characteristics. While this may appear counterintuitive, it resonates with emerging perspectives in global education research that stress the relative power of psychosocial over structural determinants (UNESCO, 2021). For example, despite persistent assumptions about economic limitations as barriers to engagement, recent studies by Jeynes (2011) and Bergnehr (2019) argue that motivation, agency, and relationship quality often override material constraints in determining parental participation. This does not negate the impact of poverty but suggests that psychological and relational variables can mediate or buffer against it.

Equally important is the role of school-led invitations to involvement, which were found to be significant. This supports Hoover-Dempsey et al.'s (2005) proposition that school-initiated invitations are among the most powerful levers for fostering engagement. When schools proactively reach out, clarify expectations, and create welcoming environments, parental participation increases, even in settings where other barriers are present (Đurišic, 2017; Epstein, 2011). In this study, the effect of school invitations highlights the need for Tanzanian schools to institutionalise communication practices that invite, respect, and value parental voices, particularly around programmes that directly affect student health and learning outcomes.

Interestingly, factors such as teacher and child invitations, role construction, and time and energy availability were not significant predictors in the final model. While previous research suggests these can influence engagement (Anderson & Minke, 2007; Patall et al., 2008), their non-significance may reflect cultural or contextual nuances. For instance, the collectivist orientation in Tanzanian communities may prioritise school- or community-led cues over child-driven prompts. Additionally, limited teacher-parent engagement outside formal channels may dilute the impact of teacher invitations, pointing to the need for professional development in parental communication strategies.

These findings suggest that policy and programme efforts should move beyond assumptions of economic constraint and instead emphasise psychological empowerment, relational trust, and informational clarity. Effective parental engagement strategies in school feeding should not be limited to logistical contributions, such as food or financial support, but also include capacity-building initiatives that elevate parents' sense of purpose, ability, and belonging within the school ecosystem. This echoes Bundy et al. (2018) global call for "school feeding 2.0", a model that integrates health, education, and community participation into a holistic framework for student well-being.

The study generally advances a more psychologically grounded and relational understanding of parental involvement in school feeding programmes. It suggests that meaningful engagement hinges more on how parents think and feel about their roles and relationships with the school rather than on what they materially possess. Future interventions should thus prioritise psychosocial empowerment, structured communication, and school climate reforms to enhance sustainable parental participation across Tanzanian schools and comparable contexts.

IMPLICATIONS OF THE STUDY

The findings of this study underscore the need for future research to move beyond traditional socioeconomic models and delve deeper into the psychological and relational dimensions of parental involvement in school feeding programs. Longitudinal and intervention studies should explore how parents' self-efficacy and emotional connections to school environments develop over time and respond to targeted school-based strategies to boost confidence and positive perceptions (Garbacz et al., 2017; Hoover-Dempsey et al., 2005).

Likewise, capacity-building emerges as critical: research must evaluate the design and delivery of culturally appropriate training initiatives that enhance parents' skills and knowledge about nutrition programs, assessing their long-term impact on program sustainability and student outcomes (Aurino et al., 2020; Gelli et al., 2019). Although economic and contextual constraints (e.g., time, energy) did not predict involvement in the final model, mixed-method and ethnographic studies are essential to illuminate how poverty, food insecurity, and competing demands interact with psychosocial factors to shape parents' engagement strategies (Jeynes, 2011; UNESCO, 2021).

Equally important is understanding the mechanisms of school–community communication: the predictive power of school-initiated invitations calls for an in-depth investigation into how schools can institutionalise inclusive outreach and build trust and what professional development teachers need to enhance family engagement (Đurišic & Bunijevac, 2017; Epstein, 2011).

Framing this work within Bronfenbrenner's Ecological Systems Theory will allow researchers to situate individual behaviours within nested environmental layers from policy and cultural norms to emerging digital mesosystems and to examine how increasing digital access in low-income regions reshapes parental involvement in both nutrition and broader educational initiatives (Lim, 2022). A multidimensional, theory-driven lens will yield more effective, contextually grounded strategies for positioning parents as co-educators and co-implementers in efforts to improve child nutrition and learning outcomes.

STRENGTHS AND LIMITATIONS OF THE STUDY

This study's strengths begin with its grounding in Bronfenbrenner's Ecological Systems Theory, which offers a holistic lens to examine how individual, school, and broader contextual systems intersect to shape parental involvement in school feeding programmes. Moreover, conducting the research in Tanzania's Mara Region, a mature SFP environment nurtured for over a decade through initiatives like PCI's Pamoja Tuwalishe, allowed for in-depth insights into long-term engagement patterns. Moreover, the large and diverse sample of 500 parents drawn from Bunda, Butiama, and Musoma districts ensured broad regional representation and increased confidence that the findings reflect common trends across varied socioeconomic backgrounds.

Another strength lies in using a structured, theory-driven questionnaire adapted from the Hoover-Dempsey and Sandler model of parental involvement and contextualised for Tanzania (building on Kigobe et al., 2018). The careful translation and back-translation process into Swahili ensured conceptual and linguistic equivalence, enhancing measurement reliability for constructs such as self-efficacy, role construction, and perceptions of school invitations.

Despite the study's many strengths, we acknowledge the limitations also: the cross-sectional design prevents the establishment of causal relationships, and reliance on self-reported data may introduce social desirability bias into the findings.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that parental self-efficacy, positive attitudes toward school (valence), and knowledge of feeding programs are associated with parental involvement in school feeding programmes (SFPs). These factors exert a greater influence than structural barriers, underscoring the need to rethink how parental engagement is understood and promoted in Tanzanian education.

The findings carry important implications for education policy, school practice, and community engagement. As Tanzania continues implementing SFPs as part of its broader educational and child welfare strategy, there is a pressing need to move beyond material contributions and acknowledge parental involvement's psychological, relational, and contextual dimensions. Schools must become spaces that actively welcome and invite parents into the educational process. Whether verbal, written, or action-based, invitations are critical in shaping parents' perceptions of their value in supporting SFPs. When schools proactively reach out and establish open lines of communication, they foster a culture of inclusion and shared responsibility.

Parents' personal beliefs, including their sense of efficacy, perceived role value, and knowledge about school feeding initiatives, also influence their level of involvement. These are not innate qualities but can be cultivated through regular engagement and targeted capacity-building efforts. Educators, especially those serving rural and marginalised communities, need support and training to engage parents effectively. Therefore, teacher education and school leadership programs should incorporate

strategies for fostering welcoming environments, initiating inclusive communication, and acknowledging diverse forms of parental support.
Life-contextual factors, such as work schedules, literacy levels, and economic pressures, shape parents' participation capacity. While these constraints are often unavoidable, schools can adopt flexible approaches that accommodate varying circumstances. For example, inviting parents to contribute in ways that align with their availability or skills can make participation more feasible and meaningful.

Given these insights, stakeholders should prioritise awareness campaigns and training sessions to increase parental understanding of SFPs and their complementary role within the fee-free education framework. These initiatives could be embedded into school meetings, ward forums, and parent-teacher days, giving parents the information and confidence to engage meaningfully.

The 2021 National Guidelines on School Feeding and Nutrition Services provide a useful policy anchor but require localisation. Ambiguities in parental roles must be addressed through accessible community dissemination, school orientations, and coordination at the district level. Embedding parental engagement as a central strategy in school development plans and national education frameworks will enhance programme ownership and sustainability.

Ultimately, this study underscores the need for inclusive, knowledge-driven, and context-sensitive approaches to parental engagement. Sustainable and community-owned school feeding models must replace externally driven interventions if long-term impact is to be realised. By addressing the interplay of personal, interpersonal, and contextual influences on parental involvement, Tanzania can improve SFP outcomes and move closer to achieving its education and nutrition development goals.

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Leadership Strategies for Enhancing Teacher Commitment in Public Secondary Schools in Tanzania: An Ethical and Moral Inquiry

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Abstract
This study explores the leadership strategies employed by heads of secondary schools to enhance teacher commitment in public secondary schools in Tanzania, with particular attention to the ethical and moral dimensions of teaching. In Masasi District, Mtwara Region, the study adopted a qualitative approach using a descriptive case study design. Twenty-four participants were purposively selected, including fourteen teachers, five heads of schools, and five ward education officers. The research was theoretically grounded in McGregor's Theory X and Theory Y. Data were collected through semi-structured interviews and focus group discussions and analyzed using thematic analysis. The findings revealed that rewarding teachers, creating a conducive working environment, providing professional support, delegating authority, and involving teachers in decision-making were key strategies to enhance commitment. However, heads of schools encountered challenges such as inadequate financial resources, political interference, limited management skills, and poor communication among staff. The study concludes that strengthening teacher commitment significantly improves learning outcomes, promotes the profession, and enhances overall teaching performance. It recommends that the government provide heads of schools with targeted management training and ensure timely and adequate financial support to facilitate the achievement of educational objectives.

Keywords: *Teacher Commitment, Leadership Strategies, Public Secondary Schools, Heads of Schools, Morality, Ethics*

INTRODUCTION

Teachers' commitment is a critical factor in enhancing the quality of education. Committed teachers demonstrate determination to work with their students and foster their academic and personal growth (Zhang et al., 2019). Contemporary educational debates increasingly highlight the need to strengthen teachers' commitment, particularly in government schools. Globally, education systems have recognized that enhancing teachers' commitment is essential for achieving educational goals (UNESCO, 2015). In many African countries, however, teachers' commitment in government schools has deteriorated, necessitating appropriate strategies by schools, governments, and other stakeholders to reverse this trend and improve quality education (Vera, 2016).

Heads of schools play a crucial leadership role by inspiring teachers to achieve educational aspirations. They are responsible for fostering a learning culture, supervising teachers, and facilitating collaboration (Wronowski, 2017). Nevertheless, heads of global schools, particularly those in government schools, face significant challenges in enhancing teachers' commitment. In developed countries such as the United States, high levels of teacher commitment are attributed to better remuneration and professional recognition (Hanover Research, 2012). Similarly, in Canada, substantial investments in recruiting qualified and competent teachers have minimised the need for intensive supervision (Haruni & Mafwimbo, 2014; Mwesiga & Okendo, 2018; Potter, Pavlakis, & Roberts, 2020). In contrast, public secondary schools in many African countries often require more active oversight to ensure teachers fulfil their responsibilities (Tony, 2011). As Bipath, Venketsamy, and Naido (2019) observe, teachers' commitment remains one of the most pressing challenges faced by heads of schools in South Africa's public education system.

The lack of teacher commitment has led to frustration, confusion, and strained relationships between teachers and school leaders, subsequently affecting student outcomes. In countries such as Ghana, Nigeria, and Uganda, diminished teacher commitment has contributed to the poor performance of public secondary schools (Gilzene, 2020). In South Africa, Okeke and Mtyuda (2017) highlighted teacher job dissatisfaction caused by resource shortages, overcrowded classrooms, and administrative inefficiencies. Moreover, poor working conditions, low

salaries, and diminished social status further exacerbate teachers' dissatisfaction and lack of commitment (Moses et al., 2017).

In Tanzania, reports also indicate a decline in teachers' commitment in public secondary schools, with some schools exhibiting poor student performance due to demotivated teachers, administrative intimidation, and political interference (Milana, 2014; Shao, 2021). Studies estimate that approximately 21.5 to 22.7 per cent of teachers in ward secondary schools demonstrate low commitment to teaching activities (Jones et al., 2017; Mwesiga & Okendo, 2018). Factors contributing to this trend include inadequate motivation, poor communication between administrators and teachers, limited career advancement opportunities, and a lack of essential teaching and learning materials (Martinez, 2019). These challenges highlight the growing demands placed on public secondary schools despite finite human, financial, and physical resources (Mosha, 2006).

Demoralization among teachers in public schools significantly undermines curriculum implementation, as teachers are key actors in realising educational objectives (Khakpour, 2015; Mosha, 2006). In contrast, teachers in private schools often exhibit higher levels of commitment, further highlighting the disparity between the two sectors (Mkumbo, 2016).

The Tanzanian government has tried to address teacher commitment by investing in teachers' housing, providing teaching and learning materials, and recognizing exemplary teachers (Mwesiga & Okendo, 2018; Olurotimi et al., 2015). Nevertheless, evidence suggests that poor salaries, inadequate working conditions, political interference, and limited involvement of teachers in decision-making continue to hinder improvements in teacher morale and commitment (Aunga & Masare, 2017; Betweli, 2013; Mfaume & Bilinga, 2017; Mgonja, 2017). A report by TWAWEZA (2017) noted that teacher commitment in the Mtwara Region, particularly Masasi District, remains insufficient, as evidenced by delayed student assessments and ineffective teaching practices.

Moreover, the lack of incentives, managerial intimidation, political intrusion, and limited promotional opportunities have further contributed to teacher demoralization (IMF, 2015; Jones et al., 2017; Mosha, 2006; Mwesiga & Okendo, 2018). Enhancing teacher commitment requires

concerted efforts to improve living and working conditions and to foster positive relationships between school leaders and their subordinates, as seen in more successful private schools (Haruni & Mafwimbo, 2014; Mosha, 2006).

From an ethical perspective, teaching is considered a noble profession that demands strong moral character (Anangisye, 2019). Teachers are expected to demonstrate true devotion, tolerance, and commitment to professional and non-professional responsibilities, helping students achieve academic and personal goals (Anangisye, 2018). Failure to adhere to these moral standards compromises teachers' effectiveness and students' outcomes. The importance of upholding morality and ethical standards in teaching cannot be overstated, especially in an era of globalisation and materialism, which has weakened traditional values (Prakasha & Jayamma, 2011).

Consequently, government interventions, faith-based organisations, and non-governmental organisations are necessary to reinforce teachers' professional and moral obligations. Heads of schools must be equipped with the managerial skills and resources to support teachers in fulfilling these obligations. Nevertheless, moral commitment should not be contingent on resource availability; rather, it must precede material considerations, reflecting the intrinsic values of the teaching profession.
Unchecked declines in teacher commitment threaten to undermine students' academic success and impede the realisation of broader educational and national development goals. Against this backdrop, the present study aims to investigate the strategies employed by heads of schools to enhance teacher commitment in public secondary schools in Tanzania, focusing on ethical and moral dimensions. Specifically, the study sought to address the following objectives:

1. To explore the specific activities undertaken by heads of schools to enhance teacher commitment;
2. To identify the challenges faced by heads of schools in enhancing teacher commitment;
3. Examine the relationship between teachers' morality and commitment to their work.

This study contributes to the existing literature by illuminating the strategies and challenges encountered by school leaders in promoting

teacher commitment, with particular attention to the role of morality and ethics.

The following section presents the theoretical underpinning and empirical literature review relevant to the study.

Theoretical Framework

This study was guided by Theory X and Theory Y, developed by social psychologist Douglas McGregor around 1960. These theories focus on how managers perceive and motivate their subordinates:

Theory X assumes that individuals inherently dislike work, lack ambition, avoid responsibility, and must be coerced, controlled, or threatened with punishment to achieve organizational goals. Thus, the "carrot and stick" management approach, rewarding good performance and penalising poor performance, is considered effective in this context (McConnell & Rorrer, 2009).

Theory Y, on the other hand, posits that individuals are self-motivated, enjoy their work, accept responsibility, and seek ways to be productive. Managers working within the assumptions of Theory Y are relieved of micromanagement and instead focus on supporting, empowering, and involving employees in decision-making (Milana, 2014; Potter et al., 2020). While both theories offer valuable insights, they also present challenges. One major weakness is the potential confusion for school heads about whether to apply the Theory X or Theory Y approaches. As Mark (2015) notes, Theory Y is not a completely progressive alternative to the seemingly negative assumptions of Theory X.

The effectiveness of applying either theory depends largely on the real-life situation of the organisation. Nonetheless, Theory Y is often considered more effective in promoting teachers' commitment in public secondary schools (Danulo, 2016). In public secondary schools, some teachers demonstrate low commitment, irregular attendance, and an unwillingness to take responsibility (Gilzene, 2020; Milana, 2014), while others are self-motivated and passionate about teaching. Consequently, heads of schools must balance rewarding committed teachers and closely supervising or sanctioning less committed ones (Hanover Research, 2012; Jude & Cornell, 2015).

To strengthen the theoretical foundation, Transformational Leadership Theory was triangulated with Theory X and Theory Y. Transformational leadership focuses on fostering change and inspiring organisational commitment. It promotes the creation of cohesive environments where leaders and followers work collaboratively towards shared goals (Islam et al., 2021). According to Rolfe (2011), transformational leadership emphasizes building interdependent relationships based on mutual trust and belonging, thus promoting teamwork and organizational effectiveness.

Empirical Literature

The empirical literature is presented under two subsections: teachers' commitment and morality in teaching.

Teachers' Commitment

Several scholars have examined the strategies employed by school heads to enhance teachers' commitment in public secondary schools:

Mkumbo (2012) investigated teachers' commitment to and experiences of the teaching profession in Tanzania. Using focus group discussions, he explored the perspectives of both community and government school teachers. The study revealed that poor working conditions significantly affected teachers' commitment. Mkumbo recommended improving housing facilities and providing better social welfare services. Although the study employed a quantitative approach, the current study adopts a qualitative approach with interviews and focus group discussions, focusing specifically on school heads' strategies related to teachers' morality.

Mwesiga (2020) examined the effectiveness of school leadership in enhancing teachers' commitment in the Kagera Region. A mixed-methods approach using questionnaires was applied. The study found that heads of schools were overwhelmed with administrative tasks, limiting their effectiveness. Unlike Mwesiga's study, the present research exclusively employs a qualitative approach.

Mwamatandala and Muneja (2020) analyzed the effect of school management on teachers' commitment in Arusha City using a quantitative approach and closed-ended questionnaires. Although they applied a

different research approach, their findings provide important insights into the role of school heads in boosting teachers' commitment.

Synthesizing the reviewed literature shows that previous studies largely emphasized governmental strategies such as salary increments, infrastructure development, and professional development to enhance teachers' commitment (Outhouse, 2012; Olurotimi, 2015; Semali, 2016; Piovan, 2017; Kirya, 2019; Gilzene, 2020). However, little attention has been paid to the strategies used by heads of schools, particularly from a moral perspective. This study addresses that gap.

Morality in Teaching

Teachers are often regarded as role models, responsible for upholding and modelling moral behaviour (Chowdhury, 2016). As such, they must embody ethical standards shaped by the values of the society they serve (Mgonda, 2019). Teachers' commitment to the profession is not only a professional obligation but also a moral one. Ethical standards guiding teachers include integrity, fairness, respect, honesty, confidentiality, and dedication to excellence (Gotterbarn et al., 2018; Stievano & Tschudin, 2019; Evstratova et al., 2020).

In Iran, Ashraf et al. (2017) employed a quantitative approach to study the relationship between teachers' emotional intelligence and their commitment to professional ethics. Their findings showed a positive correlation between emotional intelligence and professional commitment. Relating this to the current study, teachers' complaints about low pay may partly reflect a lack of emotional competence to navigate professional challenges.

Moreover, Salehnia and Ashraf (2015) emphasize that teacher professionalism directly impacts pedagogical quality and student learning outcomes. Low professionalism, therefore, can undermine effective teaching and, by extension, affect students' academic success.

In summary, the reviewed theoretical frameworks and empirical studies highlight the critical role of leadership approaches, working conditions, and teachers' moral commitment in shaping teachers' dedication to their profession. While previous research has shed light on various strategies to enhance teachers' commitment, there remains a noticeable gap concerning the specific strategies employed by school heads focusing on moral

inquiry. Therefore, this study seeks to bridge this gap by exploring how heads of public secondary schools enhance teachers' commitment through leadership practices and moral considerations.

METHODOLOGY

A descriptive case study design was employed in this study. It is one of the forms of research design that deals with a single unit, such as an individual, one group, or one organization (Cohen et al., 2011). The descriptive case study design was useful as it was applied to educational officers, including Ward Education Officers (WEO), Heads of Schools (HoS) and teachers who are information-rich on educational issues related to strategies used by heads of school in enhancing teachers' commitment (Neuman, 2012 and Creswell, 2004). Descriptive case study design is characteristically utilized when small numbers of cases are being explored (Crowe et al., 2011; Harrison et al., 2017). It is normally undertaken through semi-structured interviews and FGDs, with open-ended questions leading to information collection in narrative text instead of numbers (Punch, 2013). In the current study, semi-structured interviews and FGDs were used to fully comprehend strategies used by heads of schools to enhance teachers' commitment and the challenges they faced in doing so.

The study was conducted in the Masasi district in Mtwara region following the results of CSEE in 2018, 2019 and 2020; the district was selected from the cluster of low-performing districts in CSEE (Jones et al., 2017). This study sampled 24 participants, including five (5) Heads of Schools, five (5) Ward Education Officers, and fourteen (14) Teachers from five (5) selected public secondary schools. Table 1 provides the sample and respective tools used for data collection.

Table 1:
The Sample and Data Collection Tools Used for Data Collection

Respondents	Sample Size	Sampling Procedures
Ward Education Officers	5	purposive sampling
Head of schools	5	purposive sampling
Teachers	14	Purposive sampling
Total	**24**	

Source: Field Data, (2023)

Creswell (2014) asserts that a qualitative work should have a small sample size to obtain significant depth and useful information. From this perspective, the study's sample size had 24 participants, which was determined by point of saturation. This sample size enabled the researcher

to obtain in-depth information regarding the strategies used by heads of schools to enhance teachers' commitment.

The purposive sampling technique was employed and served as a mechanism to obtain study participants who were more experienced in issues related to the study (Freire, 2013; Vera and Rosemary, 2015; Creswell, 2009; Van Der Vleuten et al., 2010). Heads of schools were purposively sampled because the study focused on their strategies to enhance teachers' commitment, including the challenges they encountered; thus, their firsthand experiences were crucial. Ward Education Officers were also purposively selected based on their role as immediate supervisors of heads of schools, making them rich sources of information regarding the strategies employed and the overall morale of teachers. Additionally, with the assistance of teachers on duty, classroom teachers without leadership responsibilities were purposively sampled to provide varied firsthand perspectives on the issues under investigation, offering insights distinct from those of school leaders.

Data were collected through semi-structured interviews with Heads of Schools (HoS) and Ward Education Officers (WEOs), as well as focus group discussions (FGDs) with teachers. Each interview lasted about 30 minutes and was conducted in the offices of the HoS and WEOs, chosen for their conducive environment. The FGDs, which lasted around 60 minutes, comprised male and female teachers, ensuring a diverse range of perspectives. Participants were encouraged to share their views openly, with the researchers establishing ground rules to ensure equal participation. Two FGD sessions were held in two schools, each with seven teachers. During interviews and FGDs, the researchers took detailed notes and recorded audio to aid data analysis. To ensure the credibility and trustworthiness of the findings, the researchers employed several strategies, including peer debriefing, member checking, sustained involvement, and triangulation (Taherdoost, 2016).

Following the triangulation of data collection methods, comprehensive and rich information was gathered regarding the strategies that Heads of Schools (HoS) used to enhance teachers' commitment in public secondary schools and the challenges they encountered. A thematic analysis was employed to analyze the data systematically, identifying common patterns and themes. Braun and Clarke (2012) found that the six-step thematic analysis process was instrumental in identifying these patterns.

The initial stage involved transcription, familiarization with the data, and selecting quotations. The researchers transcribed and reviewed the data thoroughly to identify preliminary themes and important sections. Relevant quotations were then selected to answer the research questions. The second step involved identifying keywords, where the researchers examined the data for recurring patterns, terms, and visual elements, which were referred to as keywords. The third step was coding, where short phrases or words were assigned to data segments to derive meaning and significance. In the fourth phase, codes were organized into meaningful groups to identify patterns and relationships. The fifth step involved conceptualizing and interpreting keywords, codes, and themes. Finally, the sixth phase resulted in the development of a conceptual model.

Throughout this process, the researchers listened to the audio data and took detailed notes to familiarize themselves. They then generated initial codes and used NVIVO software to search for themes, reviewing and defining them before reporting the findings (Creswell, 2011).

Regarding ethical considerations, ethical clearance and research permits were obtained from the University of Dodoma, which facilitated permission from the Regional Administrative Secretary (RAS) of Mtwara Region and the District Administrative Secretary (DAS) of Masasi District. This allowed the researchers to access the schools through a letter from the District Executive Director (DED). Informed consent was sought from all participants, who were fully briefed on the purpose of the study and their right to participate or withdraw at any time. All participants signed consent forms affirming their voluntary participation. Anonymity was ensured by using pseudonyms when reporting the findings.

FINDINGS AND DISCUSSION

The findings and discussions of the study are presented, as well as the study objectives.

Activities Carried Out by Heads of Schools in Enhancing Teachers' Commitment

The first specific objective of the study was to explore the specific activities done by Heads of Schools to enhance teachers' commitment.

Interview results indicated that rewarding teachers, creating a conducive working environment, and giving appreciation to teachers were crucial strategies for enhancing teachers' commitment to work hard and to have a sense of commitment. Rewarding teachers by giving cash and providing certificates and letters of appreciation inspired teachers to determine their teaching responsibilities. In this regard, one of the participant school heads had the following to share:

> Despite the scarcity of resources, rewarding teachers is very important, especially when they work hard. In my school, we provide cash to those teachers producing grades A and B in different teaching subjects relating to the National examinations. Following those payments, teachers are highly committed to teaching (Interview with Head of School A).

In the same point of view, Head of School B commented that:

> Rewarding has a significant role in enhancing the teachers' commitment because it encourages teachers to work hard. In our school, we appreciate the teachers who enable students to have good academic performance in the national examinations (Interview with Head of School B)

In the same vein, the WEO of Ward A suggested that:

> To enhance the teachers' commitment, the head of the school in our ward rewards teachers by giving cash to the teachers who enhance good grades and the student's academic performance during the national examinations. She enhances the teachers' working attitude to the highest level (Interview with WEO from ward A).

During the focus group discussion, most of the study participants had views that heads of schools used to reward their teachers as the best way to enhance working commitment. Explaining this point, the study participants from the five selected ward secondary schools supported the same point. Conversely, the findings from the FGD observed that the heads of some schools rewarded their teachers. This was proven by one of the participants' teachers, who had the following to say in an FGD session:

> In this school, teachers are usually motivated by the Head of the school when students get higher grades in the National examinations. The head of the school also appreciates teachers following their contributions to the school's good performance. In so doing, teachers found themselves committed to teaching (FGD with teachers).

The findings from FGDs further revealed that some heads of schools failed to reward their teachers. Referring to the discussion, the study participants realized the potentiality of rewards for teachers' commitment,

and they argued that rewards should consider the appreciation and recognition of the teachers. While cementing this point of view, one of the participant teachers argued that:

> Our School Head does not reward the teachers. This is to say that rewarding in this school is not considered, not because of limited resources but because of the nature of our Head of school. I am confident in saying this because the application of reward is in many ways, including appreciation orally or in written form (FGD with teachers).

As the discussion was going on, another participant teacher had the following to cement on the particular point:

I have never received any rewards at this school. Its absence has not inspired me to work hard. Our school head has got no idea of supporting, encouraging and appreciating her teachers. Failure to do so, teachers cannot be committed to teaching (FGD with teachers).

In this perspective, it could be said that all the study participants basically acknowledged the importance of rewarding. However, the practice was constrained by insufficient availability of resources. In some cases, the Head of Schools were unsure whether teachers' commitment was motivated. Thus, the absence of motivation in schools lower down the teachers' morale to work hard. The findings that teachers considered rewarding in form of appreciation orally or in writing, suggest the need to do away with overreliance of monetary rewarding but more creative and innovative kind of rewarding could be put in place.

The importance of rewarding agrees with what Mwamatandala and Muneja (2014) pointed out that some teachers work hard when they are rewarded by their leaders. For this reason, the heads of schools should reward their teachers through praising, giving cash, providing letters and certificates of appreciation so as to enhance the teachers' commitment. As commented by Martinez (2019) that a reward inspires teachers towards their teaching performances. In this regard, the heads of schools are required to apply different forms of reward such as praising, appreciation and giving money so as to push teachers' commitment in public secondary schools.

In Ghana, the government pays teachers who enabled their students to perform well in science subjects in the National exams (Milana, 2014). In

the same case, Wronowski (2017) in South Africa found out that the teachers perform well their teaching assignments as they are paid huge money by the state authority.

With reference to the discussion, it could be argued that the schools' heads who did not reward the teachers lowered down the teachers' commitment. The study thus, recommend the schools' heads to apply different forms of reward such as certificate of appreciation, letter of appreciation, promotion, and giving cash so as to enhance the teachers' commitment.

Challenges Faced by the Heads of Schools in Enhancing Teachers' Commitment

The second specific objective explored the challenges which Heads of Schools encountered in the course of enhancing Teachers' commitment.

The findings of this study showed that the lack of financial resources was a challenge faced the school management. Financial resources are scarce in nature and they create some setbacks to manage some important programmes in many schools such as buying of the teaching and learning materials and repairing some school buildings. In this view, the schools' activities cannot be implemented well due to lack of financial resources. Basing on this finding, the study participants supported this point of view. In advancing this point, one of the participants Head of school revealed the following during the interview:

> In our school just as it is for others', financial resource is a setback towards implementation of school activities. The educational goals cannot be achieved well in absence of fiscal resources. As the heads of schools, we usually fail to achieve our plans due to shortage or absence of money consequently our teachers are demoralized (Interview with HoS).

The aforesaid was cemented by a participant Teacher during FGD as follows:

> Teachers' needs and interests are not taken into consideration due to the shortage or absence of money. Financial resource is a major problem in the implementation of school's activities. Without doubt, teachers' commitment to teaching is jeopardized by the lack of financial resources (FGD with teachers).

Based on the study findings, financial resource seems to be a major problem in enhancing the teachers' commitment. The findings of this

study are concurrent to those of Martinez (2019) which state that there are limited financial resources in many public secondary schools of which educational goals were not well implemented and teachers' commitment is lowered. As argued by Lewis (2015) that lack or shortage of capital among government schools lead to the failure of implementing strategic plans in many schools. Therefore, the government should support financially its secondary schools in the actual implementation of designed strategic plans (Mwesiga & Okendo, 2018). In doing so, the head of schools can be in a better position of enhancing teachers' commitment.

In the light of these findings, it was depicted that ward councilors interfere in the decision-making among heads of schools. The interference was mainly based on the expenditure of the capitation and development grants given to schools. The school heads found themselves restricted to make a right decision. The heads of schools become ineffective when the ward councilors impede the expenditure of school capitation grants, administration and academic activities. Following this, the heads of schools got difficulty to execute school activities in effective way.

Responses from the participant teachers during the FGDs indicated that the majority of the teachers' commitment was constrained by politicians. To justify this point, one of the participant teachers had the following to say:

> The politicians have got more power than the school's management. The Head of school face difficulties in the implementation of school activities following the political interferences. In our school, the Ward Councilor disturbs our school management by bringing in political issues in the schools' management. This is deliberately done to gain political popularity from the community members (FGD with Teachers).

On the same note, another teacher shared the following on the same point:

> The way politicians interrupt the school management leads to interference and confusion on the decision regarding the school activities. This situation results into discouragement among heads of schools. Hence, it leads to poor teachers' commitment to teaching (FGD with Teachers).

The finding shows that politics can interfere in the decision-making including academic issues and school capitation grants among the heads of schools. The school heads found themselves restricted to make a right decision on issues relating to academic activities and expenditure of the

school capitation grants. The school heads become ineffective when the politicians impede the school activities such as contribution from parents, administration and capitation grants. So, this situation disturbs heads of schools and the same negatively impacts teachers' commitment.

This point of view is similar to those by Olurotimi (2015) who claims that in Nigeria the politicians bring confusion and misunderstanding in the public secondary schools. In maintaining the same claim IMF (2015) in Ghana adds that the schools' heads are attacked by the politicians who are bent on gaining political scores.

In view of that situation, the findings suggest that politicians should not interfere with professional and educational matters to ensure that educational goals are achieved. They should leave the heads of schools to implement their strategic plans for the betterment of respective schools. Cooperation between politicians and HoS may be healthy and useful in bringing harmony to the school and consequently teachers' commitment would be enhanced. Regarding expenditure related to capitation grants, the warrant of fund, financial regulations and other related government directives and circulars should guide Heads of Schools rather than subjective views of politicians.

It was further depicted that the welfare of teachers is another challenging issue which lowers teachers' commitment to teaching. It was intimated that where there was no reasonable welfare among teachers including lack of houses, water supply and electricity, it became difficult to sustain teachers' commitment to teaching. The need for enhancing conducive welfare among teachers is crucial and fundamental as the need for teachers' commitment. During the FGD, one of the participant Teacher said the following:

> In this school, welfare of teachers is not highly guaranteed by the school leadership. Our school head does not have strategies to enhance the teachers' welfare including housing, …….. That is why the teachers are highly demoralized. Hence, the teachers do not are work hard in teaching and other extra-curricular activities (FGD with Teachers).

The findings that teachers' welfare were less conducive in the study location fails to appreciate the fact that these are crucial in enhancing teachers' commitment. The findings that the head of school had no effective strategies to ensure that teachers' welfare were in improved,

contrast to those of Mwangi, Odhiambo, and Otieno (2019) that in Kenya the welfare of the teachers was taken into consideration by the educational management. Similarly, findings by Barth (2020) in South Africa showed that the wellbeing of teachers was identified as a crucial in enhancing the teachers' commitment especially in the government schools. In this perspective, the findings suggest that leaders in education system should ensure that they consider the welfare of their teachers so as to raise their commitment.

The findings revealed that some of the heads of schools lacked management skills. The heads of schools lacked planning, organizing, leading and controlling skills. With regard to this reason, it became difficult for the schools' heads to manage their schools effectively. In this view, the heads of schools encounter challenges when it comes to enhancing the teachers' commitment to teaching.

Basing on the responses from the participants during FGD, one of the participant Teacher intimated the following:

> The school heads should have the management skills such as planning, organizing, coordinating and controlling school activities so as to produce positive results in their respective schools. In our school, the head is not creative enough to motivate his teachers. This is due to the lack of leadership skills (FGD with Teachers).

While explaining this point during the FGD, another participant Teacher from the same school had the following to add:

> To be effective in managing schools, the head of school need to plan and organize his strategic activities so as to enhance teacher' commitment. However, our head of school is ineffective in planning and controlling his designed goals. In this regard, teachers' commitment to teaching is not enhanced accordingly (FGD with Teachers).

The findings indicate that many Heads of Schools (HoSs) struggle to enhance teachers' commitment due to insufficient management skills. While some HoSs in Tanzania lack the necessary management skills, the situation differs in other countries, such as Ghana. Lewis (2016) found that HoSs in Ghana effectively apply management skills, as they are trained twice a year. In contrast, HoSs in Tanzania have limited opportunities for professional development, with some receiving no training at all after appointment (Gilzene, 2020). This lack of managerial skill among Tanzanian HoSs is consistent with the transformative

leadership theory, which emphasizes that leaders should be transformative in guiding their schools to higher performance levels. Transformational leadership fosters teacher commitment and can address challenges such as low pay, which some teachers cite as a reason for their disengagement.

Further, poor communication between teachers and school management was identified as a major challenge in enhancing teachers' commitment. Both horizontal communication among teachers and communication between teachers and HoSs were inadequate, hindering collaboration, conflict resolution, and effective coordination. One teacher in the focus group discussion (FGD) noted:

> In this school, there is poor communication between teachers. Our school head has failed to maintain peace and love among the teachers. As a result, morale is very low, which affects teachers' commitment to teaching.

These findings align with IMF (2018), which reports that school heads in Kenya fail to manage communication effectively due to tribal divisions, and with Mkumbo (2012), who found that ineffective communication between the community and school management limits teachers' commitment in Tanzania. Similarly, Haruni and Mafwimbo (2014) found that poor communication in Tanzanian schools reduced teachers' sense of commitment. These results highlight the critical role of effective communication in school management.

Enhancing teachers' commitment, in turn, positively impacts students' academic performance. As teachers become more motivated, they are more effective in their teaching, leading to improved learning outcomes. Bipath (2020) and Milana (2014) emphasize that fostering teacher commitment sustains work morale. Piovani (2017) and IMF (2015) further argue that sustaining teacher commitment is a key responsibility of HoSs, and it directly contributes to positive learning outcomes, as supported by Outhouse (2012).

In alignment with this, Mwamatandala and Munija (2020) found that committed teachers significantly enhance learning outcomes. Mkumbo (2012) and Mwesiga (2020) also stress that effective school management hinges on having committed teachers. In Rwanda, Gilzene (2017) observed that teachers' commitment is crucial for improving learning outcomes in private secondary schools.

Ultimately, the findings suggest that enhancing teachers' commitment is a key strategy for improving student performance. This is consistent with findings from Bipath and Naidoo (2019), who observed that improvements in teachers' welfare in India led to increased commitment. Wronowski (2017) similarly found that in Malaysia, teachers' commitment was strengthened through recognition of the importance of the teaching profession. In Canada, Potter and Roberts (2020) reported that teachers' commitment promoted the profession across both public and private schools. Therefore, the commitment of teachers is essential for the advancement of the teaching profession (Lekule, 2020).

Teachers' Morality

The third objective of the study was to examine teachers' morality in relation to their commitment to their work.

The findings that some teachers were less committed to the work including teaching and that some were able to speak plainly on their commitment status, raised a number of questions as far as morality was concerned. The study findings from the interviews with Head of schools and Ward education officers revealed that for teachers to confess that they were less motivated has something to do with morality rather than motivation. In this regard, one of the participant Head of school had this to say in an interview session:

> Nowadays some of our teachers are less committed and would openly say that they were less committed due to the fact that they owe the employer certain claims. In my view, there is a serious moral death to some our teachers. The government is trying hard to build school infrastructures to improve the working environment (Interview with Head Teacher).

On the basis of the findings, there are signs of low moral reasoning and degradation to some of the participant teachers. Normally, it is rare for professional teachers to directly declare their lack of commitment to teach, provided that teaching is their responsibility as per their employment contract and the obligation of delivering services to the society. These dissatisfactions arguably are detrimental to the teaching job and is prone to jeopardizing students' academic performance. Having teachers who can declare their lack of commitment to teach, dilutes the inherent understanding of teaching as a call, devotion and noble profession. This is to say that; a lack or shortage of certain resources

should not constitute sources of moral dilemmas rather teachers should exhibit the best ethical example possible.

CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that Heads of Schools (HoSs) have a significant opportunity to enhance teachers' commitment through the effective use of available resources, managerial skills, and emotional intelligence. Despite the challenges they face, including teachers' confessed lack of work morale, the study highlights the need for educational leaders to actively promote professionalism and ethics within their leadership practices. Furthermore, the teaching profession should be reaffirmed as a noble and worthwhile vocation for all educators.

To address the challenges identified, it is recommended that the government, alongside other educational stakeholders such as faith-based organizations and non-governmental organizations implement targeted interventions. These interventions should include capacity-building programs focused on enhancing both moral reasoning and emotional intelligence among Heads of Schools and teachers.

This study primarily explored the strategies used by HoSs and the challenges they face in enhancing teachers' commitment, with a specific focus on morality. Future research could investigate how teachers perceive the impact of moral degradation on student academic performance and the broader educational environment.

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The Contribution of Instructors' Usability of ICT Infrastructure on Students Learning Outcomes: The Case of Selected Higher Learning Institutions in Tanzania

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Abstract
Higher learning institutions in Tanzania are undergoing a paradigm shift in the delivery of academic programs, transitioning from traditional face-to-face instruction to digital platforms. In this context, instructors' ability to effectively utilize ICT infrastructure is a critical determinant of successful education delivery and enhanced student learning outcomes. This study investigates the extent to which instructors' ICT usability influences students' academic performance. The study adopted a mixed-methods approach with a cross-sectional design, focusing on two higher learning institutions in Tanzania: The Open University of Tanzania (OUT) and the Institute of Accountancy Arusha (IAA). A total of 237 instructors were randomly selected to participate in the study. Data were collected using self-administered questionnaires, key informant interviews, and focus group discussions. Descriptive statistics and binary regression analysis were employed for data analysis. The findings indicate that instructors' proficiency in using ICT infrastructure significantly influences students' learning outcomes. The usability of ICT tools by instructors was said to account for up to 29% of the variation in learning outcomes. Key usability parameters such as operating smart screens/projectors, setting up audio equipment, and using online response clickers for quizzes and surveys showed a statistically significant and positive impact on student learning. The study concludes that instructors' effective use of ICT infrastructure plays a vital role in enhancing student learning outcomes, particularly when core ICT functionalities are well understood and applied. It is recommended that higher learning institutions in Tanzania strengthen instructors' competencies in ICT tools and software to optimize their impact on student learning. Additionally, education policies should mandate ICT training for instructors to align with the ongoing digital transformation in the education sector.

Keywords*: Instructors, ICT infrastructure, learning outcomes, usability*

INTRODUCTION

The accessibility and usability of ICT infrastructure have increasingly attracted scholarly attention in the context of the global shift from face-to-face to blended and fully online modes of teaching and learning. (Mambile & Mwogosi, 2024; Zhou et al., 2019). How ICT infrastructure is effectively utilized to achieve the desired learning outcomes is of significant concern because learners are no longer experiencing such direct physical experiences with instructors in the face-to-face delivery mode. In blended or fully online modes, learners interact with their instructors exclusively through ICT infrastructure. A key question this study seeks to address is whether instructors' effective use of these ICT tools supports the achievement of student learning outcomes especially given that, in a blended-learning context, instructors simultaneously act as course designers, facilitators, motivators, and evaluators.

Nevertheless, universities particularly in developing countries face growing pressure to offer flexible learning environments, ensure round the clock access to educational resources, and develop robust software infrastructures that support distributed, anytime access for students (Sims & Solomonides, 2009). However, in mapping of the ICT infrastructure availability, Alenezi (2023) found that basic equipment such as computers and projector systems, were generally accessible; while videoconferencing and interactive whiteboards were more sparsely available. Angeli et al. (2022) observed that institutions are increasingly outsourcing the development and management of their digital infrastructure including server hardware and services such as email, shared storage, and video conferencing.

In this context, infrastructure usability denotes the ease with which instructors employ ICT infrastructure to facilitate instruction and achieve desired learning outcomes. It encompasses several key dimensions, including learnability, efficiency, memorability, error frequency, and subjective satisfaction. El-Aasar and Farghali (2022) further identify four core elements of ICT usability: perceptibility, operability, understandability, and robustness.

Conversely, learning outcomes have been defined by Adam (2004), Kennedy et al. (2006), and Semlambo et al. (2022) as the personal changes or benefits resulting from learning, or as explicit statements of

what a learner is expected to know, understand, and demonstrate at the end of a course. In this study, learning outcomes refer to students demonstrated knowledge, skills, and behavioral attributes acquired via digital platforms.

Several recent studies highlight both progress and persistent challenges in ICT-enabled education. Derder et al. (2023) report positive gains in digital pedagogical skills, although perceptions of technical support and infrastructure maintenance remain moderate. Boateng et al. (2016) and Webb et al. (2020) find that e-learning confidence and readiness among academic staff improve significantly when moderated by targeted e-learning training. However, Alhubaishy and Aljuhani (2021) identify fear of change, lack of experience, and privacy concerns as primary inhibitors of instructors' digital adoption. Similarly, Okoye et al. (2023) emphasize insufficient training, inadequate infrastructure and resources, and limited internet access as major barriers to effective teaching and learning.

In the Tanzanian context, the integration of ICT in higher learning institutions faces additional hurdles. Mahenge and Sanga (2016) note inadequate funding for ICT infrastructure, limited internet access, and a lack of technical support. Slow technological adaptation among some instructors further undermines the effectiveness of ICT tools. For instance, Mtebe et al. (2011) found that many instructors in Tanzanian universities struggle to use learning management systems (LMS) and other ICT-based tools due to insufficient training and support.

These challenges underscore the need to examine how instructors' ICT infrastructure usability contributes to student learning outcomes in Tanzanian higher learning institutions. By focusing on both usability dimensions and measurable learning gains, this study aims to inform policy and practice that will strengthen digital teaching and learning.

LITERATURE REVIEW

Information and Communication Technology (ICT) has become integral to modern education, with its adoption steadily increasing in higher learning institutions across Africa, including Tanzania. Kalyani (2024) argues that effective utilization of ICT infrastructure enhances teaching effectiveness and learning outcomes by providing access to diverse educational resources, fostering interactive learning, and improving communication between students and instructors.

In Tanzania, ICT infrastructure in universities and colleges has expanded through investments by the government and international development partners. Nevertheless, the degree of its utilization largely depends on instructors' capacity and readiness to integrate technology into their pedagogical practices (Mahenge & Sanga, 2016). Studies show that when instructors are proficient with ICT tools, they are more likely to engage students through virtual classrooms, online assessments, and multimedia content (Martin et al., 2020). In particular, Frank and James (2024) found that instructors' usability of ICT infrastructure significantly impacts student engagement and academic performance in Tanzanian higher learning institutions.

Despite these gains, many instructors in Tanzania continue to face barriers to effective ICT use, including inadequate training, limited technical support, and insufficient access to essential hardware and software (Ponera & Madila, 2024). Such constraints hinder the potential benefits of ICT-integrated teaching and restrict students' opportunities to engage fully with digital learning environments.

Training interventions play a critical role in enhancing ICT usability among instructors. Hoti and Shatri (2023) and Puteh et al. (2017) emphasize that targeted ICT training not only builds technical competence but also boosts instructors' confidence in deploying technology-driven pedagogies. This increased confidence fosters more innovative teaching strategies, which in turn positively influence student learning outcomes.
Mwakyusa and Mwalyagile (2016) report that, while Tanzanian university students generally view ICT integration positively, they frequently encounter frustrations arising from inconsistent infrastructure availability, poor internet connectivity, and varying levels of instructor preparedness. Student performance tends to improve when ICT-enabled instruction aligns with their learning preferences—for example, Frank and James (2024) found that learners in blended environments (combining face-to-face sessions with online resources) achieved higher assessment scores. Conversely, Atmazaki and Indriyani (2019) demonstrated that inconsistent or poorly integrated ICT use correlates with lower student engagement and reduced academic achievement.

The question of whether instructors' ICT usability contributes directly to learning outcomes is therefore as vital as the choice of delivery technique. Angeli et al. (2022b) emphasize that usability intertwines with content design (notably content visibility), delivery methods, and assessment quality. Instructors who co-design digital instructional materials frequently report increased teaching effectiveness, stronger student engagement, and higher-quality student work. However, English (2016) highlights that disparities in instructors' access to digital resources can produce unequal learning experiences and variable work quality among students.

Moreover, Asif et al. (2022) identified four key findings: poor institutional investment in ICT negatively affects student results; university-provided ICT training often fails to translate into improved performance; innovative and collaborative ICT use enhances student achievement; and students' acquisition of digital skills correlates positively with academic success. To maintain these gains, higher learning institutions must continuously update instructors on evolving digital platforms. Mpungose (2020) notes that while Moodle LMS provides a useful foundation, it must be supplemented with other software tools and social media to deliver fully online lectures. Finally, Muntu et al. (2023) found that digital literacy alone does not significantly influence classroom management or learning effectiveness unless supported by reliable ICT infrastructure.

The studies reviewed above suggest that the extent to which instructors' ICT infrastructure usability influences student learning outcomes ranges from negligible to substantial. This variability is shaped by factors such as the type of ICT infrastructure (hardware versus software), the quality and frequency of usability training, the accessibility of the broader ICT ecosystem, and instructors' intrinsic motivation to adopt new technologies. Consequently, there is a clear imperative to investigate, in the specific context of Tanzanian higher learning institutions, how instructors' ICT usability contributes to the attainment of desired student learning outcomes.

Theoretical framework

The study is guided by two theoretical models aligned with its objectives. The first is the Technology Acceptance Model (TAM), developed by

Davis (1989). TAM focuses on two key beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived Usefulness refers to the user's subjective belief that using a particular system will enhance their performance, while Perceived Ease of Use refers to the extent to which the user believes the system will be free of effort. These beliefs are influenced by external variables such as infrastructure availability, training, and organizational support. In the context of this study, TAM informs the understanding of how instructors perceive the usefulness and ease of employing digital technologies in their teaching practices.

The second theoretical model employed is the Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006). This model outlines the types of knowledge instructors need for effective technology integration in teaching. TPACK emphasizes the dynamic relationship between three core domains: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). It highlights the importance of instructors understanding not only what to teach and how to teach it, but also how to effectively use technology to support the teaching and learning process. In the context of higher education, the TPACK framework is particularly relevant for aligning course content with appropriate digital tools to enhance instructional delivery.

METHODS AND MATERIALS

The study employed a cross-sectional design, which was selected for its practicality in allowing data collection from multiple cases at a single point in time, particularly when time and resources are limited (Shiferaw et al., 2022). This design was deemed appropriate for the study as data were collected simultaneously from two higher learning institutions offering digital training (online programmes) located in different regions. Moreover, cross-sectional designs are recognized for their effectiveness in estimating the prevalence of behaviors and characteristics within a population (Sedgwick, 2014). This is especially useful when the objective is to identify patterns, explore statistical relationships, and make generalizations to a larger population based on a snapshot of data collected at one moment in time.

The study was conducted in the United Republic of Tanzania (URT), a sovereign nation formed from the union of Tanganyika and Zanzibar.

Tanzania is one of the five East African countries and is geographically situated between latitudes 1° and 12° south of the equator and longitudes 29° and 41° east of Greenwich. According to the Tanzania Commission for Universities (TCU) Guidebook (2022), the country hosts approximately 12 public and 24 private higher learning institutions. Additionally, the National Council for Technical and Vocational Education and Training (NACTVET) reports approximately 537 registered higher learning institutions under its regulation (NACTVET Guidebook, 2023).

Two institutions were purposively selected for this study: The Open University of Tanzania (OUT), one of the 12 public universities under TCU, and the Institute of Accountancy Arusha (IAA), one of the institutions registered under NACTEVET. These institutions were chosen due to their active implementation of blended learning modes and their extensive experience in delivering digital training. Notably, despite their adoption of digital practices, instructor engagement in digital training remains relatively low, and the extent to which such training contributes to student learning outcomes remains unclear. OUT offers its courses predominantly through a blended mode, while IAA has adopted a similar approach for several of its programmes.

The study population comprised all academic staff employed at the two selected institutions who were involved in online teaching, regardless of academic rank or area of specialization. Combined, the two institutions have an estimated total of over 583 academic staff members, ranging in designation from tutorial assistants to full professors, who are actively engaged in teaching and research. The distribution of academic staff across the two institutions is presented in Table 1.

Table 1
The study population in the selected institutions

S/No	Institution Name	Population
1	Institute of Accountancy Arusha	260
2	Open University (Dodoma, Dar es Salaam, Manyara and Arusha)	323
	Total	583

Source: Prospectus 2023

Sample size and sampling procedure

A sample size of 237 academic staff was derived from an estimated population of 583 employed academic staff from two selected higher learning institutions based on the Yamane formula of 1967.

$$= \frac{n}{1 + N e^2} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

Where n is the sample size, N population size e is the level of precision. The formula assumes that p=.05 (maximum variability). The desired confidence level is 95%, and the degree of precision/sampling error accepted is 5%. Therefore;

$$n = \frac{583}{1 + 583\ (\ 0.0025)} \approx 237$$

Each element in the sample was selected using simple random sampling, whereby a proportional representation from each selected institution was drawn randomly from employment records through the lottery method. The procedure considered the sampling elements to have homogeneous characteristics since they were all employed academic staff. However, the key informants and focus group participants were purposively selected. The sampling proportion as per the institution is indicated in Table 2.

Table 2
Sampling distribution as per selected institutions

S/No	Institution Name	Population	Sample Size
1	Institute of Accountancy Arusha	260	$\frac{260}{583} \times 237$ =106
2	Open University	323	$\frac{323}{583} \times 237 = 131$
Total		583	237

Source: Field data (2023)

Data collection methods

Three data collection techniques were employed in this study: questionnaire survey, interviews, and focus group discussions. These methods were used to gather both quantitative and qualitative data, including socio-demographic characteristics of respondents and instructors' perspectives on the usability of ICT infrastructure in higher learning institutions.

Questionnaire survey: A total of 237 self-administered questionnaires comprising both open- and closed-ended questions were distributed to selected academic staff. The questionnaires were designed to assess instructors' perspectives on the usability of digital ICT infrastructure

within higher learning institutions. The content and structure of the questionnaire were informed by the Technology Acceptance Model (TAM) (Davis, 1989) and the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006). A standard five-point Likert scale was used to collect data related to the first specific objective, with additional customized items reflecting the TPACK domains. The instrument was pre-tested on at least 5% of the target sample to ensure clarity, relevance, and reliability before full-scale data collection. The choice of questionnaires as a data collection method was driven by several advantages. Questionnaires are cost-effective and time-efficient, allowing the researcher to collect data from a large number of participants simultaneously, an essential consideration given resource and time constraints (Gomm, 2008).

Interviews: Interviews were particularly valuable to the researcher as they aimed to explore in-depth information, especially participants' opinions, perceptions, and views that may not be easily captured through questionnaires (Gomm, 2008; Sarakikya & Kitula, 2024). Face-to-face interviews were conducted with a total of eight key informants selected for this study. Four key informants were purposively chosen from each institution, making a total of eight participants. This number was deemed sufficient to ensure both data triangulation and thematic saturation. The key informants included heads of departments and deans of faculties who are directly involved in ICT usability and digital training within their respective institutions.

Focus Group Discussions: According to Morgan (2004), Duevel (2019), and Millward (2012), well-managed focus group discussions can generate richer and more nuanced insights into a topic, as the group interaction often stimulates memories, debate, and disclosure among participants. For this study, four focus group discussions were conducted, two per institution, comprising academic staff members who did not participate in the questionnaire survey. This was done for triangulation purposes. Research by Guest et al. (2017) has shown that focus groups with 4–6 participants can be sufficient to reach data saturation when the group has homogeneous characteristics.

In this study, each focus group comprised four members selected through a nomination strategy by their peers, based on their subject knowledge,

gender representation, and confidence to actively contribute to discussions. Gender inclusion was proportionally considered based on the availability of male and female participants at each institution.

Data analysis

Field data for this study were analysed quantitatively and qualitatively. Quantitative data were analysed using descriptive statistics, specifically percentages and means, to examine the socio-demographic characteristics of respondents and general patterns of ICT infrastructure usage among instructors. To assess the contribution of instructors' ICT infrastructure usability to student learning outcomes, binary logistic regression was employed. Before conducting the regression analysis, key assumptions were tested to ensure the robustness of the model. The assumption of no extreme outliers was assessed using Cook's Distance, which yielded a maximum value of 1.0602, well below the threshold of 5, indicating the absence of excessively influential data points. Additionally, the linearity of the logit was evaluated using the Box-Tidwell test, while the independence of errors was assumed based on the cross-sectional study design. Multicollinearity among predictor variables was examined using collinearity tolerance and Variance Inflation Factor (VIF). All predictors had tolerance values ranging from 0.353 to 0.578 and VIF values between 1.73 and 2.835, satisfying the acceptable thresholds (tolerance > 0.1 and VIF < 10). These results confirm that none of the variables were excessively correlated, ensuring model stability and interpretability. Moreover, the assumption of linearity in the logit was confirmed as all independent variables showed significant F-values with p-values less than 0.05, indicating a statistically significant linear relationship with the outcome variable. Specifically, all predictors had p-values at or below 0.001, providing strong evidence of linearity. An adequate sample size was also maintained, adhering to the guideline of a minimum of 10 events per predictor variable, further validating the model's reliability.

On the other hand, qualitative data, obtained through interviews and focus group discussions, were analysed using thematic analysis. Audio recordings were transcribed, and the data were coded and organized into themes following the six-phase approach recommended by Braun and Clarke (2006), as adapted by Jack (2019). This involved familiarization with the data through repeated reading, generating initial codes by labeling significant sections, identifying and reviewing emerging themes, and refining them to ensure clarity and accuracy. Themes were named and

defined to represent recurring patterns in participants' responses, particularly around their experiences, challenges, and perspectives on ICT infrastructure usability in digital teaching environments. Thematic analysis was chosen due to its suitability for exploratory research, enabling an in-depth understanding of instructors' digital practices. This method is particularly effective for identifying meaningful patterns, accommodating inductive theme development, and offering rich, contextual insights into the perceived impact of ICT infrastructure usability on student learning outcomes.

Validity and reliability of the study

To ensure that the instrument covers all the components and valid information, the entire process of developing the questionnaire was guided by content validity. This type of validity was ensured through reviewing the previous studies in assessing the adequacy and accuracy of what it measures. Multiple data collection methods were employed to enhance the construct validity of the qualitative information. Triangulation through the use of interviews, focus group discussions, and document reviews helped ensure the credibility and depth of the findings. Additionally, the validity of the qualitative data was reinforced by sourcing information from credible references, including official government reports and peer-reviewed publications from reputable academic publishers. For interview-based data, particular attention was given to the relevance and expertise of the selected participants, ensuring that only individuals with substantial knowledge and experience in ICT usability and digital teaching were included in the study.

On the other hand, reliability for this study was achieved through several strategies. For the quantitative data collected via self-administered questionnaires, internal consistency was assessed using Cronbach's alpha coefficient as defined in the formula below. This statistical measure evaluates how well the items within each scale measure the same underlying construct. A Cronbach's alpha value of 0.70 or higher was considered acceptable, indicating satisfactory internal reliability of the instrument. In addition, the questionnaire was pre-tested on a sample representing 5% of the target population to refine ambiguous items and ensure clarity and consistency. For the qualitative data, reliability was supported by maintaining a systematic coding process, consistent

interview protocols, and audio recording of all sessions to ensure accurate transcription and analysis.

Fami (2000) $\propto= K/K-1 \times S_T^2 - \sum S_i^2$ ..... (1)
Where α (alpha) coefficient, K is the number of items; S_T^2 is the total variance of the sum of the items and the variance of individual items. The reliability of variable analysis indicated by a Cronbach Alpha (α) value all exceeded 0.70. This allowed the analysis of the data for further use. Data reliability of the items for both hardware ICT infrastructure and software components was first tested. The results of the test in terms of Cronbach alpha coefficients were both above 0.005 of the required coefficients (8 items for hardware =0.89, 9 items for students' learning outcome 0.936; - items for software).

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents

Three socio-demographic characteristics concerning respondents who participated in the study were established. These include age, sex, and the name of the institution. The attributes were considered to influence the variables under this study. The findings are indicated in Table 3 below.

Table 3
Socio-demographic characteristics of the respondents

Variable	Attribute	Frequency	Percent
Sex	Male	160	67.5
	Female	77	32.5
Age category	Below 30	22	9.3
	30 to 39	105	44.3
	40 to 49	85	35.9
	50 to 59	23	9.7
	Above 59	2	0.8
Name of the higher learning institution	OUT	115	48.5
	IAA	122	51.5

Source: Field data (2023)

The findings presented in Table 3 indicate that male participants outnumbered female participants in this study. This reflects the broader gender distribution among academic staff in higher learning institutions in Tanzania, where male instructors tend to dominate. This disparity can be attributed to historical gender imbalances in educational access and

enrollment, particularly for women, within the Tanzanian socio-cultural context. These findings are consistent with the Tanzania Commission for Universities (2022) report on the status of university education, which highlights the continued predominance of male instructors in higher education institutions.

In terms of age distribution, the majority of instructors fall within the 30 to 39-year age group, suggesting a relatively young academic workforce. This age group is considered to be more technologically inclined, having been born and raised during the ICT revolution, and is therefore more likely to adopt and utilize digital tools in teaching and learning.
Regarding institutional representation, participation from the two selected institutions—Open University of Tanzania (OUT) and the Institute of Accountancy Arusha (IAA)—was nearly equal, with IAA showing slightly higher figures based on available employment records. Both institutions have documented efforts to integrate ICT into their training delivery systems, making them relevant contexts for studying the usability of ICT infrastructure by instructors.

The instructors' usability of ICT infrastructure contributes to students' learning outcomes

The usability of ICT infrastructure was assessed by categorizing it into hardware and software components, with a focus on their relationship to students' learning outcomes. The results from the binary logistic regression analysis of hardware infrastructure provide valuable insights into how instructors' use of digital tools influences educational performance. Table 4 presents a detailed summary of the key ICT hardware usability variables that significantly predict students' learning outcomes, including the use of various digital hardware devices and their application in instructional methods. These findings highlight not only the extent to which instructors are able to effectively utilize ICT hardware in higher learning institutions but also offer practical implications for educators and policymakers. Specifically, the results underscore the importance of targeted investment and training in hardware infrastructure to enhance the delivery of instruction and ultimately improve student learning outcomes.

Table 4
The instructors' usability of hardware ICT infrastructure

ICT hardware infrastructure usability	β	S.E.	Mean	Wald	Odds Ratio	Sig.
Setting up and using a Laptop/ Computer for presentation or lectures	-0.08	0.33	3.95	0.06	0.92	0.80
Connecting and operating a projector or smart screen	0.56	0.29	4.05	3.79	1.75	0.05*
Using an interactive whiteboard for teaching and collaboration	-0.12	0.19	4.05	0.44	0.88	0.51
Setting up and using audio systems for clear sound during lectures	0.49	0.22	3.92	4.90	1.64	0.02*
Utilizing tablets and smartphones for teaching and communication with students	-0.13	0.20	3.83	0.44	0.88	0.51
Operating digital cameras/video cameras for recording lectures or creating multimedia content	-0.06	0.21	3.97	0.09	0.94	0.76
Setting up and using printers and scanners for printing or distributing materials	-0.08	0.21	3.77	0.16	0.92	0.69
Utilizing response systems (clickers) for interactive quizzes and surveys	0.36	0.18	4.02	3.96	1.44	0.04*
Constant	-2.12	1.08	3.74	3.87	0.12	0.04*

Source: Field data (2023)

The findings presented in Table 4 reveal that instructors' ability to connect and operate projectors or smart screens significantly contributes to students' learning outcomes. The binary logistic regression analysis produced a positive coefficient (β = 0.56) with a standard error of 0.29, indicating that increased proficiency in using these tools is associated with improved student performance. The mean score for this predictor was 4.05, suggesting that most instructors reported a relatively high level of competence and ease in operating such hardware. The statistical significance (p = 0.05) confirms that this relationship is unlikely to be due to chance. These results emphasize the critical role of instructors'

effective use of ICT hardware infrastructure in enhancing the quality of training delivery and, consequently, improving student learning outcomes in higher education institutions. This quantitative finding is further supported by qualitative evidence from the focus group discussions, where one of the participants remarked, "…*I have used digital technologies in teaching my class over the years and I can perform some key operations successfully*…"

This implies that the instructors have some ability to use the ICT hardware infrastructure in delivering their classes. This finding concurs with the TAM model, which stipulates that the adoption of the technology depends on perceived usefulness and perceived ease of use. Instructors expressed the ability to use computer facilities and projectors in their class sessions. This initiative needs to be embraced and up-scaled to other higher learning institutions in Tanzania. Similarly, the instructor demonstrates an intersection of technological and pedagogical knowledge, whereby digital tools such as projectors and smart boards are used to enhance instructional delivery.

The findings also indicate that instructors' ability to set up and use audio systems for clear sound delivery during lectures significantly impacts students' learning outcomes. The logistic regression analysis yielded a positive coefficient ($\beta = 0.49$) with a standard error of 0.22, suggesting that effective use of audio systems is positively associated with enhanced learning outcomes. The mean score for this skill was 3.92, indicating that many instructors possess this capability to a moderate extent. The statistical significance ($p = 0.02$) confirms that this relationship is meaningful and not due to chance. These results highlight the importance of instructors being proficient in using audio technology to ensure clarity in lecture delivery, which in turn positively influences students' comprehension and academic performance. These findings are supported by English (2016), who noted that instructors engaged in instructional design using digital infrastructure reported more effective teaching, increased student engagement, and higher-quality student work.

Furthermore, the results demonstrate that the effective use of response systems (clickers) for administering interactive quizzes and surveys significantly contributes to improved student learning outcomes. The logistic regression analysis reported a positive coefficient ($\beta = 0.36$) with

a standard error of 0.18, indicating a strong relationship between the use of interactive tools and improved student performance. The mean score for this predictor was 4.02, showing that many instructors are reasonably proficient in employing response systems in their instructional practices. A Wald statistic of 3.96 and an odds ratio of 1.44 suggest that students' learning outcomes are 1.44 times more likely to improve when instructors effectively use clickers to facilitate engagement and participation during lectures. The statistical significance ($p = 0.04$) further validates this finding. These results underscore the value of integrating interactive technologies in teaching strategies to foster participatory learning environments and enhance educational outcomes in higher learning institutions.

However, the findings also reveal that certain aspects of instructors' usability of ICT hardware do not significantly influence students' learning outcomes. Specifically, the ability to set up and use laptops or computers for presentations, operate interactive whiteboards for teaching and collaboration, utilize tablets and smartphones for instruction and communication, operate digital cameras or video equipment for recording lectures or creating multimedia content, and set up and use printers and scanners for distributing materials were not found to have a statistically significant impact. These conclusions are supported by high p-values and low Wald statistics in the regression analysis, suggesting that these hardware-related skills do not meaningfully predict student learning outcomes in the studied higher learning institutions.

This may imply limited instructor capability or access to such hardware infrastructure, possibly due to institutional constraints or lack of training. It also suggests that while certain ICT skills, such as operating projectors or using audio systems, are central to the instructional process, others may play a more peripheral role and, thus, have less direct influence on learning outcomes. Similarly, the analysis of instructors' usability of software-based ICT infrastructure indicated no statistically significant contribution to students' learning outcomes. These findings, detailed in Table 5, point to the need for more targeted support and training in software integration or a reassessment of the digital tools currently in use to determine their relevance and alignment with instructional goals.

Table 5

The instructors' usability of software ICT infrastructure contribution to students' learning outcomes in the selected higher learning institutions

ICT Software Infrastructure usability	B	S.E.	Mean	Wald	Odds	Sig.
Learning management system: A platform used for managing and delivering educational content, such as blackboard, canvas, and Moodle (Text writing, pdf, word, jpg)	0.10	0.28	4.12	0.13	1.11	0.72
Video conferencing software: tools like zoom, Microsoft teams and google meet for online classes, meetings, and webinars	0.41	0.24	3.9	2.91	1.51	0.09
Presentation software: PowerPoint, prezi and google slides.	- 0.20	0.28	4.16	0.48	0.82	0.49
Document collaboration software: google Docs, Microsoft office 365, drop box for creating and shearing.	0.15	0.26	3.81	0.36	1.17	0.55
Combined (text, audio, video)	- 0.14	0.26	3.42	0.30	0.87	0.58
Education games and simulations: Kahoot, Quizlet Minecraft for engaging students and enhancing learning	- 0.21	0.27	3.02	0.63	0.81	0.43
Special software programs e.g. SPSS, R software, ANOVA and social ups e.g. WhatsApp, accounting bills	0.41	0.19	3.35	4.83	1.51	0.03
Searching tools and ups google scholar, fire fox, and chrome	- 0.16	0.26	4.13	0.36	0.85	0.55
Transmission tools e.g. email, zimbra, outlook etc.	- 0.02	0.30	4.23	0.00	0.98	0.95
Online assessment and grading software: Turnitin, SARIS, ISMS, gradecam and odmondo for grading, assessing and providing feedback on assessment.	0.07	0.22	3.91	0.12	1.08	0.73
Education content creation software: Camtasia, audacity and adobe Creative suite for creating educational videos, Slides podcast, and other multimedia content.	0.28	0.26	3.13	1.12	1.32	0.29
Mind mapping and brainstorming software: mindmeister, google and bulb.us to visualize and organize ideas	- 0.07	0.24	3.1	0.07	0.94	0.79
Programming and cording skills: Scratch, python, java for teaching programming and coding.	0.60	0.25	3.25	5.88	1.83	0.02

ICT Software Infrastructure usability	B	S.E.	Mean	Wald	Odds	Sig.
Language learning software: Duo lingo, Rosetta stone and babble for language learning and practice.	0.05	0.25	3.21	0.05	1.06	0.83
Constant	-2.67	1.05	3.68	6.50	0.07	0.01

Source: Field data (2023)

The key software ICT usability aspects assessed in the study included instructors' ability to use learning management systems, video conferencing platforms, document sharing tools, presentation software, educational gaming platforms, specialized educational software such as SPSS and mind-mapping tools, programming and coding skills, and the ability to use learning materials software and search engines. While the mean scores for these variables suggest some potential for positive contribution to student learning outcomes, the regression analysis showed that their p-values did not reach statistical significance, indicating no meaningful positive impact within the studied context. This outcome may have several implications. First, it may reflect instructors' limited familiarity or proficiency with these software tools. Second, it could point to restricted access to such platforms due to infrastructural challenges, particularly inadequate internet connectivity across the selected higher learning institutions. Despite the lack of statistical significance, the descriptive data suggest there is still potential for software-based ICT tools to positively influence student learning, especially if appropriate support and infrastructure are provided. These findings are reinforced by qualitative data from the focus group discussions, where internet accessibility was consistently identified as a major barrier. One of the key informants noted:

> The Internet is a problem within the institute, especially during the afternoon session and evening. Software platforms within the institute are outdated and not friendly to be used by instructors. Also, the ICT infrastructure is not enough for students. For instance, you may find one class has 180 students, but only 40 computers are working.

This quotation suggests that instructors' usability of ICT infrastructure is challenged by internet accessibility, the size of the class, and the availability of digital facilities. This, consequently, may affect the students' learning outcomes. These findings are consistent with the study conducted by Okoye (2023), which identified a lack of training, inadequate infrastructure and resources, limited internet access, and restricted availability of digital platforms as the main challenges hindering the effectiveness of the teaching learning process.

CONCLUSION

The usability of ICT infrastructure among instructors in Tanzanian higher learning institutions shows promising trends, particularly concerning hardware components. Instructors appear to be more familiar and

comfortable with hardware ICT infrastructure, such as smart screens/projectors, audio systems, and clickers for quizzes, than with software-based tools. The study concludes that the effective use of hardware ICT infrastructure significantly contributes to students' learning outcomes. This indicates that such tools play a critical role in supporting instructional delivery and enhancing the learning process.

However, the findings also reveal that instructors' usability of software ICT infrastructure remains limited. This presents a concern in an era characterized by rapid technological advancement. The results have important policy implications, particularly in the need to establish enabling environments that support both instructors and students in improving training delivery through technology. While ICT offers significant potential to enhance student learning, its successful integration into teaching largely depends on instructors' competencies and adaptability. Therefore, education policies should prioritize comprehensive capacity-building initiatives, investment in ICT infrastructure, provision of ongoing technical support, and measures to address resistance to change within academic institutions.

It is recommended that higher learning institutions actively work to improve instructors' software ICT usability by offering affordable and accessible training programs. Institutions should also strengthen internet infrastructure and prioritize continuous professional development tailored to digital instruction. At the individual level, instructors are encouraged to enroll in self-paced, freely available online training programs to enhance their digital competencies. Furthermore, national education policy should mandate ICT training for instructors, particularly through recognized free online platforms, to ensure that teaching professionals remain responsive and adaptive to the evolving demands of digital education.

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Enhancing Curriculum Reforms for Employability Skills in Tanzania: Stakeholders' Knowledge and Experiences

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Abstract
The study aimed to assess the role of stakeholders' knowledge, skills, and experiences in enhancing curriculum reform for employability in Tanzania, using the OECD Framework for Curriculum Reform as its theoretical foundation. A mixed-methods approach with a convergent design was employed, gathering data from 243 respondents. The findings revealed a statistically significant correlation between knowledge and skills ($\beta = 0.619$, $p = 0.000$), experience ($\beta = 0.354$, $p = 0.000$), and effective curriculum reform. This indicates that stakeholders' competencies are vital in designing curricula that meet employability demands. Additionally, stakeholders' experience plays a key role in identifying practical strategies for implementing job-oriented education. The study highlights the importance of collaborative efforts in curriculum reform to achieve meaningful and sustainable employability outcomes

Keywords: *Curriculum reform, effectiveness, employability skills, experience, stakeholders and knowledge.*

INTRODUCTION

Since 1961, Tanzania has undertaken several curriculum reforms aimed at addressing socio-economic challenges, particularly the employability of its graduates. The first major reform in 1967, inspired by Nyerere's philosophy of education for self-reliance, focused on equipping students with practical skills (Nyerere, 1967; Kassam, 2002). The second reform, introduced in 1997, sought to respond to global economic challenges, while the 2005 reform ushered in a competence-based curriculum intended to prepare students to participate and compete in a free-market economy (Nzima, 2016; TIE, 2013; URT, 2015). However, these reforms have had limited effectiveness due to the weak alignment between curricula content and community life (Nzima, 2016; Osaki, 2002). Much of the content introduced in the 1997 reform was considered irrelevant to both the learners' level and the national context (Mosha, 2012; Nzima,

2016; Osaki, 2002). The 2005 reform further exposed critical gaps between curriculum design and its implementation, particularly in terms of syllabi and textbooks (Mosha, 2012). Evidence suggests that one of the central weaknesses in these reform efforts has been the inadequate involvement of key stakeholders. The limited engagement of educators, industry experts, and community members has contributed to the development of curricula that fail to adequately prepare students for the labour market (Athuman, 2018; Opalo, 2022; URT, 2015; 2021). As highlighted in numerous reports, including those by UNESCO (2018), the URT (2015), the OECD (2020a), and Bonilla-Rius (2020), meaningful stakeholder engagement is a critical component of successful curriculum reform processes aimed at enhancing graduate employability.

Inclusive engagement in curriculum reforms has been debated, often linked to the knowledge, skills, and experience of stakeholders (Fullan, 2015). In Finland, for example, the curriculum reform process included knowledgeable and skilled stakeholders, such as teachers, principals, and researchers, who effectively addressed student needs (Lavonen, 2020). Mainga et al. (2022) highlighted that employability skills improve when stakeholders understand the skills employers seek. Limited knowledge may, however, prompt teachers to struggle to engage in reforms. There is ample evidence that suggests that curriculum reform often fails because developers lack awareness of social issues impacting students and communities (Bantwin, 2010; Wadja, 2019).

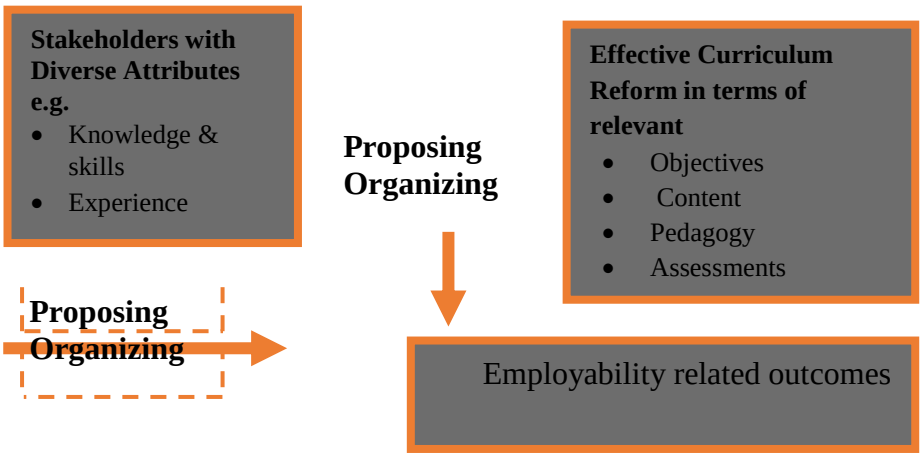
Tikkanen et al. (2019) and Sullanmaa et al. (2019) indicate that 62.5% and 61% of stakeholders had prior experience with curriculum reform. These studies, rarely provide evidence on how these experiences impacted the curriculum reform process which aligns with expectations. Aguas (2020) highlighted that the lived experiences of key stakeholders play a significant role in shaping curriculum planning, implementation, and evaluation. In the context of Ireland, stakeholders involved in upper secondary education curriculum reform were selected based on their prior experience with similar reform initiatives, underscoring the value of practical insight in driving effective educational change. However, existing studies have not explored how these lived experiences affect curriculum reforms specifically related to employability. This study assessed the role of these factors in improving curriculum reform in Tanzania.

Theoretical framework

This study is based on OECD Framework for Curriculum Reform, developed by Viennet and Pont in 2017. Specifically, the framework emphasises that inclusive stakeholder engagement is crucial for successful curriculum reform. This engagement can be assessed by evaluating the capacities of stakeholders involved, which include their knowledge, skills, and experiences (OECD, 2020a; 2020b; Viennet & Pont, 2017). Engaging stakeholders with diverse competencies significantly enhance curriculum development by ensuring closer alignment with labour market demands (Viennet & Pont, 2017). As such, this framework is essential for examining how stakeholders' knowledge, skills, and experiences influence curriculum reforms aimed at improving employability in Tanzania. Inclusive stakeholder engagement and the strategic use of their expertise in both curriculum design and labour market practices can result in more relevant and responsive curricula, ultimately better equipping students for the demands of an evolving workforce. However, this framework has a potential weakness in universal application due to its uncertain applicability in other contexts. Despite this concern, the framework is a recommended guide for curriculum reform practices as it offers a valuable lens for measuring curriculum effectiveness. The following conceptual framework complements the theoretical framework by illustrating the relationships among key variables examined in the study.

Conceptual Framework

Figure 1:
The effects of stakeholders' attributes on effectiveness of curriculum reform



More specifically, stakeholders at all levels contribute to curriculum reform by identifying and organising necessary changes in areas such as learning objectives, content, pedagogical approaches, and assessment practices. These reforms are structured in a systematic and coherent manner to align with the evolving needs of the labour market (see Figure 1). Overall, the knowledge, skills, and experience of stakeholders play a pivotal role in enhancing educational practices that equip graduates with the competencies required for labour market success, thereby strengthening their employability.

METHODS AND MATERIALS

This study adopted a mixed-methods research approach, recognising the complex nature of the world rather than relying solely on quantitative or qualitative methods (Cohen et al., 2018). This approach improved the credibility and robustness of the research findings through triangulation and complementarity. The statistical evidence was supported by qualitative explanation to provide a comprehensive understanding of how stakeholders' knowledge, skills, and experience enhance curriculum reforms for employability in Tanzania. The study involved a total of 243 participants, including university academics, teachers, tutors, and curriculum developers. In addition, 12 participants were purposively selected for semi-structured interviews. These included faculty deans, senior researchers, curriculum directors, and executive officers from NGOs and the Association of Tanzania Employers (ATE). The interviews, lasting between 20 and 30 minutes, were conducted through face-to-face meetings, phone calls, and online platforms to accommodate participants' availability, and all sessions were recorded with informed consent. To ensure the validity of the research instruments, a pilot test was conducted with 30 potential respondents. Feedback from this process informed revisions that improved the clarity, relevance, and overall quality of the research tools. Also, Cronbach's alpha was employed to evaluate the internal consistency of the questionnaire, yielding a value of ($\alpha = 0.840$). The study adhered to ethical standards and logistical procedures. Quantitative data collected through close-ended questionnaires were analyzed using three-way ANOVA and multiple regression methods as well as descriptively using frequencies and percentages and presented in descriptive tables. Qualitative data from interviews underwent thematic analysis and were reported as verbatim

quotes and narratives to provide deeper insights into the stakeholders' perspectives.

RESULTS AND DISCUSSION

The study assessed the role of stakeholders' knowledge, skills, and experiences in enhancing curriculum reform for employability in Tanzania. The findings were presented using both quantitative and qualitative approaches. Quantitative data were analysed through three-way ANOVA and multiple regression methods, while background information was summarised using descriptive tables. Qualitative data were reported using verbatim quotes and narrative accounts to provide deeper insights into stakeholders' perspectives and experiences.

Background information of respondents

The study collected data on respondents' educational qualifications, curriculum knowledge, skills, and work experiences to understand their impact on curriculum reform effectiveness as can be seen in Table 1.

Table 1
Background information of respondents

Variable	Category	Frequency	Percentage
Educational qualification level	Certificate	13	5.35
	Diploma	11	4.53
	Bachelor' degree	76	31.28
	Masters	118	48.56
	PhD	25	10.29
	Total	**243**	**100**
Sources of knowledge and skills on curricula issues	Cert	13	5.35
	Dip	6	2.47
	BA	69	28.40
	P-Dip	1	0.41
	Cert + Dip	5	2.06
	Cert + Dip + BA	14	5.76
	Cert + Dip + BA + MA	2	0.82
	Cert + Dip +BA +MA + PhD	3	1.23
	Cert + BA +MA	5	2.06
	Dip + BA	33	13.58
	Dip + BA + MA	20	8.23
	Dip + BA +MA + PhD	5	2.06
	BA + MA	37	15.23
	BA + MA + PhD	3	1.23
	Post-Dip + MA + PhD	4	1.65
	BA + PhD	2	0.82
	Seminars, workshops and research activities	14	5.76
	Cert.+ BA	7	2.88
	Total	**243**	**100.00**
Working experience	Under five years	38	15.6
	5-10 years	69	28.4
	11-19 years	80	32.9
	20 years and above	56	23.0
	Total	**243**	**100.0**

Source: Field data (2024)

The study revealed that 90.13% of the respondents had educational qualifications ranging from bachelor's degree to PhD. Additionally, 58.02% reported acquiring curriculum knowledge and skills through multiple pathways. Furthermore, 55.97% had more than 10 years of working experience, indicating a strong foundation of expertise among the participants.

Effects of knowledge and experience on curriculum reform effectiveness

The study assessed the impact of stakeholders' knowledge, skills, and experiences on the effectiveness of curriculum reform. A three-way ANOVA examined how the education level, knowledge and skills sources, and working experiences significantly influenced the curriculum reform for employability.

Table 2

ANOVA Results for respondents' characteristics on rating scores

Tests of Between-Subjects Effects

Dependent Variable: Response ratings

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	47.915[a]	53	.904	3.917	.000	.587
Intercept	464.961	1	464.961	2014.525	.000	.932
Education	2.575	4	.644	2.789	.029	.071
Sources	9.303	13	.716	3.101	.000	.216
Experience	9.466	4	2.367	10.253	.000	.219
Education * Sources	1.465	8	.183	.793	.609	.042
Education * Experience	4.550	7	.650	2.816	.009	.119
Sources * Experience	7.850	12	.654	2.834	.002	.189
Education * Sources * Experience	3.186	1	3.186	13.806	.000	.086
Error	33.697	178	.231			
Total	3055.360	231				
Corrected Total	81.613	230				

a. R Squared = .587 (Adjusted R squared = .437)

Source: Field data (2024)

Table 2 reveals that stakeholder education, knowledge source, and experience significantly influence curriculum reform effectiveness ($F = 13.806$, $p = 0.000<0.05$), underscoring the importance of inclusive stakeholder engagement. Furthermore, it was revealed that education level, knowledge and skills, as well as work experience of participants significantly influenced their rating scores ($F = 2.789$, $p = 0.029<0.05$; $F = 3.101$, $p = 0.000<0.05$; $F = 10.253$, $p = 0.000<0.05$). The analysis suggested that greater variability in curriculum reform effectiveness was more strongly influenced by respondents' working experience than by their educational qualifications or curriculum-related knowledge and skills ($F = 10.253$). On the other hand, stakeholders with practical experience in curriculum reform were more likely to offer relevant and actionable feedback, thereby making their engagement critical for

aligning curricula with labour market demands. These findings align with the OECD Framework on Curriculum Reform, which emphasises the central role of knowledge, skills, and particularly experience in enhancing the relevance and effectiveness of educational reforms (OECD, 2020a). The study also utilised multiple linear regression to analyse how stakeholders' knowledge, skills, and experiences affect the effectiveness of curriculum reform for employability as demonstrated in Table 3.

Table 3
Effects of knowledge and experience on curriculum reform

Model Summary[b]

Model	R	R Square	Adjusted R Square
1	.865[a]	.748	.739

a. Predictors: (Constant), Lived experience, Knowledge
b. Dependent Variable: Curriculum reform effectiveness

The (R^2 =0.748) shows that knowledge, skills, and experience collectively account for 74.8% of the variance in curriculum reform effectiveness, significantly exceeding the recommended threshold of 0.26. This underscores the importance of engaging stakeholders with relevant expertise to enhance curriculum reform for employability.

Table 4
Knowledge and experiences on curriculum reform effectiveness

Coefficients[a]

	Unstandardized Coefficients	Standardized Coefficients	
Model	B	Beta	Sig.
1 (Constant)	1.679		.000
Knowledge and skills	.379	.619	.000
Lived experience	.246	.354	.000

a. Dependent Variable: Curriculum reform effectiveness
Source: Field data (2024)

Table 4 indicates that knowledge, skills, and experience all have a positive and statistically significant relationship with curriculum reform. Among these factors, knowledge and skills exert the strongest influence ($\beta = 0.619$, $p = 0.000$), followed by experience ($\beta = 0.354$, $p = 0.000$). The differing effect sizes suggest a dynamic interplay among these attributes in shaping the effectiveness of curriculum reform for

employability. These findings underscore the critical role of stakeholders' knowledge in setting educational goals and organising curriculum components, as also highlighted by Walsh (2018). Results From the interviews regarding the knowledge, skills, and experiences in enhancing curriculum reform for employability skills was thematically analysed and presented as narratives and verbatim excerpts data as summarised in Table 5.

Table 5
Qualitative data analysis for knowledge, skills and experiences

Category	Theme	Description
Curriculum Reform effectiveness	Knowledge	• Ensures the logical organization of objectives, contents, and resources • Assists in adapting relevant and functional skills for students
	Experience	• Aids in the identification of effective alternatives in the curriculum reform process

Source: Field data (2024)

Data from interviews, as presented in Table 5, revealed that stakeholders' knowledge and skills are essential for logically organising curriculum components. One of the senior researchers explained:

> The skills that students acquire and grow in can be greatly influenced by an expert participating in curriculum reform. The professional knowledge that is brought to the table assists in ensuring curricula focus and ensures that the goals, contents, and resources are properly and logically organized.

The findings corroborate those of Walsh (2018), who emphasised that stakeholders with relevant knowledge play a critical role in effectively structuring key elements of the curriculum. In other words, knowledgeable stakeholders can organize a curriculum so that clear objectives are set, proper content is selected, and effective materials are provided to ensure effective learning experiences. Furthermore, it was revealed that stakeholders' knowledge and skills help adapt relevant skills for students by identifying valuable education trends and job market requirements. One of the faculty deans elaborated:

> The reform of curricula can be more effective and adaptable to society and students' needs if stakeholders involved possess relevant knowledge in their fields of expertise. For example, the employment experts

> facilitate identification of relevant and functional skills that are mostly demanded in the labour market.

The study underscores the critical role of knowledge in curriculum reform, particularly in aligning educational outcomes with the demands of the labour market. These findings are consistent with the OECD Framework for Curriculum Reform, which advocates for knowledge-driven approaches to ensure relevance and responsiveness in education systems. The framework also identifies the necessary knowledge and skills for successful curriculum reform adaption (OECD, 2020a; Lavonen, 2020).

In addition, it was revealed that stakeholders' experiences significantly influence the success of curriculum reform in terms of identifying effective alternatives for job-focused education. One of the employers commented:

> Stakeholders with lived experience on job market can easily identify market needs and requirements to enrich the curriculum reform process. This ensures that the needs are effectively met.

The findings align with previous studies that highlight the value of experiences in curriculum reform (Mellegård & Pettersen, 2016; OECD, 2020b). As previously noted, in Ireland, stakeholder selection for upper secondary education curriculum reform was largely based on their prior experience (OECD, 2020a). This finding aligns with existing literature and reflects a growing consensus on the pivotal role of stakeholder experience in informing and guiding effective curriculum reform processes.

CONCLUSION AND IMPLICATION OF THE STUDY

The study concludes that stakeholder engagement significantly enhances the quality of curriculum reform, particularly in aligning educational outcomes with labour market demands and improving graduate employability. It makes a meaningful contribution to the existing body of knowledge by providing empirical evidence on how stakeholders' knowledge, skills, and experience influence the effectiveness of curriculum design and implementation. Additionally, the study supports and expands current theoretical frameworks related to curriculum development, especially in the context of addressing economic and employment needs in developing countries such as Tanzania. Moreover,

the findings offer valuable insights for policy formulation and educational reform by advocating for inclusive stakeholder engagement and collaborative approaches that integrate professional expertise and practical experience. In light of these findings, the study recommends the development of a collaborative framework that actively involves professionals with relevant expertise and experience to ensure the curriculum reflects national priorities and labour market requirements. Finally, the study suggests that future research could involve a broader sample, including students, to gain deeper insights into how stakeholder engagement shapes curriculum reform and enhances employability outcomes.

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Enhancement of Chaining Strategy in Developing Reading Skills among Deaf Pupils in Tanzania

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Abstract
Reading difficulties among deaf pupils are recognised as a global concern, and this issue is particularly evident in Tanzania. In Tanzania, deaf pupils have been facing challenges in developing reading skills compared to their hearing peers. This persists even with the implementation of the chaining strategy by teachers, which is widely endorsed by many researchers as an effective strategy for teaching reading skills. Thus, this study explored tactics to enhance the chaining strategy in developing reading skills among deaf pupils in Tanzania and developed a model that incorporates the identified tactics with the chaining strategy. The study applied a qualitative approach with a sample size of 12 teachers from four special primary schools for deaf located in Dar es Salaam, Njombe, Kagera and Tabora regions. Data were collected through in-depth interviews, and were analysed through thematic analysis. The study underscored the importance of early identification as the foundation for proactive measures to ensure that deaf children receive appropriate support from an early age, which can lead to better literacy outcomes. Furthermore, the study indicated the need to improve memory and connection abilities of deaf pupils while raising their learning curiosity by incorporating learning games and visualization within the chaining strategy. Again, the study revealed that the strategy's effectiveness increased when teaching and learning barriers are eradicated through curriculum adaptation, the availability of teaching materials, and competent teachers with sign language skills. Therefore, the study recommends that the government should make sure that all deaf children attend pre-primary education program before enrolling into primary education where they will get early sign language exposure and be oriented to the world around them. As well, the government should make sure that the curriculum is adapted to address

the literacy learning needs of deaf pupils and should include sign language content. Likewise, the government should allocate specific funds for purchasing visual aids, developing tailored teaching materials, and training teachers in sign language to enhance the application of the chaining strategy.

Keywords: *Deaf, chaining-strategy, reading, sign language, visualisation literacy, learning Games.*

INTRODUCTION

The development of reading skills is a gradual process that builds an individual's ability to recognise words and comprehend written information (Indeed, 2020). This development involves a number of activities, including cognitive and visual tasks (Suharti et al., 2018), which engage various parts of the brain (Kartal & Terziyan, 2016). The process of developing reading skills among deaf pupils differs from that of their hearing peers (Wass et al., 2019). This difference arises from their inability to perceive sound waves; thus, they cannot learn by associating sounds with letters. This situation adversely affects their word recognition and comprehension abilities (Kyle & Cain, 2015).

Due to this problem, teaching reading to deaf students requires teachers who understand the needs of this group and who are able or willing to improvise their teaching methods in order to meet the learning needs of deaf pupils (Kisanga, 2019). This was one of the factors that motivated various scholars around the world to develop the chaining strategy. The chaining strategy is an instructional approach used in teaching pupils through the repetition of the same concepts and ideas by employing different techniques and approaches connected in a series (Gentry et al., 2004; Knoors and Marschark, 2014). In relation to reading skill development among deaf pupils, the chaining strategy can be defined as a method used by teachers to enhance word recognition and language comprehension abilities among deaf pupils by facilitating their learning through associations and connections with related information presented in a sequential manner (Padden & Ramsey, 2000).

The application of the chaining strategy in teaching reading skills to deaf pupils has been reported by a number of scholars as an effective way of addressing reading challenges among deaf pupils worldwide. Haptonstall-Nykaza and Schick (2007) and Herrera-Fernández et al. (2014) emphasize

that the chaining strategy contributes to a substantial increase in the reading and vocabulary skills of deaf pupils. Mutatembwa et al. (2024a) report that the chaining strategy significantly contributes to the development of word recognition skills among deaf pupils in Tanzania. This finding supports the adoption of the chaining strategy in teaching reading skills in schools for the deaf, as confirmed during preliminary interviews conducted with six teachers from the target schools on December 18, 2022. Moreover, Mutatembwa et al. (2024b) report that the use of a chaining strategy in teaching reading skills to deaf pupils does not guarantee the development of language comprehension among these pupils. This can be interpreted to mean that the chaining strategy has a greater impact on developing word recognition ability among deaf pupils compared to its effect on their language comprehension ability.

Mutatembwa et al. (2024b) findings serve as one of the reasons why the majority of deaf pupils in Tanzania graduate with poor reading skills, despite the implementation of the chaining strategy. The results also raise question about what can be done to make the use of the chaining strategy more effective in Tanzania regarding the promotion of reading skills among deaf students. This situation heightened a need of conducting a study on how to enhance the impact of the chaining strategy in developing reading skills in Tanzania. Therefore, this study aims to develop a model that improves the application of the chaining strategy in fostering reading skills among deaf pupils in Tanzania.

Objectives of the study

The objective of this study was to develop a model that enhances the use of chaining strategy in developing reading skills among deaf pupils in Tanzania.

LITERATURE REVIEW

To effectively use the chaining strategy in teaching reading skills to deaf pupils, teachers must understand their classroom dynamics and integrate a variety of appropriate techniques to address the diverse learning needs of each student (Dzulkifli, 2021). In addition, teachers should diversify their instructional methods to engage students and support the acquisition of reading skills (Koutsoubou, 2004, as cited in Patrick & Awari, 2017). These views align with a study by Cannon et al. (2010), which investigated vocabulary instruction using books read in American Sign Language for English-language learners with hearing loss. This study

used expository books containing vocabulary within a multiple-baseline design (chaining) across three sets of five vocabulary words. It employed an experimental design involving four participants aged 10 to 12 years with severe to profound hearing loss. The findings indicated that the chaining strategy effectively supported reading skills development when combined with pre-teaching of the target vocabulary words and the use of multimedia tools.

Similarly, Staden (2013) findings revealed comparable results on the effectiveness of multi-sensory coding strategies and reading scaffolding to enhance the reading development of deaf readers in elementary education. This experimental study involved 64 deaf children aged 6 to 11 years with severe to profound bilateral hearing loss. The findings revealed that when the chaining strategy (which combined sign language with multiple visual and tactile elements) was applied alongside reading scaffolding techniques and kinaesthetic coding strategies improved literacy and vocabulary development among deaf children.

Moreover, these studies align with the VARK model of learning (Catts, 2018), which promotes the use of diverse teaching strategies such as visual, auditory, reading/writing, and kinaesthetic modalities when teaching (Broadbent, 2021). In connection with the VARK model, Heick (2021) highlights the Gradual Release of Responsibility Model as a strategy that can support literacy learning among deaf pupils by applying a sequence of learning activities that shift responsibility from the teacher to the student.

All of the reviewed empirical studies employed a quantitative research approach with an experimental design. Consequently, the studies did not consider qualitative or mixed approaches. This suggests that the studies assumed that knowledge of chaining strategies and reading development could only be derived from quantitative data. As a result, they ignored the potential insights, reality and truth that could be gained from lived experience of participants via chaining strategy. Moreover, considering all examined participants fell within the age range of six to twelve years, it is still uncertain whether these approaches work for older children, particularly those who start schooling late. The researchers have not studied the particular functions of teachers concerning the execution of the chaining strategy as it applies to teaching reading. While the studies showed that combining chaining strategies (on developing reading skills

to deaf children) with other models enhanced outcomes, they did not specify the sequence of implementation. It remained unclear whether chaining should proceed of follow other models enhanced outcomes; such as the Gradual Release of Responsibility.

The researcher concurs with the reviewed studies that diversifying teaching techniques and styles is very important when educating deaf pupils, as each deaf pupil possesses a unique learning style. Therefore, using multiple techniques to teach the same content is more likely to benefit all learners. Additionally, there is a need for a comprehensive model that integrates critical reading skills and utilizes a chaining strategy tailored to the context of deaf learners in Tanzania.

METHODOLOGY

The study applied a qualitative approach to find out ways to enhance the impact of chaining strategy in developing reading skills among deaf pupils in Tanzania. The approach was chosen because it facilitated a richer exploration of teachers lived experiences and views, which was essential for capturing the complexities and tones absent from the quantitative studies reviewed under this study. The study was conducted in four special primary schools for deaf, which are located in Dar es Salaam, Kagera, Njombe and Tabora regions in Tanzania. First of all, these regions were purposively selected because each region had one school that enrolled only deaf pupils, and teachers from each school were trained on how to use the chaining strategy in teaching reading to deaf. Secondly, in 2022, more than 49.9% of deaf pupils in each region, regardless of teachers being trained on how to teach literacy to deaf through chaining strategy had poor performance either in general or in Kiswahili language during the national examinations for standard seven or standard four. The study obtained a sample size of 12 teachers' respondents, which was determined by saturation of information.

This study employed in-depth interviews in collecting data from the respondents. The method was used to collect data from teachers due to its capacity to provide an in-depth understanding of the phenomenon being examined. Thus, its use helped to gain comprehensive insights into teachers' experiences and perspectives regarding how to enhance the use of the chaining strategy in developing reading skills among deaf pupils in Tanzania. Data were analysed through thematic analysis by checking inner meanings of the data from in-depth interview with teachers and

from observation. This was done by analysing individual words, sentences and paragraph to get their meanings, data with similar meaning were grouped together into themes. Lastly the data were presented in short narrations with quotations from interview findings.

FINDINGS

This study sought to investigate how the chaining strategy could be improved for developing reading skills among deaf pupils in Tanzania, and to create a model from it. In-depth interviews were conducted with teachers at some of the primary schools for the deaf in Tanzania. The data were analyzed thematically and presented in narrative form with short, illustrative quotes. These findings were used to propose a model for enhancing reading skills for deaf pupils. According to teachers, early identification and thorough evaluation of deaf pupils is fundamental in confront a learning problem. Such identification enables timely aid to be provided, as learning complications can be far more challenging to help address when their existence isn't obvious.

As one teacher put it:

> To effectively implement the chaining strategy, I suggest that deaf students be screened first. This will enable us to understand each child in detail, ensuring that when we design techniques under the chaining strategy, we are aware of the learning needs of all students in the class. Consequently, this approach will allow us to employ various techniques that are relevant and appropriate for all students.

Another one added that:

> I strongly advise that all deaf students be thoroughly screened at the time of their enrolment to identify the presence of multiple disabilities. I am certain that in my class, there are other deaf students who have multiple disabilities because I spend a significant amount of time teaching. Sometimes, I repeat lessons and use various visual aids as well as video games from my tablets; however, some students still struggle to grasp the concepts. Therefore, when we understand the status of each student, it will be easier for us to assist them effectively.

The findings from interviewees aligns Shojaei et al. (2016), who assert that early identification of hearing loss and other related disabilities, followed by intensive intervention, increases the chances of mastering various skills, such as literacy skills, among pre-lingual deaf individuals. Moreover, Nikolaraizi (2000) supports the findings on the argument that children who experience language problems may lag behind their peers if

they are not provided with appropriate early support. Thus, early intervention should be employed to maximize students' educational potential. The results of this study indicate that with early screening, teachers are able to formulate appropriate teaching methods, including the chaining method, based on each student's strengths and weaknesses.

When responding to the interview questions, teachers underlined the necessity of registering hearing-impaired children into pre-primary schooling prior to advancing to primary schooling. They also supported teaching sign language at the pre-primary level. This is elaborated upon by the interviewees' responses, one of whom remarked:

> Deaf students should be enrolled in pre-primary education at their early years so that they can be taught Tanzanian Sign language and be oriented to the world around them before beginning literacy classes in primary education. This will make them be competent in the language rather than learning sign language at the time of learning reading skills in standard one.

Another one said that:

> If pre-primary education is made compulsory for all deaf pupils before they join primary education, it will eliminate the presence of older deaf students in lower primary classes than expected. This change will provide relief to these students, as they have been facing numerous challenges and neglect from others.

The other teachers remarked that:

> When deaf pupils enrol in standard one with sign language skills acquired during pre-primary education, it will be easier for us to apply the chaining strategy. This is because, for deaf students to benefit from the use of chaining, they need to be proficient in sign language.

The preceding results derived from various respondents underscored the necessity of making pre-primary schooling mandatory for all deaf students so that they can learn sign language prior to enrolling in primary school. Nikolaraizi (2000) supports these findings by demonstrating that developing sign language skills at an early age is fundamental for deaf children's literacy acquisition later in life. The findings are also in accordance with Stone et al. (2015), who highlighted the importance of sign language proficiency in reading comprehension of English and its associated reading skills amongst deaf children. It is, thus, imperative to provide sign language as the first language to pre-lingually deaf children to facilitate their reading skill development, considering their unique

learning requirements. This method serves as a remedy for equipping deaf children with appropriate reading competencies at the appropriate age. During pre-primary education, deaf children will build a strong foundation that will enable them to benefit from the chaining strategy when they enter primary education.

During interviews with teachers, it was emphasized that one of the techniques to enhance the use of the chaining strategy in teaching deaf pupils is to make learning games a part of the chaining strategy. This is due to the fact that games not only help deaf students relax and enjoy themselves but also consolidate their learning. This is evidenced by responses from interviewees who highlighted that:

> I suggest that learning games may be used in conjunction with the chaining strategy. This is based on the fact that learning games assist deaf students in memorizing various concepts and vocabulary. Deaf individuals tend to remember more easily when they are actively engaged in their learning process. Therefore, games actively involve all students in the classroom, making it easier for them to retain concepts by recalling events from the games.

Another teacher elaborated that:

> I usually incorporate learning games as one of the techniques I use as part of a chaining strategy. Games help consolidate the lesson and assess students' understanding. Their effectiveness depends on teachers' creativity. If teachers are creative and engage in thorough planning, the games can take various forms that aim to develop multiple skills related to reading.

The study revealed the importance of incorporating learning games into the chaining strategy when teaching reading skills to deaf pupils in Tanzania. This aligns with the study by Khenissi et al. (2015), which indicates that the use of computer games strengthens various skills among deaf pupils, such as literacy skills, while also promoting learning motivation among students. In addition, the study by Costa et al. (2018) serves as a foundation for the current research through its findings, which demonstrate that game-based learning approaches have a substantial and constructive impact on different areas of cognitive development, thereby influencing reading skills development among deaf children. Furthermore, these findings are consistent with those of Miller et al. (2021), who indicate that the use of games in teaching deaf students contributes to their improved learning outcomes.

The aforementioned views indicate that when learning games are applied as part of a chaining strategy, they reduce the number of deaf students experiencing reading problems. Furthermore, what can be learned from teachers' comments is that not only does the use of games make chaining effective, but the incorporation of learning games into the chaining strategy requires creativity and careful planning based on students' abilities and learning needs. If learning is not interesting and motivating, children often find it useless. This is why the current study posits that integrating learning games into the chaining strategy will motivate deaf children and encourage them to actively engage in their learning. This implies that for the chaining strategy to be more effective in improving the reading skills of deaf pupils, the use of engaging learning games alongside the strategy is essential.

Similarly, teachers emphasized the use of different visual materials as part of the chaining strategy. They believed that the chaining strategy increases the understanding of deaf students and helps them remember concepts more easily. Supporting this idea, one of the interviewees said:

> My suggestion for enhancing the use of the chaining strategy is to incorporate visualization as part of this approach. Visualizations help create a mental picture of the concept under study, allowing deaf pupils to more easily remember either the lesson or concept by recalling the visual aids used by the teacher during instruction. This method has proven to be of great importance to my students.

Another said:

> I recommend that one of the components of the chaining strategy should be audio-visual materials. The audio-visual technique is very important for both deaf and hard-of-hearing students. Therefore, when it is used within the chaining strategy, I am confident that it will be beneficial because hard-of-hearing students will gain from both audio and visual materials, while deaf students will benefit solely from visual materials.

The findings declare the value of strengthening the use of visual material when applying the chaining strategy in teaching reading skills to deaf pupils. Staden (2013) aligns with the current findings, in the argument that, visualization helps in creating mental images that, in turn, contribute to the development of reading comprehension among deaf children. Gentry et al. (2004) also support these findings by highlighting that the use of strong, relevant visual materials when applying the chaining strategy has a significant impact on the development of reading skills among deaf pupils. Moreover, Knoors and Marschark (2014) and Subasno

et al. (2021) add to the current study by demonstrating that when teaching reading skills to deaf pupils, it is very important to visualize concepts that they are reading because it supports their language comprehension. In the same manner, Puente et al. (2006) and Herrera-Fernández et al. (2014) findings support the notion that deaf students demonstrate improved literacy skills when teachers utilize various visual materials to supplement their sign language knowledge and written concepts.

The use of visual materials as part of a chaining strategy is very important because visualization helps in creating mental images among the deaf, as they are visual learners. When a lot of attractive visual materials are used along with fingerspelling, sign language, and learning games, deaf students will be able to easily associate the concepts under study, and these concepts will remain with them for a long time. This is because when the deaf remember the visual materials used during the lesson, it helps them to recall the entire content of that day. Sometimes, the deaf have many pictures and images in their minds, but they do not have clear meanings for them due to a lack of incidental learning resulting from their hearing loss. Therefore, when teachers use visual materials along with a chaining strategy, the deaf can generate meaning from the concepts starting from the visual materials used.

The interviewees proposed the need for curriculum adaptation to meet the needs of deaf students. They were optimistic that if the current curriculum is modified to suit these needs, it will be easier to apply chaining strategies and achieve the desired outcomes. This perspective was expressed by one of the interviewees during an interview session with teachers at selected primary schools for the deaf, who claimed that:

> Even if you apply a chaining strategy, if the content that you are teaching is not relevant to the needs of deaf students, it will not be effective. For instance, one of the subtopics that standard one deaf pupil is required to learn under the reading subject is punctuation markers. This situation is similar to trying to crush water with a mortar; the pupils are still struggling to generate meaning from both short and long sentences, yet we need them to understand punctuation markers. Therefore, I propose that the curriculum should be reviewed to make adaptations that meet the learning needs of deaf students.

The findings highlight the importance of having learning content that is relevant to the educational needs of deaf pupils. Deaf children have different learning requirements; thus, teachers should be able to adapt the

curriculum to meet the learning needs of this group. Curricula need to be flexible to provide opportunities for teachers to improvise based on the learning pace of the students. Therefore, a flexible curriculum contributes to decreasing the number of learning obstacles faced by deaf pupils. The current study believes that curriculum adaptation is not about overprotecting deaf children; rather, it is a way of creating a conducive learning environment for them. Curriculum adaptation must ensure that deaf children learn the same content as hearing children in a manner and at a pace that adheres to their individual learning needs and speeds. Thus, adaptation discourages any issues that compel teachers of deaf students to compromise or rush the teaching and learning process.

Interviewees expressed the view that if the materials are made available at all times, the application of the chaining strategy will be easier, and its impact will be enhanced. Teaching materials are crucial for the application of the chaining strategy; if they are not available or adequate, the effectiveness of the chaining strategy may be compromised. For example, in response to one of the interview questions, an interviewee stated that:

> Chaining is a good strategy but it requires the use of different techniques that involve different teaching aids. Sometimes I use my money to buy materials for preparing teaching aids. Therefore, for the application of chaining strategy to be effective, I recommend that the materials for preparing teaching aids be provided and made available all the time.

Another one explained that:

> If heads of schools are educated on the importance of teaching aids in teaching reading skills to deaf through chaining strategy, they will make sure that necessary resources are available. Likewise, they will understand that there is no any teacher who misuses materials, because chaining strategy involves preparations of materials that consume resources.

The availability of teaching and learning materials increases the chances of reading skills development among deaf pupils through the use of the chaining strategy. This is supported by Dzulkifli (2021), who argues that the use of relevant teaching aids fosters learning and understanding speed in deaf students. Easy access to teaching and learning materials for teachers enhances their innovation and creativity, which, in turn, helps facilitate better understanding among deaf pupils.

Teachers are responsible for the competence of all students. For that matter, teachers need to be competent in various aspects to effectively handle all learners. This was one of the reasons why teachers emphasized employing or allocating educators with sign language skills to teach classes with deaf students. The aforementioned views were marked during conversations with interviewees, where one commented that:

> Without being competent in sign language, it will be difficult to apply the chaining strategy. Thus, teachers who teach deaf pupils at lower primary classes need to be competent in sign language because, without sign language skills, no competent students will be produced.

Another interviewee highlighted that;

> I suggest that the government should make sure that all teachers teaching in schools for the deaf have knowledge of deaf education, which includes sign language. If they employ someone who has no special need for educational knowledge and skills, they should not be allocated to teach in lower primary levels.

Another one emphasised that:

> There are regular teachers at our schools who are allocated to teach the deaf, but they don't have sign language skills. I suggest that in-service training should be established so as to equip such teachers with appropriate skills.

The findings show the need for teachers of the deaf who are competent in sign language. This agrees with the study by Khasawneh (2021) and Ngobeni et al. (2020), who believe that sign language skills are the foremost and most important skills for any teacher of the deaf to possess. The findings are also supported by Yusuf et al. (2023), who demonstrate that if teachers are not competent in sign language, deaf students will not acquire the intended skills; thus, teachers need to undergo frequent training in sign language to remain updated.

It should be well understood that teachers are key players when it comes to teaching and learning. If teachers cannot communicate effectively due to a language barrier, their competency in the subject matter becomes meaningless. Teaching and learning require effective communication, and it is well understood that for any communication to be effective, the receiver of the information or message must clearly understand the message from the sender. Thus, understanding cannot exist if the medium of communication used is not common between both parties. Based on the fact that deaf individuals use sign language as their medium of

communication, teachers must also be competent in sign language for teaching and learning to be effective.

Proposed Model

Considering the discussions and conclusions reached in the preceding section, the current study proposes Mutatembwa's model for improving the application of the chaining strategy in teaching reading to deaf pupils. This model combines several complementary methods to ensure effective integration of the chaining strategy into reading instruction. It starts with the crucial step of early identification of disabilities since timely diagnosis is important in dealing with the specific concerns of deaf children well before they commence formal schooling. Such identification ensures that essential intervention measures are put in place, and enables teachers to create appropriate starting points for instruction. It also aids in the identification of any additional coexisting disabilities which, if not appropriately addressed, could severely hamper effective teaching. Schools, therefore, in conjunction with the education authorities, will be able to appropriately staff the schools with qualified teachers who sufficiently meet the needs of these learners.

Apart from diagnosis and intervention, the model highlights the need for enrolling deaf children into pre-primary school. This phase is crucial for establishing basic sign language competencies which are most important for pre-lingual deaf children. Sign language as one of the channels of the medium of communication plays a great role in enabling reading with the chaining strategy. A great number of deaf children are born to hearing parents and others who live in communities where no language is spoken or signed. This clearly shows that there is a need for deaf pupils to be enrolled into pre-primary school as early as possible so that they can acquire important communication skills, which they are required to have before they join primary school.

After achieving basic sign language skills, the model suggests that other methods should be added to chaining strategy. One of these is educational games. When designed sequentially, these games facilitate teaching and learning by making them more enjoyable which increases motivation towards the knowledge being imparted. Aided instruction through visual materials such as charts, pictures, and other specially designed visuals assists deaf learners in understanding and remembering reading skills.

The model also emphasizes the importance of adapting the curriculum as a fundamental process to address the educational needs of deaf children. This adaptation entails making essential modifications and adjustments to the curriculum to ensure it is both accessible and beneficial for deaf pupils, while considering their unique learning requirements. The model views curriculum adaptation as a crucial mechanism for effectively implementing the chaining strategy, which facilitates the teaching of content that corresponds with the age and learning styles of deaf learners. If the chaining strategy is applied without relevant content specifically designed for these children, assessing its effectiveness becomes problematic. Therefore, to maximize the potential of this strategy, it is imperative to eliminate all barriers. Additionally, the model highlights the critical need for teaching and learning materials to be consistently available in order to support literacy development among deaf children. Teachers are required to create teaching and learning aids that can be used with the chaining strategy. As a result, if they do not possess the essential materials needed to develop improvised teaching tools, the strategy will fail to yield the expected results.

In line with these, the model illustrates the importance of professionally qualified and competent teachers in deaf education. A great part of the success of this technique depends on the use of sign language and qualified teaching personnel who understand the relevant methods of instruction and how to employ them. The implementation and resultant setback in achieving the set learning objectives due to unqualified teachers underscores the need for sign language. The entire model as depicted in Figure 1 and its subsequent components.

Figure 1 shows the pictorial representation of the proposed model that shows how to enhance the impact of the chaining strategy in developing reading skills among deaf pupils in Tanzania.

Figure 1
Researcher's Model for enhancing the use of chaining strategy in developing reading skills among deaf pupils developed from the findings of this study

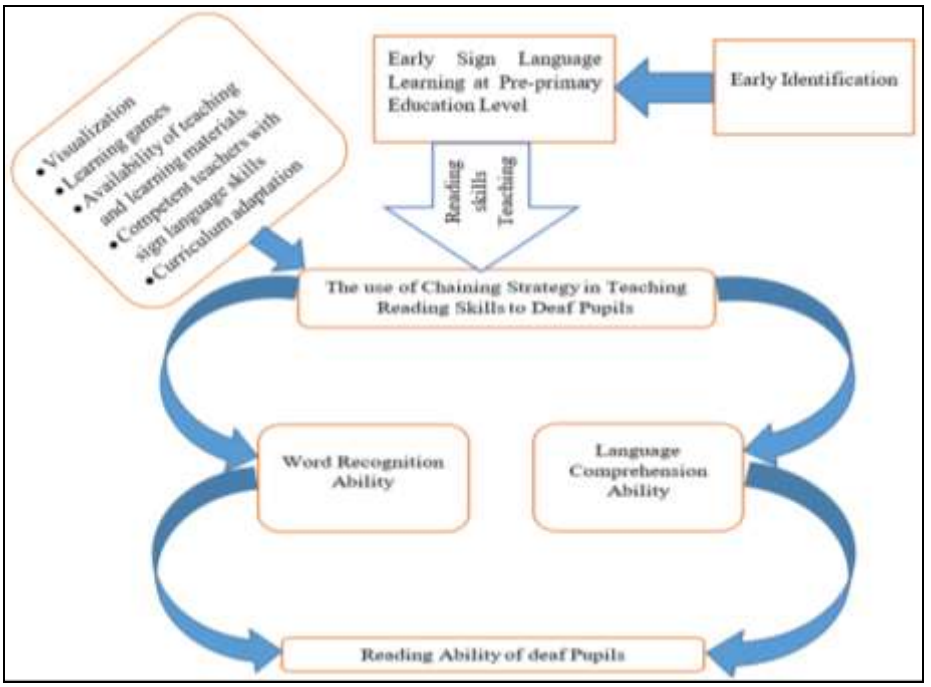

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Figure 1 shows that chaining strategy works better if deaf children are identified early, given appropriate intervention and enrolled into pre-primary education for early sign language learning as well as if learning games, visualization are included as the part of chaining strategy. Likewise, it becomes more efficient if curriculum for the pupils is adapted and teaching and learning materials are available all the time as well as if competent teachers with sign language skills are allocated to teach reading skill to deaf pupils. This is due to the fact that when the highlighted strategies are put into implementation together with the use of chaining strategy, promote the development of word recognition ability and language comprehension ability among deaf children which in-turn promote effective reading ability among deaf pupils.

CONCLUSION AND RECOMMENDATIONS

From this study it is logical to conclude that, the impact of chaining strategy will be enhanced if deaf children are identified early, get early sing language exposure, learning games and visualization are included as

the part of chaining strategy. Moreover, chaining strategy will become more efficient if curriculum for the pupils is adapted; teaching and learning materials are available all the time; if competent teachers with sign language skills are allocated to teach reading skill to deaf pupils and if sign language content is included in the pre-primary education curriculum.

The study recommends that the government should put the follow-up mechanism to make sure that all deaf children attend pre-primary education program before enrolling into primary education where they will get early sign language exposure and be oriented to the world around them. As well, the government should make sure that the curriculum used in the schools for deaf is adapted to address literacy learning needs of deaf pupils and should include sign language contents. Likewise, the government should allocate specific funds for purchasing visual aids, developing tailored teaching materials, and training teachers in sign language to enhance the application of the chaining strategy.

The study also recommends for further study in this area with a greater number of participant and different approach. This is due to the fact that the current study has applied only a qualitative approach with the sample size of 12 respondents which is small and thus limits the generalizability of findings.

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Assessment of ICT Integration in Competence-Based Curriculum in Moshi Public Primary Schools

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Abstract
This study assessed the integration of ICT in implementing a Competence-Based Curriculum (CBC) in public primary schools in Moshi Municipality, Tanzania. Specifically, the study aimed to determine teachers' perceptions of integrating ICT into their lessons and to examine the challenges they face in this process. A mixed-methods approach was employed, using a convergent parallel design and a sample of 266 respondents. Data were collected through questionnaires and in-depth interviews. Quantitative data were analysed using descriptive statistics with the aid of the Statistical Package for Social Sciences (SPSS), while qualitative data were analysed thematically. The findings revealed that the majority of participants viewed ICT integration in CBC as essential for delivering quality education to pupils. Most respondents reported access to mobile devices (smartphones) with internet and email functionality (75.5%), laptops (67.3%), tablets (61.6%), and desktop computers (60.4%). However, key challenges identified included a lack of ICT facilities (39.2%) and inadequate digital infrastructure (32.2%). The study concludes that although ICT integration is critical for improving the quality of education and achieving Sustainable Development Goal 4, Target 4.1, its implementation in CBC remains limited. Consequently, the provision of quality education is hindered. The study recommends increased provision of ICT facilities and the development of digital infrastructure in schools. Furthermore, it calls for additional research on effective ICT integration in primary education.

Keywords: *Integration of ICT, competence-based curriculum, perceptions, computer, internet*

INTRODUCTION

Educational stakeholders around the world are increasingly emphasizing the integration of Information and Communication Technology (ICT) into competence-based curricula (Sendagire, 2023). ICT is widely recognized as a transformative tool capable of revolutionizing teaching and learning while enhancing the quality and accessibility of education (Facer & Selwyn, 2021; Saif et al., 2022). Technologies such as interactive whiteboards, instructional software, tablets, and laptops have been shown to improve both instructional effectiveness and student learning outcomes (Yalman & Basaran, 2021). The growing adoption of ICT in education is largely driven by its potential to foster creativity, actively engage learners, and provide access to a wide range of digital learning resources (Haleem et al., 2022; Kiwonde, 2024). However, to fully realize these benefits, technology must be seamlessly integrated into teaching and learning environments, ensuring more efficient, effective, and equitable educational experiences (Cheung et al., 2021).

Similarly, academic institutions worldwide, particularly primary schools, recognize ICT as a vital tool for enhancing learning as its integration enables learners to improve subject comprehension, acquire knowledge, and boost academic performance (Barakabitze et al., 2019; Li et al., 2022). In competence-based curricula, students develop principles, facts, attitudes, and skills essential for personal and national growth. However, despite the growing prominence of computers and digital tools in education, integrating technology into classrooms remains a significant challenge (Sendagire, 2023). For example, in Malaysia, the lack of sufficient ICT infrastructure has created major barriers to incorporating technology into the new curriculum (Ghavifekr et al., 2016). Similarly, in Indonesia, the effective implementation of the revised curriculum is hindered by both a shortage of ICT facilities and limited digital literacy among students and teachers (Yamtinah et al., 2022). To ensure high-quality and accessible ICT, policies must provide sustainable and adequate funding for the development and ongoing maintenance of ICT infrastructure, particularly in rural and remote areas (Ntorukiri, Kirugua, & Kirimi, 2022). Recognizing these challenges, the UN and other global education partners have integrated ICT into their development agendas, assisting nations in formulating legal frameworks and master plans for ICT in education (Miao et al., 2022). According to UNESCO, such initiatives can effectively address the complex challenges facing modern societies (Ismail et al., 2024). A notable example is Kenya, which has

developed a National ICT Policy and implemented digital learning initiatives across its education system. These measures have improved access to digital resources in both urban and rural areas, thereby enhancing teaching quality and learning outcomes (Barasa, 2021). This practical application highlights how international support and policy frameworks can drive ICT integration in education.

In Sub-Saharan Africa, the adoption of Competence-Based Curricula (CBC) reflects a regional commitment to improving education quality and equipping learners with essential 21st century skills, including ICT proficiency. This educational shift aligns with global trends championed by organizations such as UNESCO and the World Bank, which advocate for skill-based and digitally inclusive curricula (Nguvi, 2023). Countries such as Kenya, Rwanda, Tanzania, and Uganda have embraced CBC frameworks to enhance students' problem-solving capabilities and prepare them for participation in the digital economy (Wambiya & Ogula, 2023). Studies, including Nsengimana et al. (2020), emphasize that CBC in Africa aims to bridge the digital divide and foster innovation through the integration of ICT in teaching and learning. However, implementation remains a challenge in many contexts, where traditional teaching methods continue to dominate despite curriculum reforms (Thomas & Onyango, 2022). To promote effective ICT integration, school-based communities are encouraged to engage in knowledge-sharing practices and adopt modern pedagogical strategies (Nsengimana et al., 2020; Agyei, 2021).

Furthermore, educational institutions must develop comprehensive strategies to cultivate core competencies essential for lifelong learning and sustainable development across the continent (Amponsah, Adarkwah, & Ledwaba, 2024). In Tanzania, broad educational reforms—including the revised Education and Training Policy (2014) as updated in 2023, the ICT Policy for Basic Education, and the ongoing Education Sector Development Programme—have underscored the importance of ICT integration. These reforms have prompted a national shift from a traditional knowledge-based curriculum to a Competence-Based Curriculum (CBC) at both primary and secondary school levels. Revisited around 2015, this transition was designed to equip students with practical skills aligned with labor market demands while promoting personal development (URT, 2014; Mwakalinga, 2016). Within this framework, ICT integration has been prioritized as a strategic approach to enhance

teaching, learning, and skills acquisition for both teachers and students (URT, 2023).

Despite these policy commitments, successful ICT integration remains dependent on early-career teacher training and continuous professional development (Lubuva et al., 2024). In response, the Ministry of Education introduced ICT pedagogy into Teachers' Colleges (TTCs) as early as 2005, aiming to equip educators with the requisite competencies for technology-enhanced instruction (URT, 2019). This initiative focused on curriculum planning, innovative pedagogical methods, and ICT literacy to modernize teaching practices (URT, 2016). However, significant barriers continue to impede the effective use of ICT in Tanzanian schools. Research highlights the persistent lack of ICT infrastructure and digital resources as major constraints, undermining the implementation of CBC and the development of essential competencies for sustainable development (Joseph, 2021; Masegenya & Mwila, 2023; Warioba et al., 2022). These limitations are particularly acute in under-resourced areas, where digital exclusion further widens educational inequalities (Nkya et al., 2021; Tandika & Ndijuye, 2019). Addressing these challenges requires sustained investment in ICT infrastructure, targeted teacher capacity-building programs, and the provision of accessible digital learning tools to ensure the full realization of CBC objectives and equitable education outcomes across the country.

Despite Tanzania's endeavours to improve digital teaching by implementing the initiatives outlined in the draft of National Digital Education Strategy (2024–2030) and the Education Sector Development Plan (2025/26–2029/30), which include the expansion of ICT infrastructure, the integration of curriculum, the development of digital content, and the development of capacity, the education system continues to face substantial challenges. The objective of these reforms is to enhance teaching and learning, and they are bolstered by frameworks in cybersecurity, governance, and partnerships. However, their implementation continues to encounter systemic obstacles (URT, 2024; 2025).

In particular, ICT integration in teaching and learning seems to face multiple barriers, including insufficient infrastructure, lack of trained personnel, inadequate access to modern learning resources, and poor teacher ICT competence (Joseph, 2022; Kalinga, 2024; Kiwonde, 2024;

Koomar et al., 2022). Limited ICT literacy and persistent resource constraints significantly hinder both students and teachers from fully engaging with the Competence-Based Curriculum (CBC), ultimately affecting learners' academic performance and long-term career development. Although the Tanzanian government continues to promote ICT integration in education as a means to enhance learning outcomes, many schools still struggle with implementation. Existing studies, such as those by Masegenya and Mwila (2023) and Warioba et al. (2022), have explored these challenges; however, none have focused specifically on Moshi Municipality. This indicates a gap in localized research on ICT integration within this context, which this study seeks to address. Therefore, there is a limited amount of localised research on the integration of ICT at the primary level within a competence-based curriculum (CBC) in Tanzania, particularly in specific municipalities such as Moshi. As a result, there is a knowledge gap regarding ICT integration in CBC implementation at the primary school level.

Given this gap, it is essential to examine whether ICT integration facilitates the effective implementation of the Competence-Based Curriculum (CBC). Therefore, this study aims to investigate the integration of ICT in the implementation of CBC in public primary schools in Moshi Municipality, Tanzania. Specifically, the study seeks to determine teachers' perceptions of integrating ICT into their lessons as part of CBC implementation and to examine the challenges they face in doing so.

LITERATURE REVIEW

The ICT Competence-Framework for Teachers (ICT-CFT) by UNESCO is widely used to evaluate ICT integration in CBC (Farısa et al., 2023). While teachers acknowledge ICT's benefits, challenges such as inadequate training, limited ICT-based assessments, and curriculum misalignment hinder effective use (Yamtinah et al., 2022; Abel et al., 2022; Ishaq, 2023; Seifu, 2020). Despite policy awareness, a gap remains between intent and practice (Ngao et al., 2022; Rana et al., 2022; Zeng, 2022), highlighting the need for better ICT infrastructure and support, especially in underserved areas. Despite efforts to promote ICT integration, research indicates that only 15% of teachers in Indonesia use ICT as a pedagogical tool (Machmud et al., 2021). The rapid advancement of digital technology in the millennial era compels teachers to develop ICT skills to enhance student learning both in the classroom

and extracurricular activities (Fitria, 2023). In response, some educational institutions in Indonesia have implemented teacher training workshops, ICT-supported project management tools, and collaborative learning platforms to overcome ICT implementation challenges. These initiatives highlight the potential for continuous improvements in ICT integration strategies within CBC.

ICT is increasingly vital in education, helping students acquire essential digital skills (Mavuso & Makeleni, 2022; Qaddumi et al., 2023; Zhang et al., 2022). In many developing countries, ICT supports Competence-Based Curriculum (CBC) implementation. Nations like Kenya, Rwanda, and Tanzania have introduced national ICT policies, including Tanzania's Draft National Digital Education Strategy (2024/25–2029/30) and Rwanda's Vision 2050 and NST1. Programs such as Kenya's Digital Learning Programme and Rwanda's Smart Classroom Initiative aim to enhance CBC through ICT (Wambiya & Ogula, 2023). However, Sub-Saharan Africa faces barriers such as inadequate infrastructure, limited teacher skills, and viewing ICT as a separate subject rather than a cross-curricular tool (Agyei, 2021; Gonfa et al., 2024; Kibirige, 2023; Murithi & Yoo, 2021; Nii Akai Nettey et al., 2024). Additional issues include overcrowded classrooms and a lack of resources (Khan, 2023; Otieno, 2020). Despite reforms, traditional teaching methods persist in places like Rwanda (Nsengimana et al., 2020). Addressing these challenges requires targeted support, professional development, and ICT strategies tailored to CBC to improve learning quality and digital literacy (Qaddumi et al., 2023; Boahen & Atuahene, 2021; Rana & Rana, 2023; Kalinga, 2024).

The integration of ICT into Tanzania's Competence-Based Curriculum (CBC) in public schools faces significant challenges which limit its effectiveness in enhancing teaching and learning. While teachers recognise the potential of ICT in implementing CBC, many struggle to integrate it into their instructional practices due to insufficient training, lack of ICT resources, and inadequate curriculum orientation (Joseph, 2021; Koomar et al., 2022; Mbawala, 2023). Additionally, poorly resourced learning environments further hinder effective ICT adoption, preventing teachers from utilising technology as a pedagogical tool or incorporating digital assessments (Kalinga, 2024; Kiwonde, 2024; Simbeye, 2020; Stephen, 2022). Research suggests that effectively addressing challenges in ICT integration requires structured teacher training programs, alignment between policy and classroom practice, and

improved access to ICT infrastructure (Ngao et al., 2022). However, most existing studies have concentrated on secondary education, resulting in a limited understanding of ICT integration at the primary school level. To fill this gap, the present study investigates the integration of ICT in the implementation of the Competence-Based Curriculum (CBC) in public primary schools in Moshi Municipality, Tanzania.

Theoretical framework

This study was guided by Rogers' Diffusion of Innovations (DOI) Theory (2003), which explains how new technologies or practices are adopted and spread within a social system over time. The theory is particularly relevant for understanding the challenges teachers face in implementing the Competence-Based Curriculum (CBC) in Moshi's public primary schools, as well as their perceptions of ICT integration. DOI Theory categorizes adopters into five groups—Innovators, Early Adopters, Early Majority, Late Majority, and Laggards—allowing for an analysis of teachers' varying readiness and willingness to integrate ICT into their instructional practices. It also identifies five key attributes that influence the rate of adoption: relative advantage, compatibility, complexity, trialability, and observability. These characteristics help explain how easily or reluctantly teachers embrace ICT in the classroom. Moreover, the theory highlights several barriers to innovation diffusion, such as limited infrastructure, insufficient training, low digital literacy, and resistance to change, all of which can impede the effective implementation of CBC. By applying DOI Theory, this study aimed to explore the potential for enhancing ICT adoption in primary schools, thereby improving alignment with CBC objectives and contributing to the overall quality of education in Tanzania.

MATERIALS AND METHODS

This study employed a mixed-method research approach to capitalize on the strengths of both quantitative and qualitative data. The approach enabled a more comprehensive investigation of ICT integration in the implementation of the Competence-Based Curriculum (CBC) in public primary schools in Moshi Municipality, Tanzania (Jawabreh et al., 2023). In addition, the study utilized a convergent parallel research design, which allowed for the simultaneous collection of quantitative and qualitative data to better understand the research problem (Dawadi et al., 2021).

The target population comprised 798 individuals within the Moshi Municipality Council. To ensure adequate representation, the study purposively selected 20 public primary schools from a total of 37, accounting for more than half of the schools in the area while also considering geographical distribution. A purposive sampling technique was used to select one District School Quality Assurance Officer (DSQAO) and 20 head teachers due to their direct involvement and relevance to the study. In contrast, simple random sampling was employed to select 245 teachers from the 20 schools, minimizing selection bias and ensuring a representative sample. This brought the total sample size to 266 respondents. Data collection instruments included in-depth interviews with the DSQAO and head teachers, while structured questionnaires were administered to the teachers, yielding a 100% response rate. Quantitative data were coded, entered into a computer, and analysed using descriptive statistics with the aid of the Statistical Package for Social Sciences (SPSS) Version 22.

The frequency, percentage, tables, and graphs were prepared under descriptive statistics. Thematic analysis was used to analyze the qualitative data collected during the study. The researcher first gathered and organized the field data, sorted it into broad thematic categories, and then constructed meaning by interpreting each theme to support discussion and reporting of the study's findings. The data were subsequently categorized, coded, and examined qualitatively to draw meaningful insights. To ensure the validity and reliability of the research instruments, the study employed content validity and Cronbach's Alpha, with a reliability coefficient of 0.85, to assess the internal consistency of the questionnaire. The validity of the interview guide was confirmed through expert consultation with research professional and further refined through a pilot test. The pilot was conducted in one public primary school that was not included in the main study sample. A variety of respondents were involved during the pilot phase to ensure the appropriateness and clarity of the instruments. To adhere to ethical guidelines, the researcher obtained a research clearance from the Open University of Tanzania. Subsequently, permission to collect data from the target population was requested from the Director of the Moshi Municipal Council. Additionally, participants were enrolled in the study based on their voluntary and informed consent. The researcher ensured that participants' concerns regarding privacy, confidentiality, and anonymity were fully respected and addressed throughout the research process.

RESULTS

This section presents the results based on the research objectives. The data were analyzed and organized into distinct themes, which are discussed in the following subsections.

Socio-Demographic Characteristics

This subsection outlines the socio-demographic profile of the study participants, providing context for interpreting their perspectives on ICT integration in the implementation of the Competence-Based Curriculum (CBC). The demographic data include gender, age, academic qualifications, and teaching experience, collected from both questionnaire respondents and in-depth interview participants. Out of the 245 primary school teachers who completed the questionnaire, the majority were female (55.1%). In terms of age, 33.9% of respondents were between 25 and 34 years old, while 40.4% were aged between 35 and 44 years. Regarding educational qualifications, 38.0% held teaching certificates and 38.4% held diplomas. Additionally, 36.3% of the teachers had between 6 and 10 years of teaching experience. These findings suggest that most participants had relevant professional experience and qualifications, positioning them to provide meaningful insights into the implementation of CBC since its introduction in 2016. The balanced gender representation also ensured that diverse perspectives were captured in the study.

Teachers' perception of integrating ICT into their lessons in implementing the competence-based curriculum

The study aimed to explore teachers' perceptions regarding the integration of ICT into their lessons to support the implementation of the Competence-Based Curriculum (CBC). Teachers expressed generally positive attitudes toward ICT integration, recognizing it as essential for enhancing teaching and learning. Under the subtheme of key qualities required for successful ICT integration, over 90% of teachers rated all identified attributes as either important or very important, with responses ranging from 92.3% acknowledging the importance of policy frameworks to 98.4% emphasizing the need for ICT skills. While their perceptions were largely favourable, the findings highlighted a clear need for ongoing training and support. Regarding personal and professional development needs, more than 64% of respondents rated all examined areas—ranging from using ICT for evaluation (64.1%) to instructional delivery (76.3%)—as high priorities. Fewer than 3% of participants considered any of the professional development items unnecessary, indicating strong

interest in capacity-building initiatives to improve ICT integration in CBC implementation (see Table 1*).*

Table 1
Professional development needs (n=245)

Professional Development Needs	Ranking			
	HLN	**MLN**	**LLN**	**NLN**
	Freq. (%**)**	Freq. (%)	Freq. (%)	Freq. (%)
Use of ICT in teaching	187 (76.3)	37 (15.1)	14 (5.7)	7 (2.9)
Selection of ICT resources appropriate for teaching	179 (73.1)	53 (21.6)	8 (3.3)	5 (2.0)
Use of ICT for assessment	157 (64.1)	70 (28.6)	16 (6.5)	2 (0.8)
Knowledge and understanding of using ICT in the teacher's specific subject(s)	171 (69.8)	51 (20.8)	16 (6.5)	7 (2.9)
Technological pedagogical knowledge	158 (64.5)	67 (27.3)	16 (6.5)	4 (1.6)
Use of ICT for administrative purposes	170 (69.4)	58 (23.7)	12 (4.9)	5 (2.0)
Use of ICT as a depository data tool	162 (66.1)	67 (27.3)	14 (5.7)	2 (0.8)
ICT integration into the classroom	173 (70.6)	57 (23.3)	12 (4.9)	3 (1.2)
Development of ICT skills in a particular context	169 (69.0)	58 (23.7)	15 (6.1)	3 (1.2)

HLN= High level of need, MNL= Moderate level of need, LLN= Low level of need
NLN= No need at all

Similarly, during in-depth interviews, participants thought that workshops and seminars were a more effective way of increasing knowledge and confidence to teachers to make them comfortable in implementing the integration of ICT in the competence-based curriculum as mentioned below:

> Workshops and seminars for effective ICT use are very important because they give teachers more confidence, increase their knowledge from those who know, and make them comfortable in using ICT in teaching and the learning process. [R8, 2024]

The findings suggest that workshops and seminars aimed at enhancing ICT usage are essential, as they help build teachers' confidence and expand their knowledge through interaction with experts and experienced peers. These professional development activities make teachers more comfortable using ICT tools, equipping them with the necessary skills and support to effectively integrate technology into teaching and learning.

Level of experience in the use of ICT facilities

Regarding teachers' level of experience with ICT facilities, respondents were asked to report their familiarity with various tools and platforms. While more than half indicated they had experience using computers and the internet, fewer than 40% reported being knowledgeable or well-experienced in specific applications. For instance, 39.2% were familiar with word processing software, 38.8% with e-learning platforms, 37.6% with spreadsheets, 35.1% with digital instructional technologies, 30.6% with PowerPoint, and only 26.5% with data projectors. These results, as illustrated in Table 2, highlight that limited exposure, inadequate training, and poor ICT infrastructure continue to pose significant barriers to the effective integration of ICT in teaching and learning.

Table 2

Level of experience in the use of ICT facilities (n=245)

Please indicate your experience with:	Well Experienced Freq. (%)	Experienced Freq. (%)	Neutral Freq. (%)	Not Experienced Freq. (%)	Not Experienced at all Freq. (%)
Computers	39 (15.9)	90 (36.7)	83 (33.9)	21 (8.6)	12 (4.9)
Internet	34 (13.9)	95 (38.8)	79 (32.2)	28 (11.4)	9 (3.7)
e-learning platform (e.g. Blackboard, Moodle etc.)	34 (13.9)	72 (24.9)	75 (30.4)	54 (22.0)	10 (4.1)
Overhead Projector	20 (8.2)	66 (26.9)	72 (29.4)	72 (29.4)	15 (6.1)
Word processor	23 (9.4)	73 (29.8)	63 (25.7)	69 (28.2)	17 (6.9)
Spreadsheet [Excel]	23 (9.4)	69 (28.2)	75 (30.6)	60 (24.5)	18 (7.3)
Experience using digital technologies to teach	23 (9.4)	63 (25.7)	93 (38.0)	46 (18.8)	20 (8.2)
PowerPoint	17 (6.9)	58 (23.7)	67 (27.3)	69 (28.2)	34 (13.9)
Data Projector	16 (6.5)	49 (20.0)	10 (4.0)	103 (42.0)	67 (27.3)

The data presented in Table 2 reveals that while a modest number of teachers are well-experienced with general digital tools such as computers (15.9%) and the internet (13.9%), their proficiency significantly drops with more specialized educational technologies. Notably, fewer than 10% of respondents reported being well-experienced in using PowerPoint

(6.9%), data projectors (6.5%), or digital technologies for teaching (9.4%). A considerable proportion of teachers also rated themselves as not experienced or not experienced at all, particularly with data projectors (69.3%), PowerPoint (42.1%), and e-learning platforms (26.1%).

These results imply that although basic ICT familiarity exists among many teachers, the integration of ICT into actual classroom instruction remains limited due to low exposure and limited competence in using more pedagogically targeted tools. This skill gap directly affects the implementation of the Competence-Based Curriculum (CBC), which relies on the integration of digital tools for interactive, learner-centered instruction. The findings underscore the urgent need for targeted professional development programs that focus not just on general digital literacy, but on the pedagogical application of ICT tools in real classroom settings. Without improving these skill areas, the potential of ICT to enhance CBC implementation and improve learning outcomes remains underutilized.

Furthermore, results from in-depth interviews indicated that most of the participants had a positive perception of ICT integration that, ICT enables learners to be creative and makes learning easy as it is narrated below:

> Quality education depends on how ICT will be integrated because it is the one which enables learners to be creative, active and it facilitates easy learning [R11, 2024]

Another participant narrated that:

> ICT is the most important of the core competencies in implementing CBC because it is the one which enables students to acquire the 21st century skills through active learning [R17, 2024]

The two statements thereof suggest that the integration of ICT is crucial for ensuring quality education, as it enables students to become more creative, active, and engaged in the learning process. ICT plays a vital role in facilitating effective learning and creating an environment where students can actively engage in the learning process. It is also recognized as one of the core competencies in the implementation of the Competence-Based Curriculum (CBC). By promoting active learning, ICT helps equip students with essential 21st-century skills, thereby enriching their educational experience and better preparing them to meet future academic and professional challenges.

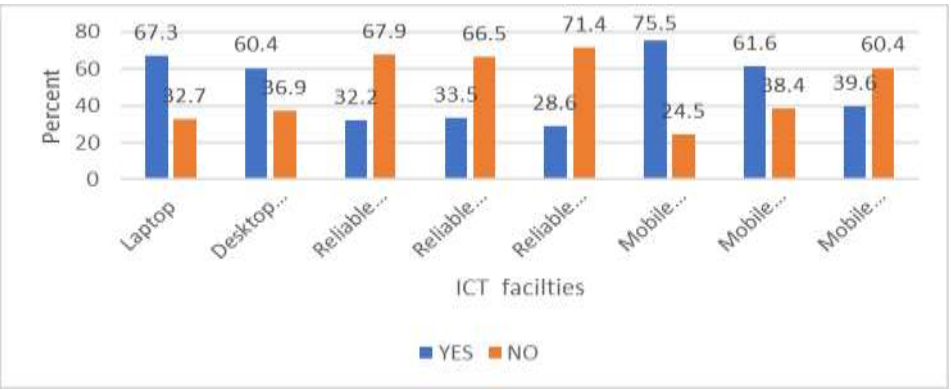
Challenges in integrating ICT in the implementation of CBC for public primary schools

Availability of ICT facilities

The distribution of availability of the ICT facilities to the study participants was as follows. The majority of the participants had the following ICT facilities available: see the figure below.

Figure 1

Availability of ICT facilities (n=245)



According to the data, the most commonly available ICT facilities reported by participants were mobile devices (smartphones) with internet and email functionality (75.5%), laptops (67.3%), tablets with similar features (61.6%), and desktop computers (60.4%). However, more advanced infrastructure, such as reliable internet connections (Wi-Fi, 3G/4G, or LAN), was reported as available by less than 34% of respondents. This indicates that while basic devices are somewhat accessible, overall ICT infrastructure is insufficient for effective integration into teaching and learning. Further insights from in-depth interviews supported this finding. Many respondents highlighted the shortage of ICT facilities in schools, particularly desktop computers. It was also noted that most of the laptops used were personally owned by teachers rather than provided by the schools. As one participant explained:

> Top of Form
> Bottom of Form
> No, the implementation is not good because teachers lack enough computers for students to learn practically. For example, most of the science and technology teachers fail to teach some topics (internet, word processor, spreadsheets etc.) [R3, 2024]

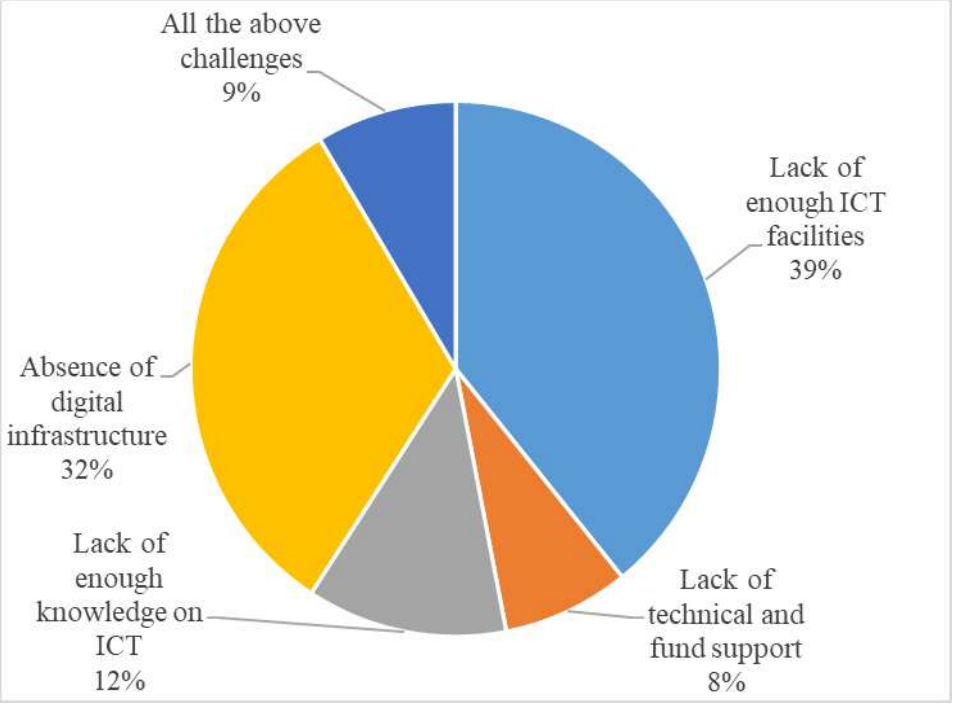
The above statement underscores the shortage of computers in schools, which significantly hampers the integration of ICT in teaching, particularly in science subjects. This limitation affects the use of tools such as the internet, word processing, and spreadsheets, thereby reducing teachers' ability to effectively deliver essential digital skills to learners.

Main Challenges faced by schools in integrating ICT

Respondents were asked to identify the challenges they face in incorporating ICT into the Competence-Based Curriculum in primary schools. The most frequently reported issue was insufficient ICT facilities (39.2%), followed by a lack of digital infrastructure (32.2%). Poor technical and financial support was the least cited challenge (7.8%). Additionally, only 8.6% of respondents reported experiencing all the listed challenges. These findings suggest that limited ICT integration in the studied schools is largely attributed to infrastructural and resource-related barriers that affect teachers' ability to effectively use technology in the teaching and learning process. Figure 1 shows the result below.

Figure 2

Challenges faced by schools in integrating ICT (n=245)



Likewise, most of the participants in in-depth interviews mentioned inadequacy of funds and technical support including frequent power cut-offs when it came to facilitating ICT integration in delivering CBC in primary schools. This was narrated by one of the participants:

> We have many challenges during ICT integration, for example, low facilities, lack of funds to support operations (internet, increasing some ICT resources), lack of technical support, power cut-off, poor infrastructures, and some teachers are not well prepared on using ICT tools. [R9, 2024].

Also, the participants mentioned the inadequacy of information technology (IT) literacy among teachers and the lack of facilities to implement integration of ICT in delivering CBC as mentioned by one of them who said that "Few of them are confident and comfortable in using ICT; about 75% are not using it because of low skills as well as lack of enough facilities." [R21, 2024]

Another head teacher had this to say:

> "We recognize the importance of ICT in education, and as a school, we are striving to integrate it into our teaching and learning processes. However, the reality is that we face several challenges. The most pressing issue is the lack of adequate ICT resources, particularly computers and internet access, which makes it difficult for teachers to incorporate ICT effectively into their lessons. Although we have some ICT equipment available, it's not enough for every student to engage practically during lessons". [R4,2024]

The responses highlight critical barriers to ICT integration in primary schools, particularly limited teacher competence and inadequate access to ICT resources. The lack of confidence and skills among teachers, combined with insufficient computers and internet connectivity, directly impacts the practical application of ICT in classrooms. These challenges hinder effective implementation of the Competence-Based Curriculum (CBC), limiting students' exposure to essential digital skills. The findings underscore the urgent need for targeted teacher training and equitable distribution of ICT infrastructure to ensure meaningful integration and improved learning outcomes. Furthermore, teachers are aware of the potential benefits that ICT can offer in terms of improving student engagement, enhancing creativity, and fostering critical thinking. But without sufficient resources, many teachers struggle to teach certain topics, especially in science and technology. For example, while we aim to teach students to use computer applications like word processors or

spreadsheets, we simply don't have enough devices for every student to practice. The narration above was complimented by the SQAO when remarked:

> From a quality assurance perspective, we recognize that ICT has the potential to enhance teaching and learning significantly, especially when it comes to fostering creativity, critical thinking, and student engagement. However, several challenges hinder its effective implementation, basically the issue of infrastructure. Many schools, particularly in rural or underfunded areas, still lack the necessary ICT resources such as computers, reliable internet access, and interactive learning tools. Without these, even the most motivated teachers struggle to integrate ICT into their lessons effectively. Additionally, we've observed that the limited availability of devices often leads to students not getting hands-on experience with technology, which is essential for building their ICT competencies. [SQAO,2024]

The statement emphasizes the pivotal role of ICT in enhancing educational quality by fostering creativity, critical thinking, and student engagement. It also highlights significant challenges hindering effective ICT integration, particularly in rural or underfunded areas. These challenges include inadequate technological infrastructure—such as limited access to computers, unreliable internet connectivity, and a shortage of interactive learning tools—which significantly hinder teachers' ability to effectively integrate ICT into their lessons. Consequently, students miss out on essential hands-on experience with technology, limiting their development of ICT competencies.

The study revealed that most teachers acknowledged the importance of ICT in implementing the Competence-Based Curriculum (CBC) to enhance the quality of education. The findings demonstrated a generally positive perception of ICT integration, consistent with Rogers' Diffusion of Innovation (DOI) Theory, which categorizes adopters into Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. This framework provides a useful lens for analyzing the varying levels of teachers' readiness and willingness to adopt ICT in their instructional practices. Teachers reported that ICT facilitates more efficient resource management, reduces reliance on traditional chalkboard teaching, and streamlines assessment processes. These insights highlight how positive attitudes toward ICT are closely linked to teacher preparedness and digital competency, both of which are essential for transforming pedagogy and equipping students with critical 21st-century skills. This view aligns with UNESCO's (2018) updated ICT Competency Framework for Teachers,

which emphasizes the role of ICT proficiency in advancing equity and excellence in education. The framework addresses key dimensions such as curriculum integration, pedagogy, infrastructure, and continuous professional development (Tomczyk & Fedeli, 2021). Similarly, the World Bank's ICT policy framework highlights the strategic use of technology to promote economic growth, enhance governance, and improve educational outcomes.

These perspectives are supported by Ishaq et al. (2023), who found positive teacher perceptions of ICT in the classroom, and by Kalinga (2024), who emphasized the importance of technical literacy among Tanzanian teachers. Mwendwa (2017) also reported that primary school teachers and principals perceived ICT as beneficial in improving performance, collaboration, and learning outcomes. Despite this enthusiasm, the study found a persistent gap between national ICT policy ambitions and actual implementation in schools. Although teachers and school leaders recognize the value of ICT, current infrastructure limitations, inadequate training, and resource constraints are not sufficiently addressed by existing ICT initiatives. This disconnect underscores the need for stronger alignment between policy intent and school-level support to realize the full potential of ICT in CBC implementation.

Despite positive perceptions of ICT, the study found that only 34.6% of respondents had mastered essential software like word processors, spreadsheets, and Moodle. While many were computer and internet literate, this gap in digital competencies suggests insufficient integration of ICT in teaching, which may hinder the effective implementation of the Competence-Based Curriculum (CBC). This shortfall also poses a challenge to Tanzania's goal of becoming a digitally-driven economy, as outlined in the updated National ICT Policy (2023), which emphasizes digital skill development for all sectors. World Bank (2023) has similarly identified gaps in Tanzanian teachers' ICT competencies, recommending strategies such as Learning Management Systems (LMS), e-libraries, and digital skills frameworks. Comparable issues were found in Kenya, where limited teacher training in ICT was a major barrier (Murithi & Yoo, 2021). Other studies (Kihoza et al., 2016; Simbeye, 2020) also highlight deficiencies in ICT skills and limited access to necessary tools and support. The study further revealed that the main barriers to ICT integration in CBC were inadequate ICT facilities and poor digital

infrastructure. These findings were supported by both survey responses and interviews with school leaders. Additional obstacles included limited technical support, power outages, and the prioritization of ICT for administrative rather than instructional use, mainly due to resource constraints. While mobile phones and laptops were reportedly available, they were often personal devices owned by teachers. There was also a noted lack of adequate digital and scientific learning materials. This situation contradicts the goals of the Draft National Digital Education Strategy (2024/25–2029/30) and the National ICT Policies (2016, 2023), which call for accessible, reliable, and sustainable digital infrastructure to support education. It also challenges the ambitions of Tanzania's Development Vision 2025, which emphasizes science and technology education and the role of ICT in building a skilled, knowledge-driven society (URT, 2019).

Addressing these gaps through greater investment in ICT infrastructure, teacher training, and learning resources is essential. Doing so would accelerate ICT integration, improve primary education quality, and support the achievement of Sustainable Development Goal 4, Target 4.1, which advocates for inclusive, equitable, and quality education by 2030. Similar studies (Murithi & Yoo, 2021; Mwendwa, 2017) affirm that many schools lack the financial capacity to provide adequate ICT resources, exacerbating educational disparities and limiting progress toward national education goals.

The study also found that the primary challenges of integrating ICT into the CBC curriculum in primary schools were inadequate ICT facilities and poor infrastructure. Key issues included limited technical support, unreliable electricity, and a lack of digital learning resources, which led to the use of ICT primarily for administrative tasks rather than for instructional purposes. A digital divide was evident between public and private primary schools in Moshi Municipality, with ICT rarely used for teaching in public schools. These findings align with the United Republic of Tanzania (2022), which acknowledges the gap between ICT policy goals and actual classroom practice. According to SDG Target 4.1, by 2030 all learners should acquire the technical and vocational skills needed for employment or entrepreneurship (United Nations, 2015), and ICT integration is central to achieving this vision (Antoninis et al., 2023).

The findings also support Nieminen (2020), who highlighted poor IT support, insufficient teacher training, and a shortage of qualified personnel as barriers to ICT adoption in Tanzanian schools. These constraints conflict with the goals of the Draft National Digital Education Strategy (2024/25–2029/30), which emphasizes accessible, curriculum-aligned digital learning resources and teacher empowerment (URT, 2024). Other studies (Mbawala & Lestari, 2023; Joseph, 2021; Kiwonde, 2020) reported inadequate devices, unreliable internet, and limited professional development opportunities. Teachers in this study echoed similar concerns, citing slow internet, frequent power outages, and a lack of training as key barriers to effective ICT integration. These findings are consistent with Lubuva, Ndibalema, and Mbwambo (2024), who noted that many Tanzanian primary school teachers lack the digital skills and tools necessary for meaningful ICT use. UNESCO (2023) also reports that education systems in low- and middle-income countries struggle to meet acceptable ICT integration standards due to systemic resource and capacity limitations. To address these challenges, increased investment in digital education infrastructure is critical. This includes providing appropriate digital tools for both online and offline use, training teachers and students in digital literacy, and ensuring access to relevant, localized digital learning materials. Collaboration among education stakeholders is essential to support the adoption, implementation, and sustainability of ICT in schools. The findings offer valuable insight into teachers' perceptions of ICT integration in CBC and underscore the need for education policies to prioritize digital transformation. Achieving SDG 4.1 by 2030 will require proactive measures to expand ICT access, improve infrastructure, and enhance teacher capacity to deliver quality, inclusive education in Tanzania’s public primary schools.

CONCLUSIONS

In conclusion, the assessment of ICT integration in the Competence-Based Curriculum (CBC) within Moshi Municipal public primary schools is both timely and significant. It addresses key gaps in educational policy and practice by providing localized evidence on digital readiness, teaching capacity, and infrastructure. The study contributes to the effective implementation of the CBC and aligns with national efforts, such as the Draft National Digital Education Strategy (2024/25–2029/30), to enhance education through technology. The findings have the potential to inform future educational reforms, improve teacher professional development, and support equitable access to quality education.

To achieve Sustainable Development Goal (SDG) 4 and Target 4.1—ensuring inclusive, equitable, and quality education by 2030—the integration of ICT into CBC teaching and learning must be prioritized. Key challenges such as limited ICT infrastructure, unreliable internet, and inadequate teacher training must be addressed. The government should increase the availability of digital tools including computers, tablets, projectors, and routers. Additionally, funds should be allocated to support regular internet access through term-based capitation grants. Addressing frequent power outages through electricity subsidies or solar installations is also critical. Teachers need to adjust their instructional practices and receive ongoing professional development in ICT integration. Therefore, education stakeholders must ensure that teacher training institutes are well-equipped to foster technology-supported teaching innovations and share training benefits across schools.

However, this study has several limitations. It was conducted solely in public primary schools within Moshi Municipality, which limits the generalizability of the findings to other regions. Some respondents may have withheld information due to concerns about disclosing ICT-related challenges, though this was mitigated through assurances of confidentiality. Moreover, the study focused only on government education officials and teachers, excluding students who could have provided deeper insights. A broader or longitudinal study involving more diverse participants could yield a more comprehensive understanding of ICT integration in education.

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The Inclusion of Students with Disabilities in Higher Learning Institutions: To What Extent Are They Socially Included?

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Abstract
Social inclusion is vital for students with disabilities as it significantly affects their academic progress and overall well-being in terms of collaborative learning and self-esteem. This study gives insights to Higher Learning Institutions (HLIs) on the importance of accommodating the social needs of students with disabilities, which consequently determines their learning needs and academic achievements. The study employed a mixed-methods research approach, with a convergent parallel design to collect data from 76 respondents. Questionnaires and interviews were used to collect data in two higher learning institutions. The findings revealed that students with disabilities were socially engaged in various aspects of teaching and learning processes, as established by this study. The results of the means revealed slight differences between genders (Males; M=43.9574, SD=4.75009 and Females; M=42.4138, SD=5.57108) in social engagement, although statistically, no significant differences were observed when the hypothesis was tested to determine social engagement in learning between male and female students (p>0.05). The study concludes that although students with disabilities are highly socially engaged in teaching and learning processes, these students are engaged differently according to the means established and comments made by informants. The study recommends that higher learning institutions should encourage peer social support and engage both students with disabilities equally in classrooms to ensure that students with disabilities realize their academic and social potential.

Keywords: *Inclusive education, students with disabilities, social engagement, teaching and learning, higher learning institutions*

INTRODUCTION

Social inclusion to children with disabilities is important and is a many-sided concept. In the context of education setting, social inclusion pre-determines the absence of marginalisation and stigmatisation in the process of learning to persons with disabilities (Le Boutillier & Croucher, 2010). In this case, social inclusion entails active interaction with peers in learning, participation in academic activities such as group work, classroom presentation activities, and access to quality inclusive practices in the classroom. Social inclusion, therefore, forms the basis for overall well-being and is a significant factor of becoming a valued and contributing member in learning for students with disabilities (M^asse *et.al.*, 2012; Murray & Greenberg, 2006).

Studies have indicated that access to education of children with disabilities has met many challenges such as low enrolment and high dropout due to unfriendly learning environment which are grouped in the lens of social exclusion (Dutta *et al*., 2009; Mpofu & Wilson, 2004). The challenges are more pronounced in Higher Learning Institutions than lower levels of education due to high demand of education concentration. Challenges in HLIs that emanate from social exclusion include scarce accessibility of higher education institutions, poor academic support, negative social attitudes, social isolation, as well as low financial support from the government and society; and lecturers' attitudes and self-efficacy (Foreman *et al*., 2001; Jung, 2003; Johnson, 2006; McKenzie & Schweitzer, 2001; Mpofu & Wilson, 2004; Shaw, 2023).

Researches indicate that positive support from faculty determines smooth progression of students with disabilities in education (Jung, 2003; Johnson, 2006; Rao, 2004;). Such support comprises the institution's positive attitudes toward students with disabilities, consciousness on the students' needs, and understanding towards reasonable provision of accommodation services to the students (Barazandeh, 2005; Kraska, 2003). Studies have shown conflicting results of students with disabilities with regard to academic achievement. For example, some studies have shown that students with disabilities perform average and dropout from some courses compared with their counterparts (Foreman *et al*., 2001; McKenzie & Schweitzer, 2001). Other studies, however, have reported frustrations, failure, isolation and poor coping mechanisms of students

with disabilities in their studies in inclusive institutions (Shevlin, Kenny & McNeela, 2004; Willett, 2002).

Claiborn *et al*. (2010) underscore that social inclusion plays a significant role in the retention of students with disabilities in studies. Such social inclusion aspects include; peer acceptance, positive attitude of the institution towards students with disabilities and accommodation in teaching and learning (Claiborn, et. al., 2010). The study conducted by Yusof *et al*. (2019) in Malaysia Higher Education revealed that students with disabilities indicated that social inclusion comprised provision of support services as facilitation in learning, access in learning facilities, creating awareness about the needs of students with disabilities, thus ensuring disabled-friendly facilities and implementing specific policies to address issues concerning disabilities.

Recent study conducted in Japanese Higher Learning Institutions to students with disabilities indicate that social inclusion in HLIs is thwarted by low expertise in special needs education in which instructors fail to provide adequate communication channels, lack of collaboration and poor instructions. Likewise, the study revealed that the faculty was unable to adapt the teaching strategies which catered for personal learning needs of students. It was also revealed that there were inclusion management gaps in terms of recognising the needs of students with invisible disabilities which could facilitate the provision of accommodations and management services (Dyliaeva, Rothman, & Ghotbi, 2024).

Presently, in Tanzania, there has been a growing number of students with disabilities being enrolled in Higher Learning Institutions (HLIs) (Mgumba & Kija, 2023; Semunyu &Rushashu, 2023; Philip, 2024). However, studies conducted in Tanzania indicate that students with disabilities in HLIs face challenges of lacking sign language interpreters and assistive devices such as hearing aids for children with hearing impairment, lack of braille machines and other audio and visual materials for those with visual impairment; which in turn, create communication barriers to students' peers and instructors, consequently, leading to social exclusion (Mwaipopo, *et al.,* 2011). Further, shortage of skilled teachers and specialists who are committed to managing academic and administrative duties has also been documented (Kisanga, 2020; Mgumba & Kija, 2023).

Although there are number of studies which have been conducted to assess the provision of education to students with disabilities in HLIs in Tanzania (Kisanga, 2019, 2020; Mgumba, 2018; Mwaipopo, *et al.*, 2011; Philip & Juma, 2023; Semunyu & Rushashu, 2023), those studies have dealt with small area of study. Moreover, studies in Tanzania have only been limited to a group of students with disabilities which cannot provide comprehensive information of their learning experiences in HLIs. Realising that research lacuna, this study intended to assess social inclusion of students with disabilities in learning and specifically examine their social interactions when learning with students without disabilities in higher learning institutions. It was hypothesized that: *there is no statistically significant difference in social interaction between male and female students with disabilities in higher learning institutions*.

Universal Design for Learning (UDL) Theory

This study was guided by the Universal Design for Learning (UDL) Theory promulgated by Meyer and Rose (2000). The UDL theory centres on the diversity of learning environment in which a learner interacts with. The UDL theory emanates from early civil rights advocacy and special education legislation which underscore the right of all students to have free, appropriate public education in the least restrictive environment (Hitchcock et al., 2005) in the process of learning.

The theory forges a link between a learner's learning needs and the educational environment that supports participation, access, and progress for learning (Meyer & Rose, 2000; Rose & Meyer, 2002). The UDL theory is an instructional theoretical framework which is entrenched in neuroscience and cognitive psychology. Viewed from the educational perspective; the theory draws attention to flexibility and inclusivity, thus ensuring that instructional aims, materials and methods are accessible by all, including learners with disabilities (Meyer, Rose, & Gordon, 2014). UDL theory advocates the learning styles that address the learning needs of a wide range of learners and not for a particular group of persons (Brokop, 2008**;** CAST, 2018).

The UDL theory is relevant to this study as it gives insights on the appropriate learning environment which all learners including those with disability should be exposed and supported in order to access quality education with equity. With regard to HLIs where many lecturers are not

trained to handle diverse learning needs, the institutions should create conducive environment for all students to learn. This situation calls for audio-visual materials, online resources and flexible learning environment to accommodate diverse learning needs (Creed et al., 2005**;** Meyer et al. 2014). Universal Design for Learning (UDL) principles encourage the availability of multi-modal means of representation, expression, and active engagement during teaching which provide students with different avenues to access information and be actively involved in learning activities (Meyer et al., 2016**).** Further, the UDL theory was deemed pertinent to this study as it advocates for inclusive pedagogy where all learners regardless of their physical, social and psychological limitation have to learn. Thus, Higher Learning Institutions should empower lecturers in inclusive pedagogical skills in order to enable all learners access education by accommodating diverse learning needs. For example, lecturers can prepare notes and provide them to students in different formats such as; audio, text, and visual to support students with dyslexia, hearing impairments, or learning disabilities.

METHODOLOGY

This study employed mixed research approach with convergent parallel design. The aim was to get data that would inform policies, guidelines prepared in HLIs and other educational stakeholders in order to make informed decision when planning the day-to-day curriculum activities and other related teaching and learning aspects. During data collection, both quantitative and qualitative data were collected simultaneously and analysed separately. While in report writing, the results were integrated to complement each other. Two universities were studied to determine the levels of social engagement of students with disabilities in learning with other students. Besides, gender as one of the issues in today's education was also tested to determine the social engagement level across genders, that is males and females. The aim of doing this was to find out whether there were significant differences between males and females in terms of social interaction in learning with other students.

The sample size of 76 respondents was considered through the use of simple random sampling from the given target population of 143 students with disabilities across the two higher learning institutions. Later on, purposive sampling was employed to get informants who could give views on the social interaction status of students with disabilities in

learning with other students. Thus, 5 students amongst the 76 students with disabilities were included in the study for interview purposes.

Questionnaires and semi structured interview guide were used to get data from the 76 respondents. The Likert scale with 5 statements of strongly agree=5, agree=4, neutral=3, disagree=2 and strongly disagree=1 was used in the study to examine the experiences of students with disabilities on social interaction in learning with other students in inclusive classes. The questionnaire set by the researchers had 10 items for measuring social interaction of students with disabilities. The researchers administered the questionnaire to the sampled students with disabilities. In order to triangulate the data, semi structured interview guide was used to the 5 sampled students with disabilities to get their opinion and experiences on social support they had received from their peers in learning at the classroom.

Prior to the actual data collection, the instruments for data collection were validated by the researchers' colleagues and expert review in order to determine the relevance of the study, objective, hypothesis set, language used and accuracy of the questions set in both questionnaire and semi-structured interview guide. Reliability of the study and its instruments were also checked whereby internal consistency was determined by using the Cronbach's alpha. The results obtained was (α) = 0.890, which is suitable.

Both quantitative and qualitative data obtained from the questionnaire and semi-structured interview guide were analysed in order to determine the social interaction of students with disabilities in learning with other students. The data obtained from the field were coded and entered into the computer for running descriptive data. Statistical Package Software for Social Sciences (SPSS) version 26 was used to obtain the quantitative data that could be used in testing the hypothesis established in the study. Means, standard deviation, percentages and frequencies were used to analyse the data. Furthermore, Independent sample T-test with confidence level of 95% and significance level of 0.05 was also used in the study to determine the statistical significance differences of social interaction across gender. The analysed quantitative data were presented in frequency distribution table. Qualitative data were analysed thematically and presented in quotation forms.

Before data collection, the study followed ethical clearance procedures. Permission was obtained from HLIs through an official ethical clearance letter. To ensure privacy, confidentiality, and anonymity, respondents were provided with an informed consent form. This form included four sections: an introduction to the researchers, the research purpose, a confidentiality statement, and a consent section requiring signatures from both researchers and participants. This process enabled the respondents to confidently complete questionnaires and participate in interviews.

RESULTS

The results of this study were established based on the objective and the tested hypothesis. The themes and sub-themes emerged from the objective, which states to *explore the social interaction of students with disabilities in learning with other students*. The tested hypothesis formulated states *to determine the statistical significance of differences in social learning support across genders.*

Demographic Characteristics

In order to determine the relevance of the study, demographic characteristics of the studied sample were obtained. Table 1 shows various demographic characteristics.

Table 1
Demographic Characteristics of Students with Disabilities

Demographic Characteristics (n=76)	Item	Type of Ownership	Frequency	Percent
Name of the University	A	Private	22	28.9
	B	Public	54	71.1
Gender	Male		47	61.8
	Female		29	38.2

Source: Field Data (May, 2024).

In Table 1, the findings reveal that both male (61.8%) and female (38.2%) students with disabilities were involved in the study. This shows that a large number of students with disabilities were males compared to females. The number of female students between the two universities is shown to be less regardless of the universities' intention to provide equal chances of enrolling both male and female students. This reflects that a large number of students who are enrolled at the universities are males

When it comes to disability, there is likelihood of observing fewer females.

Social Interaction of Students with Disabilities in Learning with Other Students (Peer Support)

Despite their physical condition, students with physical disabilities are supposed to interact with their peers in different learning activities. Their interactions not only benefit students with disabilities, but also normal students. There is mutual support from each other as they live in a diverse environment with multiple needs. In order to explore the social interaction with other students in learning, Table 2 reveals the findings.

Table 2

Social Interaction of Students with Disabilities in Learning with Other Students (μ=4.33)

Statements	Mean (μ)	Std Deviation	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel accepted by other students in my class.	4.45	.641	0	0	6(7.9%)	30 (39.5%)	40 (52.6%)
I have positive interactions with students without disabilities	4.32	.734	0	0	12(15.8%)	28(36.8%)	36 (47.4%)
I feel included during group activities.	4.24	.831	0	2(2.6%)	13(17.1%	26 (34.2%)	35 (46.1%)
I receive support from my peers in my learning journey.	4.39	.850	2 (2.6%)	1(1.3%)	3(3.9%)	29(38.2%)	41 (53.9%)
I have opportunities to collaborate with other students.	4.53	.553	0	0	2 (2.6%)	32(42.1%)	42(55.3%)
I experience a sense of belonging in my classroom.	4.25	.695	0	2 (2.6%)	5(6.6%)	41(53.9%)	28 (36.8%)
I am able to participate in social events with other students.	4.33	.681	0	1 (1.3%)	6(7.9%)	36(47.4%)	33(43.4%)
I am comfortable asking for help from my classmates.	4.34	.809	0	4(5.3%)	4(5.3%)	30(39.5%)	38(50.0%)
I am treated with respect by my peers.	4.33	.641	0	1(1.3%)	4(5.3%)	40(52.6%)	31(40.8%)
I feel that my opinions and ideas are valued by other students.	4.20	.783	0	3(3.9%)	8(10.5%)	36(47.4%)	29(38.2%)

Source: Field Data (May, 2024).

Table 2 shows the findings on the social interaction of students with disabilities in learning with other students. The findings revealed that there was maximum engagement of students in learning almost across all variables. However, 3 (3.9%) out of 76 students showed to be not comfortable with the support they were receiving from their peers during the academic journey. 3 (3.9%) out of 76 students also felt that their opinions and ideas were not valued by their colleagues and 1 (1.3%) out of 76 students showed not to have been treated with respect by their peers. Although the number of students who showed lack of comfortability with the social interaction, they were receiving from their peers was small, this should not be neglected. This is because; all students are required to be engaged equally in all spheres of social interaction during the teaching and learning processes. Scholars Monteverde *et al.* (2023): Gresham, Sugai and Horner (2001) demonstrate that when students with disabilities are isolated from their peers, their social skills in both the academic and everyday situations are hindered. This indicates the important role of social interaction for students with disabilities in learning situations.

In responding to the interview on the peer support received, one student had this to say:

> …...well, I receive some social support in learning, but when I need more, some of my fellow students do not show cooperation. Whenever this happens, I feel so bad! Therefore, I sometimes wish to have an individual who could be permanent in assisting me in all social and academic issues (Interview with the third-year students with visual impairment, May 2024).

In a similar vein, another student with a hearing impairment commented that:

> In fact, social support to me seems to be difficult to get. I have tried several times to share with my friends how I feel about their support during teaching and learning in the class, but very few care; the majority neglect me! This is contrary to where I was studying in my advanced level of education. I think social mobilisation and awareness to all students on individuals with disabilities should be encouraged during the orientation week (Interview with the first student with hearing impairment, May, 2024).

From these two quotes, the study establishes that some students had been left aside during the teaching and learning processes in the aspect of social engagement. As emphasised in the National Strategies for Inclusive

Education-2022-2026 framework (URT, 2021). The framework rests on the provision of holistic education (URT, 2021) with five key values which include: collaboration, rights to non-discriminatory education, respect to diversity, equity and access to quality education. Therefore, lecturers are required to encourage and promote social interaction in the classroom situation which in turn may enhance peer interaction at times of teaching and learning processes. Studies show that, peer support and interaction have significant, positive impacts on the lives of students with disabilities (Carter & Hughes, 2005). These students, when supported by their peers and others, they will be capable of refining their social skills, engage in learning activities and have adaptive behaviours (McCurdy & Cole, 2014). Furthermore, social interaction with peers promotes permanent life-changing ways (Shippy, 2015). Therefore, from these studies, one underscores the importance of social engagement of all students in HLIs as revealed by this study.

Significant Differences in Social Learning Support Across Genders

The study aimed to test the hypothesis to determine whether there was a significant difference in social learning support across genders. Tables 3 and 4 reveal the results as follows:

Table 3*:*
Significant Differences in Social Learning Support Across Genders (n=76)

Group Statistics (n=76)					
Statement	**Gender:**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
SOCIAL ENGAGEMENT	Male	47	43.9574	4.75009	.69287
	Female	29	42.4138	5.57108	1.03452

Source: Field Data (May, 2024).

Based on Table 3, the findings show that higher social engagement in learning was observed within males (**μ**=43.96, sδ=4.75) unlikely their female counterparts (**μ**=42.41, sδ=5.57). This might be due to the nature of the given activities and groupings, self-efficacy of a student in performing the given activities, gender socialisation and interactive social level between the members of the family and society where the students belong and the developmental factors during childhood (Mursita, et al, 2018). Besides, it is important to note that the level and nature of social interaction between males and females in HLIs may vary depending on the specific institution, culture, and the individual experiences and

preferences of the students. This study was conducted in two HLIs which varied in terms of ownership whereby one was under private ownership (Religious affiliation) and the other is public owned (publicly owned). Therefore, the nature of social interaction in learning may not be similar. This is why the study findings show that more social interactions in learning were found on male than female respondents although their mean groups were not statistically significant as revealed in Table 4 of this study.

Table 4
Gender and Social Interaction of Students with Disabilities in Learning with Other Students (n=76)

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
Statement		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Social Engagement of students with disabilities in learning	Equal variances assumed	.369	1.288	.202	74	1.544	1.199	1.1987	-.845	3.932
	Equal variances not assumed		1.240	.221	52.34	1.544	1.245	1.2451	-.954	4.042

Source: Field Data (May, 2024).

An independent sample T-test was conducted to determine whether there was significant difference in social interaction of students with disabilities in learning with other students whether males or females. The results in Table 4 indicate a not significant difference between male (μ=43.9574, sδ=4.75009) and female students with disabilities (μ=42.4138, sδ=5.57108), [t (74) =0.202, p=0.229>0.05]. The 95% confidence interval of the difference between means ranged from [-0.845 to 3.932] and did not indicate a statistical difference between the means of the sample. Consequently, we fail to reject the null hypothesis that there is no statistically significant difference between the sample means (t >0.05). Thus, the observed findings clearly show that male and female students with disability in HLIs possess no significant differences on the above-mentioned variables. The findings of this study are in agreement with Kumar et al (2016) and Bebetsos et al. (2014), who found that female students and their male peers were responsive and collaborative towards students with disabilities. Therefore, it is essential to emphasise the importance of social interaction among students, both with and without disabilities, as this helps improve their ability to adjust to learning and prepares them for future life as revealed by this study.

CONCLUSIONS AND RECOMMENDATIONS

The study concludes that although students with disabilities are highly socially engaged in teaching and learning processes, these students are engaged differently. All students with disabilities regardless of their sex have the right to participate in the learning process. Based on the findings, this study recommends that academic institutions are required to actively promote peer social support among students by creating an inclusive and supportive learning environment. Additionally, institutions should ensure that students with disabilities are equally engaged in classroom activities, discussions, and learning opportunities. By fostering inclusivity and participation, these students can fully demonstrate their abilities, thus enhancing their academic performance, and develop essential social and cognitive skills. This approach not only benefits students with disabilities but also contributes to a more diverse and enriched learning experience for all students in academic institutions.

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Gender Differences in Environmental Sustainability Attitudes among Pre-Service Science Teachers in Selected Teacher Training Colleges in Tanzania

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Abstract
This study aimed to assess gender differences in sustainability attitudes among pre-service teachers in Tanzania. A total of 926 pre-service science teachers (486 males and 440 females) from five teacher training colleges participated in the study. Data were collected using a questionnaire which essentially measured the participants' sustainability attitudes. Descriptive statistics (mean and standard deviation) and an independent sample t-test were employed to analyze the data. The results revealed that pre-service teachers generally exhibited positive sustainability attitudes, with an average mean score of 3.96. However, no significant gender differences between male and female pre-service teachers were found in sustainability attitudes ($t(924) = 1.455$, $p = 0.146$). The study recommends educational institutions prioritize on innovative pedagogical approaches that instill environmental responsibility to all students. Future research should explore other factors beyond gender that may affect sustainability attitudes.

Keywords: *Gender Differences, Sustainability attitudes, Pre-service teachers, and Teacher Training Colleges*

INTRODUCTION AND BACKGROUND

Environmental Sustainability has become a critical global concern due to increasing challenges posed by climate change, resource depletion, and environmental degradation (UNESCO, 2018; MoEVT, 2010). For example, globally the population of wild vertebrate species has fallen by an average of nearly one third (31%), and fresh water ecosystems has declined to 41% from 1970 to 2006 (Convention on Biological Diversity, 2010). In Tanzania, at least one-third of its important ecosystems has been

lost in the last few decades (URT, 2015). Land degradation has increased from 42% in 1980 to almost 50% in 2012 (URT, 2014).

To address the environmental challenges, the Government of Tanzania introduced the Environmental Education Strategy (EES) in 2010 (URT, 2010). This strategy aimed to integrate environmental sustainability into the education system by revising teaching, learning, and assessment approaches in basic education and pre-service teacher education. The primary focus was on fostering lifelong learning skills and equips learners with the knowledge, attitudes, and values necessary to promote sustainable environmental practices (MoEVT, 2010). By recognizing the need for further refinement, in 2015, the same government developed additional guidelines which advocated for participatory and inclusive pedagogical approaches in Environmental Education (EE) and Education for Sustainable Development (ESD) (URT, 2015).

These approaches emphasize interdisciplinarity, learner-centred education delivery, collaboration, and a transformative, pluralistic perspective. To achieve these outcomes, curriculum reforms in teacher education, such as those implemented in 2003 and 2009, embedded environmental education content across various subjects including Biology, Geography, Physics, and Agriculture (MoEVT, 2010). These comprehensive initiatives were designed to change learners' behavior and attitudes towards environmental conservation and sustainability. According to Gifford and Nilsson (2014), early exposure to nature and environmental education significantly impacts on pro-environmental attitudes and behaviours later in life. Knowledge and education enhance awareness and understanding of environmental issues. This provides opportunities for individuals to adopt sustainable practices. Uitto, Boeve-de Pauw andSaloranta (2015) assert that sustainability experiences obtained in schools should influence sustainability-related attitudes, values, and self-efficacy beliefs of the graduates outside the schools. These influence their behaviours and the behaviours of other community members.

Despite deliberate efforts to integrate environmental sustainability issues into pre-service teacher education programs, evidence shows that sustainability issues are still challenging. The disconnection between lifestyles and daily actions of teachers who have completed teacher education programmes exist across different settings (URT, 2015). One of the factors which contribute to this issue is the absence of strong pro-

environmental attitudes among teachers and pre-service teachers. Without a strong pro-environmental mindset, the knowledge and skills acquired in pre-service teacher education programs often become ineffective.

According to Gifford and Nilson (2014), environmental attitudes are shaped by complex interactions between personal values, social norms, cultural contexts, and external factors like education and policy frameworks. The personal factors include childhood experience, knowledge and education, personality and self-construal, as well as sense of control, values, political and world views (Gifford & Nilson, 2014). Others are goals, felt responsibility, cognitive biases, place attachment, age, gender, and chosen activities. The social factors include religion, urban-rural differences, norms, social class, proximity to problematic environmental sites, and cultural and ethnic variations.

Even though multiple factors influence environmental sustainability attitude, this study placed attention to gender. Gender plays a crucial role in shaping and reshaping sustainability practices and influences how individuals perceive, prioritize, and respond to environmental issues (Fremerey& Bogner, 2015; Sutton & Gyuris, 2015; Bergman, 2016; Ezpeleta & Sanz, 2020). Research conducted in various countries, including the USA (Plavsic, 2013; Levine & Strube, 2012; Cifuentes-Faura, et al, 2020; Briscoe et al, 2019), China (Wang & Li, 2020; Chen et al, 2021), Taiwan (Tien & Huang, 2022), South Africa (Synodinos, 2016), and Kenya (Njeru, 2020), consistently highlights that men and women exhibit distinct attitudes and behaviours toward environmental conservation. A common finding across these studies is that women generally demonstrate greater concern for sustainability and engage more actively in pro-environmental behaviors than men. However, while gender differences in sustainability attitudes appear to be a global trend, variations may exist across diverse cultural, economic, and educational contexts.

The study at hand anticipated that the universality around pro-environmental attitudes in terms of gender may not be applicable across all regions. Therefore, this study explored the extent to which gender differences are manifested between and among pre-service teachers in Tanzania. Most studies in the country have focused on discipline-bound differences and sustainability integration into secondary and primary school settings (Mwendwa, 2018; Kimaro, 2018; Kimaryo, 2011). The

study tested one hypothesis:There are significant gender differences in environmental sustainability attitudes among pre-service teachers.

Theoretical Framework

The study adopted Gender Role Socialization Theory developed by Sandra Bem in 1993. The theory explains how individuals learn and internalize gender specific expectations, behaviours, and attitudes in their own environment. This process begins in early childhood and continues to be shaped by family, education, peers, media, and culture. Over time, these agents of socialization influence how men and women perceive their societal roles, responsibilities, and attitudes towards environmental sustainability. According to the theory, women are traditionally socialized to be caregivers and nurturers. This often leads them to develop a greater sense of responsibility for nature and sustainability. Thus, women are more likely to be the primary household managers, making them more attuned to issues related to resource conservation, waste management, and environmental protection (Xiao and McCright 2015; Vicente-Molina,et al., 2018).

In contrast, men are often socialized to value individualism, competition, and resource exploitation, which may lead to less immediate concern for sustainability issues (Evans, 2024). Traditional masculinity norms emphasize technical problem-solving and economic productivity. This can make men prioritize industrial growth and technological solutions over conservation. In some cases, men may also perceive environmentalism as incompatible with their gender identity, resulting in lower engagement with pro-environmental behaviours (Evans, 2024).

Understanding gender differences in sustainability attitudes is essential for developing gender-responsive teacher education programs that encourage engagement in multiple perspectives. By doing so, college pre-service teacher education can foster a balanced and holistic approach to sustainability. This ensures that both male and female pre-service teachers are equipped with the necessary knowledge and skills to enhance environmental sustainability in their future teaching practices. In other words, gender-sensitive approach ensures that both male and female educators are empowered to become active agents of change. This promotes sustainable practices that resonate with all learners regardless of gender.

METHODOLOGY

Participants

This study involved pre-service science teachers from five teacher colleges in Tanzania which enrolled and produced a large number of diploma science teachers. Science related pre-service teachers were specifically chosen because their subject areas of specialization contain a substantial amount of environmental sustainability content compared to social science and humanities subjects. Moreover, all pre-service teacher colleges follow a national curriculum. This ensures consistency in their preparation and training they receive. Only the final year student teachers were selected as they were assumed to have developed sufficient knowledge and skills around environmental education content and teaching methodologies.

The number of pre-service science teachers across five teacher colleges was 2,057. From this population, around 926 student teachers (i.e., 486 males and 440 females) were sampled. This formula was used to obtain the sample: n = [z2 * p(1-p)] / e2 / 1 + [z2 * p(1-p)] / e2 * N]. In this light, **n**is the sample size, **P** is population proportion or the standard deviation (assumed as 50% or 0.5), **Z** is the z-score which was determined based on the confidence level of 95%, **e** is the margin of error or confidence interval (in this study 5% of margin error/confidence interval was used), **N** is the population.

Procedures

The researcher conducted visits to five teacher colleges. During these visits, the researcher first met with the college principals to provide them the introductory letter. The letter explained the purpose of the study and how it would be conducted. Once the principals agreed, I scheduled the meeting with all second-year pre-service science teachers. These students were provided with consent forms to complete. They were clearly informed that their participation in the study was entirely voluntary and thus, they could withdraw at any time.

Instrument

Questionnaires adopted from Gericke et al (2019) were primary data collection instrument. This instrument has previously been tested and validated to ensure its reliability in relation to assessing environmental sustainability attitudes. The questionnaire consisted of fourteen (14) items each rated on a five-point Likert scale ranging from 1 (Strongly Disagree)

to 5 (Strongly Agree). These items were grouped into three dimensions to comprehensively assess the different aspects of sustainability attitudes as follows:

1. **Environmental Dimension:** This included six items assessing participants' attitudes toward environmental sustainability. These items evaluated their views regarding protecting ecosystems, conserving resources, and addressing climate change. The statements included: (1) using more natural resources than necessary does not threaten future well-being, (2) the need for stricter environmental protection laws, and (3) taking measures against climate change-related problems.
2. **Social Dimension:** This consisted of four items: providing opportunities for sustainable living, ensuring future generations enjoy the same quality of life, and promoting equal educational and empowerment opportunities for both women and men. The statements included: (1) everyone should be given the opportunity to acquire knowledge and skills for sustainable living, (2) current generations should ensure that future generations enjoy the same quality of life, and (3) women and men must have equal opportunities for education and empowerment.
3. Economic dimension: This included four items focusing on participants' attitudes toward economic growth, resource allocation, and balancing economic progress with sustainability. These items examined the responsibility of companies in reducing waste, the importance of poverty reduction, and ensuring equal working conditions for employees in both poor and rich countries. The statements included: (1) companies should reduce packaging and disposable items, (2) reducing poverty is important, and (3) companies should provide equal conditions for employees in poor and rich nations.

The inclusion of these three dimensions (i.e., environmental, social, and economic provided a holistic understanding of participants' sustainability attitudes. This ensured that the multifaceted nature of sustainability, reflecting the interconnectedness of environmental, social, and economic factors were captured.

Instrument Reliability

In order to ensure reliability of the research instrument, the reliability analysis was conducted using Cronbach α (i.e., the most common

measure). Data obtained during pilot study was used for this purpose. The data generated from 24 participants who engaged in the pilot were analyzed statistically using SPSS 20 version for reliability test. The results are indicated in Table 1.

Table 1
Cronobach'sAlphafor sustainability attitudes

S/N	Dimensions of sustainability attitudes	Number of Items	Cronbach's α
1	Environmental dimension	6	0.66
2	Social dimension	4	0.79
3	Economic dimension	4	0.73

Source: Piloting Data 2023

DATA ANALYSIS PROCESS

The collected questionnaire responses were entered into SPSS software (version 20.0), and each item was numerically coded based on a five-point Likert scale to facilitate quantitative analysis. Specifically, responses were assigned values as follows: 1 "Strongly Disagree", 2 "Disagree", 3 "Neutral", 4 "Agree", and 5"Strongly Agree". This was followed by a normality test to determine whether the data were normally distributed or not. A normality test was performed using the Kolmogorov-Smirnov (K-S) Test and Shapiro-Wilk (S-W) Test to determine whether the data met the assumption of normal distribution. Descriptive statistics specifically mean and standard deviation (SD) were computed to summarize the sustainability attitude scores for both male and female participants. These descriptive statistics helped establish an initial understanding of gender differences in sustainability attitudes. Finally, inferential analysis using an independent sample t-test was undertaken to determine statistical significance about sustainability attitudes between and among pre-service science teachers.

Findings and Discussion

The findings of the study are presented starting with an assessment of the assumptions underlying the data analysis through a normality test followed by an examination of gender differences in environmental sustainability attitudes among pre-service teachers.

Normality Testing

To assess whether the data met the assumption of normality, both the Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted. The results of these normality tests are presented in Table 2 below.

Table 2
Normality Tests for Sustainability Attitude

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Variable	Statistics	df	p	Statistic	df	p
Sustainability attitude	.087	926	.049	.967	926	.054

Table 2 shows that the p-value for the Kolmogorov-Smirnov test is 0.049, which is less than 0.05, indicating that the data deviate from normality. However, the p-value for the Shapiro-Wilk test is 0.054, which is greater than 0.05, suggesting that the data do not significantly deviate from normality. Since the Shapiro-Wilk test is generally more reliable for a large sample, the data are considered approximately normally distributed which is suitable for parametric tests.

Gender Differences in Environmental Sustainability Attitudes among Pre-service Teachers

Descriptive statistics related to gender and attitudes toward environmental sustainability among pre-service teachers are presented in Table 3.

Table 3
Descriptive statistics on Gender Differences in Environmental Sustainability Attitudes

Participants	N	M	SD
Male	486	3.75	.557
Female	440	3.89	.589
Total	926		

The findings in table 3 indicate that female pre-service science teachers exhibited slightly higher sustainability attitude scores than their male counterparts. This difference, though modest, may indicate variations in environmental awareness, socialization, or educational engagement. The standard deviations (0.557 for males and 0.589 for females) suggest a relatively similar level of variability within each group. This means that attitudes toward sustainability are not drastically different among individuals of the same gender. However, these descriptive results alone do not confirm whether or not the observed difference is statistically significant. For this reason, an independent sample t-test is necessary to determine the mean scores. This is crucially important because of random variation which reflects a genuine gender-based disparity in sustainability attitudes.

Independent Sample T-Test

Since the data were approximately normally distributed, an independent samples t-test was performed to compare the mean sustainability attitude scores between male and female pre-service teachers. The t-test results were interpreted based on the t-statistic and p-value, with a significance level set at 0.05. This helped to determine the extent to which gender differences in sustainability attitudes were statistically significant. Table 4 below presents the results of the independent samples t-test.

Table 4
Independent sample t-test of gender differences on sustainability attitude

	t	df	Sig. (2-tailed)
Gender	1.455	924	.146

p>0.05 level. On two tail test

The t-test results, t (924) = 1.455, p = 0.146, presented in Table 4, indicate that there is no statistical substantial difference in sustainability attitude scores between male and female pre-service science teachers at the 0.05 significance level. Male pre-service teachers had a mean score of 3.75 (SD = 0.557) and female pre-service teachers had a slightly higher mean score of 3.89 (SD = 0.589). This difference is not significant enough to conclude that gender plays a decisive role in shaping sustainability attitudes. The implication here is that shared educational experiences, instructional strategies, and curriculum exposure have a stronger influence on sustainability attitudes than gender differences.

Research indicates that when pre-service teachers receive the same curriculum content, teaching methodologies, and learning opportunities, gender-based differences in attitudes tend to diminish significantly (UNESCO, 2017; Tuncer et al., 2009). Kollmuss and Agyeman (2002) argue that sustainability attitudes are primarily shaped by curriculum design, pedagogical approaches, and engagement in environmental issues rather than gender alone. As earlier noted, both male and female pre-service science teachers in this study had opportunities for professional development related to sustainability concepts, discussions, and practical activities. This could be one of the contributing factors to their comparable attitudes. Evidence indicates that socialization, cultural norms, and prior environmental experiences have a greater impact on shaping sustainability attitudes than gender itself (Schultz et al., 2005).

Findings align with previous research which indicate that gender differences in sustainability attitudes become less pronounced when both male and female pre-service teachers receive equal environmental education (Olsson et al., 2016). This highlights the importance of high-quality sustainability education in fostering positive attitudes among future educators. Burmeister and Eiks (2013) and Marcos-Merino et al. (2020) found that pre-service teachers develop stronger sustainability attitudes when they participate in sustainability-focused education programs. This supports the view that sustainability attitudes are not significantly influenced by gender (Larson et al, 2010; Castleberry & Green, 2010; Levine & Strube, 2012; Liefländer& Bogner, 2014). The results at hand suggest that well-designed teacher training programs can effectively foster sustainability attitudes acrossgender and subsequently reinforce the universal nature of sustainability education.

CONCLUSION AND RECOMMENDATIONS

These findings underscore the transformative power of education in shaping sustainability attitudes. In other words, the well-designed teacher training programs can cultivate pro-environmental mindsets across gender. Rather than being an inherent trait, sustainability attitudes are a reflection of curriculum quality, instructional strategies, and meaningful engagement with environmental issues (Tomas et al., 2017; Misseyanni, 2020). The integration sustainability education into teacher preparation is crucial in ensuring that all future educators are equipped with the knowledge, skills, and motivation to foster environmental responsibility in their students. By embedding sustainability principles into pedagogy, institutions can create a ripple effect that extends beyond individual teachers to influence entire generations of learners. A commitment to high-quality sustainability education will not only strengthen environmental literacy among pre-service teachers but also empower them to become agents of change in their communities. Therefore, the focus should shift from demographic factors to the broader goal of enhancing sustainability education beyond gender.

Educational institutions must prioritize on innovative pedagogical approaches that instill environmental responsibility in all students. This involves integrating active learning strategies, problem-based learning, and interactive discussions into classroom teaching practices. This not only enhances engagement but also reinforce positive attitudes toward environmental stewardship. Future research should go beyond existing

frameworks to examine the influence of other demographic information on sustainability attitudes. These include cultural background, prior environmental education experiences, and socio-economic status. A mixed methods research approaches that incorporate qualitative and quantitative data will provide a deeper and more comprehensive understanding of the phenomena at hand.

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Enhancing Critical Thinking Skills for Visually-Impaired Students: Insights from Tanzanian University Tutors

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Abstract
This study explores strategies for enhancing critical thinking skills among visually impaired university students, aiming to empower them with essential competencies for academic success and future employment. By fostering greater independence and confidence, the study contributes to more inclusive higher education practices. A qualitative research approach, guided by a phenomenography design, was employed. Using criterion purposive sampling, seven university tutors from a special education unit within the Department of Educational Psychology and Curriculum Studies were selected. Data were collected through a focus group discussion (FGD) and analysed using the Miles and Huberman model. The findings highlight key strategies to support critical thinking development, including the use of assistive technologies, multisensory learning approaches, individualized support, and adapted instructional methods. Creating accessible learning materials and offering opportunities for collaborative learning with sighted peers were also noted as effective. The study recommends that higher education institutions provide professional development workshops to equip tutors with inclusive teaching strategies. Additionally, diverse assessment methods—such as oral presentations and project-based tasks—should be employed to enable visually impaired students to demonstrate their critical thinking skills. The study further advocates for continuous research into best practices for supporting critical thinking among students with visual impairments.

Keywords: *Visual impairment, critical thinking, university tutors, visually impaired student*

INTRODUCTION

This study seeks to answer the research question: What are the tutors' strategies for enhancing critical thinking skills among visually impaired

students at the University of Dodoma? Globally, education is recognised as a fundamental human right for all individuals, regardless of disability status, and serves as a key vehicle for acquiring essential 21st century skills (Indriastuti, Sugini, & Anwar, 2020). According to the rights-based approach to education, visually impaired students are entitled to quality learning experiences that equip them with competencies such as critical thinking (UNESCO, 2007). In the context of higher learning institutions, students with visual impairments should have equitable opportunities to develop critical thinking skills, supported by their tutors and inclusive educational environments. Afzal, Kamran, and Naseem (2023) emphasise that higher education institutions are committed to advancing knowledge and fostering intellectual growth, including critical thinking, among all students. They further assert that university tutors serve in multiple roles instructors, mentors, and facilitators and are instrumental in shaping the cognitive development of students, including those with disabilities. Critical thinking skill is a vital skill in the 21st century; however, educational programs for visually impaired student have not adequately focused on fostering this ability (Indriastuti et al., 2020). Furthermore, Indriastuti et al. (2020), confirm that people with visual impairment are individuals who have limitations in visual acuity and visual field. This implies that the limitations of visual acuity and visual field possessed by visual-impaired students cause them to demand special treatment from people surrounding them. The special treatments include special techniques and methods as well as certain aids to be followed by visually impaired students in the learning process. This implies that the higher-learning institutions in Tanzania should have specialized services, books, teaching-learning materials, and equipment that are easily available and accessible to all students.

The concept of critical thinking is interpreted differently by scholars, psychologists, and philosophers. For instance, Bassham, Irwin, Nardone, and Wallace (2011) define critical thinking as the process of thinking clearly and intelligently. They describe it as a broad term encompassing various cognitive skills and intellectual dispositions essential for effectively identifying, analysing, and evaluating arguments and truth claims. It also involves recognising and overcoming personal biases, formulating and presenting sound reasoning, and making rational decisions about beliefs and actions. Similarly, Murawski (2014) defines critical thinking as “the art of thinking about thinking,” highlighting its metacognitive nature. In the context of this study, critical thinking is

understood as the cognitive abilities and dispositions of visually impaired students to analyse, evaluate, and synthesise information effectively.

Visually impaired individuals are those with significant vision loss that limits their ability to perform tasks requiring sight (Kachweka & Rupia, 2022). Visual impairment is commonly categorised into two types: blindness and partial sight (Kimoka, 2014). According to Naipal (2018), visual impairment refers to a reduction in visual performance that cannot be corrected through spectacles, contact lenses, surgery, or medical intervention. In the context of this study, visually impaired students are defined as learners with severely limited light perception who are unable to read print or enlarged fonts, even with magnification or optical aids.

Visual impairment can hinder students' ability to acquire knowledge, as they struggle to interpret their surroundings through limited sensory input. Kizilaslan (2020) asserts that reduced visual perception makes it difficult for visually impaired students to form meaningful connections between experiences, as the mind cannot process information it does not receive through the senses. One of the persistent challenges faced by visually impaired students in higher education both globally and in Tanzania is limited access to educational materials (Butler, Holloway, Marriott, & Goncu, 2016). These include braille materials, talking books, styluses, embossed maps, and abacuses, all of which are essential for developing critical thinking skills (Akakandelwa & Munsanje, 2011; Butler et al., 2016). However, recent advancements in digital technologies have increased the availability of accessible learning materials in electronic formats, enabling visually impaired students to access content through screen readers and braille displays (Butler et al., 2016).

Globally, there is recognition that visually impaired students possess varying levels of intelligence that can be nurtured through supportive environments (Al-Shenikat, 2022). Indicators of intelligence among these students include the ability to explore causal relationships, classify information, make inferences, and experiment. Additional traits involve identifying errors, organising information, and using abstract symbols effectively. Understanding these indicators is essential for university tutors to design appropriate educational programs and instructional strategies aligned with students' intellectual capabilities.

In Tanzania, there has been a notable increase in the enrolment of visually impaired students in higher education institutions such as the University

of Dodoma, the University of Dar es Salaam, and the Open University of Tanzania (Bhalalusesa, 2016). This trend reflects a broader global movement driven by anti-discrimination policies and expanded educational access for students with disabilities (Butler et al., 2016). In this context, it is imperative that university tutors actively foster critical thinking skills among visually impaired learners. As Al-Shenikat (2022) affirms, these skills enhance academic performance, encourage creativity and problem-solving, and improve students' ability to navigate academic and real-life challenges. Critical thinking also enables visually impaired students to regulate their thinking processes, make informed decisions, and respond effectively to new information and emergencies.

Students with visual impairments at higher-learning institutions in Tanzania face various barriers, including challenges in interaction with the physical and social environment, inadequate learning support services, and inaccessible information (Kija & Mgumba (2024). This implies that the existing challenges limit the ability to expand their critical thinking skills. Building on this context, the study sought to explore university tutors' insights on strategies for enhancing critical thinking skills among visually impaired students in higher-learning institutions. Despite the steady increase in the enrolment of visually impaired students at the tertiary level, there remains a notable gap in research regarding how these students are supported and motivated to develop critical thinking skills comparable to their sighted peers. To address this gap, the study focused on understanding the perspectives of tutors at the University of Dodoma, aiming to identify effective approaches for fostering critical thinking among visually impaired learners in inclusive academic environments.

MATERIALS AND METHODS

The study used qualitative research approach to explore tutors' insights in enhancing critical thinking skills among visually-impaired students at the University level. The study was guided by phenomenography design which aimed to understand varied experiences in which informants understand the phenomenon understudy. This study was undertaken at the University of Dodoma (UDOM) as a case study due to the fact that the university hosts large number of students with visual impairments. Also, the university under the college of education offer a programme on special needs education (i.e., bachelor of education in special needs). with purposive sampling procedure, a total of seven (7) tutors were selected from the Special Education Unit within the Department of Educational

Psychology and Curriculum Studies (EPCS). The participants included four male and three female tutors, all chosen for their extensive experience in supporting and facilitating the learning of students with visual impairments, both during lectures and practical sessions. Notably, these tutors are the only academic staff at the College of Education who specialise in special needs education. To gather insights into how critical thinking skills can be enhanced among visually impaired students at the university level, a focus group discussion (FGD) was conducted. This method was selected for its effectiveness in bringing together individuals with shared professional backgrounds and experiences. The FGD allowed tutors to engage in a dynamic and open conversation about their strategies, challenges, and recommendations. The session was guided by a moderator who introduced the topic and facilitated active participation, ensuring a lively and natural exchange of ideas among the tutors.

After data collection, the researcher analysed the data using the Miles and Huberman model (2014), which consists of three key stages: data reduction, data display, and conclusion drawing or verification. In the data reduction stage, the researcher organised, selected, and summarised the information gathered from the field. This included coding the data by categorising and labelling different segments to identify patterns, themes, and relationships. The second stage, data display, involved presenting the coded data visually, typically in the form of tables, which enabled the researcher to explore connections between various codes, categories, and themes. This visual representation provided a comprehensive overview of the data and supported the identification of emerging patterns. In the final stage, conclusion drawing and verification, the researcher interpreted the findings, made connections to existing literature, and developed evidence-based explanations grounded in the data analysis. To ensure ethical conduct, the researcher obtained informed consent from all participants, providing them with complete information about the study's purpose and procedures. The researcher also prioritised participants' well-being by adhering to the principle of beneficence and striving to maximise potential benefits. Furthermore, the researcher upheld honesty and integrity throughout the study by strictly following established research protocols.

RESULTS

From the study findings, five key themes emerged which were related to the research objective (see Table 1). The key themes include assistive

technologies, multisensory learning approaches, individualized support and feedback, creating accessible learning materials and adapting instructional methods.

Table 1
Major findings of the study

Key themes	Categories
Assistive Technology	Screen readers, digital note-taking tools, magnification software
Multisensory Learning Approach	Tactile and auditory learning materials, experiential learning
Individualized Support	Motivation, Guidance, and problem-solving skills
Instructional Methods	Class discussion, group activities, perspective sharing, guiding questions and prompts
Creating T/L Materials	Interests of visually-impaired students, tactual image design

Source: Field Data (2024)

From Table 1, the findings highlighted that university tutors enhance critical thinking skills in various ways. A further analysis of the emerged key themes is carried out in the subsequent sections.

Assistive technologies

This theme emerged from the data reflecting tutors' insights on enhancing critical thinking skills among visually impaired students. The findings revealed that tutors employ various assistive technologies such as screen readers, digital note-taking devices, and magnification software to support learning and promote critical thinking. Tutors reported using screen readers to enable visually impaired students to access learning materials and actively engage with the curriculum. These tools help cultivate essential critical thinking skills, including attentive listening and sustained concentration. Additionally, the use of note-taking devices, such as refreshable braille displays, was seen as instrumental in encouraging deeper engagement with course content, allowing students to reflect critically on what they have learned. Tutors also emphasised the role of magnification software in supporting students' ability to analyse and synthesise visual information, further enhancing their capacity for critical thought. One tutor had this view;

> In my lectures and practical with students with visual impairments, I prefer them to use electronic digital note-taking devices, such as refreshable Braille displays, and magnification software to facilitate

> active engagement within their learning process. I hope the electronic devices help them use their senses to expand their critical thinking skills.

The narrative above sheds light on the importance of utilizing assistive technologies in enhancing critical thinking skills among visually-impaired students at higher-learning institutions.

Multisensory learning approaches

Another key theme that emerged from the findings on tutors' insights into enhancing critical thinking skills among visually impaired students was the use of multisensory learning approaches. The data indicated that tutors employ a range of multisensory strategies, including tactile, auditory, and experiential learning methods, to foster critical thinking. Specifically, tutors reported using tactile and auditory materials such as 3D models, raised-line diagrams, and recorded lectures to support students' understanding and engagement with abstract concepts. These resources enable visually impaired learners to interact with content in ways that stimulate critical analysis and deeper reflection. Additionally, tutors emphasised the value of experiential learning, which encourages students to engage multiple senses in solving real-world problems. For example, one finding highlighted how visually impaired students rely on their sense of smell to distinguish between fruits with similar shapes and textures, illustrating the adaptive use of sensory input to develop problem-solving skills and apply critical thinking in practical contexts. A tutor remarked this;

> I use 3D models to assist students with visual impairments to lean contents which involves understanding of various diagrams such as geography and biology. I believe that the use of 3D for visually-impaired students to learn shapes in a virtual learning environment helps them motivate their critical thinking skills.

The above quotation regarding tutors' insights in enhancing critical thinking skills reveals the necessity of using multisensory learning approaches in promoting critical thinking skills among students with visual impairments at higher-learning institutions.

Individualized support

Another key theme that emerged from the data on tutors' insights into enhancing critical thinking skills among visually impaired students was the use of individualised support. The findings revealed that tutors employ a range of personalised strategies—such as encouraging reflective

thinking, assigning individual and group tasks, and offering one-on-one tutoring sessions—to nurture critical thinking skills. Tutors reported that they actively prompt visually impaired students to reflect on taught content by asking targeted questions during lessons, which helps deepen students' understanding and stimulates analytical thinking. Additionally, the assignment of individual and group-based tasks was highlighted as a means of fostering collaboration, independent reasoning, and critical engagement with academic material. The findings further indicated that tutors regularly provide personalised tutoring sessions to address specific learning needs. According to the tutors, these sessions create a safe space for visually impaired students to express difficulties, ask questions about challenging topics, and build self-confidence—an important foundation for developing critical thinking and problem-solving skills. One tutor had this to say:

> When I notice that in my class there is an individual visual-impaired student does not understand what was taught, I plan for an extra time to have a tutoring session with him or her to address the challenges he or she faces. I discuss with him or her, asking questions and I give him or her an opportunity to ask questions in area that are difficult for him and I give him or her time for reflection of what we have discussed I think this will help develop critical thinking skills.

The above statement portrayed that individualized learning is an essential tool for the promotion of the critical thinking skills among students with visual-impairments in higher-learning institutions.

Instructional methods

This was another theme that emerged from the findings on tutors' insights in enhancing critical thinking skills among visually-impaired students. It revealed that tutors use various instructional methods to foster critical thinking skills. The findings confirmed that tutors employ class discussion, group activities perspective sharing, critical discourse and guiding questions and prompts to enhance critical thinking skills among visually-impaired students. The findings revealed that tutors actively engage visually impaired students in class discussions and group activities as a means of enhancing their critical thinking skills. Tutors reported that creating opportunities for these students to express their perspectives and participate in critical discourse encourages deeper analysis and reflection. Through guided discussions and collaborative tasks, visually impaired students are supported in developing argumentation, reasoning, and the ability to evaluate diverse viewpoints core elements of critical thinking.

Moreover, the findings showed that tutors provided guiding questions and prompts to help visually-impaired students to analyze and synthesize information as a way of fostering their critical thinking skills. One of the tutors commented this;

> I use different teaching strategies to enhance critical thinking skills for visually-impaired students during my lecture hours. The methods include engaging students with visual impairments in group discussions and various group activities such as group presentation during seminar sessions. I also allow them to share perspectives that allow them to engage in critical discourse. Furthermore, I provide guiding questions or seminar questions that help them in analyzing and synthesizing information to motivate their critical thinking skills.

The quotation above illustrates that tutors recognise the importance of using diverse instructional methods in the classroom. They view these approaches as effective strategies for enhancing critical thinking skills among students with visual impairments in higher learning institutions

Creating T/L materials

Creation of customised teaching and learning materials also emerged as a key finding on tutors' insights into enhancing critical thinking skills among students with visual impairments. The result revealed that tutors actively design and develop instructional materials tailored to the specific content and learning needs of visually impaired students. Tutors emphasised the importance of aligning these materials with both the subject matter and the interests of the students, enabling them to explore, test, and engage through touch. For instance, tutors reported designing tactile representations—such as a raised image of a triangle in mathematics to support students in conceptualising abstract ideas. These materials foster active learning and promote the development of critical thinking skills by encouraging exploration, analysis, and interpretation through tactile interaction. One of the tutors said the following:

> I design tactual materials by using textured materials that I incorporate different textures, including smooth, rough and soft to convey information to visually impaired students through touch. This practice helps them develop critical thinking skills.

The aforementioned quotation implies that tactile materials can capture the attention of visually impaired students more effectively than traditional teaching methods. This increased engagement leads to greater participation in learning activities and, consequently, fosters the development of critical thinking skills.

DISCUSSION

The findings from this study on tutors' insights into enhancing critical thinking skills among visually impaired students in higher learning institutions highlight the essential role of assistive technologies in supporting these learners. Tutors noted that developing critical thinking skills in visually impaired students requires more than curriculum content and teacher performance; the integration of assistive technologies is equally critical. This aligns with findings by Silman, Yaratan, and Karanfiller (2017), who observed that technology enhances the learning experiences of visually impaired students and improves their ability to develop essential skills, including critical thinking.

Additionally, the study reinforces the significance of multisensory learning approaches in fostering critical thinking. Tutors indicated that engaging students through multiple sensory pathways, such as tactile and auditory stimuli not only promote active participation but also facilitates long-term knowledge retention and deeper cognitive processing. These findings are supported by Manna and Dheesha (2017), who emphasised the impact of multisensory approaches on the learning outcomes of students with visual impairments. They advocate for the use of all available senses to enhance perception, concept formation, and ultimately, critical thinking skills. Similarly, Renelle and Jones (2022) describe multisensory learning as the use of sensory cues including visual, verbal, tactile, kinesthetic, auditory, and olfactory stimuli to create meaningful learning experiences that support critical thinking development.

The study also revealed that tutors utilise individualised learning to nurture critical thinking among visually impaired students. This finding echoes the research by Hathaway and Eriks-Brophy (2018), who concluded that personalised instruction is crucial for fostering both critical thinking and independence in visually impaired learners. Moreover, the findings showed that tutors promote independent problem-solving skills as a strategy to enhance critical thinking. This is consistent with Pratama, Saputro, and Riyad (2018), who emphasised that 21st century education requires students to engage in problem-solving to build analytical and reflective thinking capacities. In subjects such as mathematics, the problem-solving process comprising understanding the problem, devising a plan, executing the plan, and reflecting on the solution provides visually impaired students with structured opportunities to develop critical thinking skills. Also, the findings of the study indicated

that tutors deployed instructional methods and they create teaching and learning materials to enhance critical thinking skills among students with visual impairments at higher-learning institutions. This is consistent with the findings of Hill (2024), who confirmed that both tutors and students benefit from instructional methods and educational resources that support the development of critical thinking in students with visual impairments. These resources include screen readers, braille, magnification devices, and various accessibility tools such as voice recognition, audio descriptions, colour and font customisation, and intuitive interfaces (Hill, 2024).

Based on the study findings, it is recommended that higher-learning institutions offer professional development workshops to equip tutors with inclusive teaching strategies and a deeper understanding of the needs of visually impaired students. These workshops should cover the use of assistive technologies and methods for fostering critical thinking. Tutors should also create opportunities for visually impaired students to collaborate with sighted peers through group discussions and projects, promoting diverse perspectives and critical engagement. Additionally, institutions should encourage the use of varied assessment formats such as oral presentations and project-based tasks to allow students to demonstrate their critical thinking skills. Finally, universities should support ongoing research into effective strategies for enhancing critical thinking in visually impaired learners and provide hands-on training sessions involving assistive technologies and adaptive teaching practices.

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Challenges of teaching and learning space dynamics in ever-changing climatic conditions in Secondary schools in Tanzania

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Abstract
The teaching and learning of space dynamics, which basically addresses dynamic content such as weather and climate, presents significant challenges to teachers due to its complexity and ever-changing nature. This study examines the practical experiences of teachers in navigating these challenges within the context of Tanzania. The study employed a mixed-methods research approach, and an embedded mixed research design. To collect data, the study used documentary reviews, semi-structured interviews, and open-ended questionnaires. A sample of 20 geography teachers from seven selected schools in the Dodoma Region participated in the study. The findings reveal that teachers face major constraints such as insufficient teaching resources and inadequate professional training. Moreover, the complexity of the space dynamics and teachers' incompetence impeded the development and assessment of the intended competencies. The study further indicates that teachers and students focus on success in the national examination, at the expenses of practical application of knowledge in real-world contexts. The study concludes that without appropriate interventions, the ability of both students and teachers to effectively contribute to mitigating the adverse impacts of climate change will remain unfulfilled. To enhance the teaching and learning of space dynamics in secondary schools, it is recommended that the government should increase funding for teachers' professional development programs; and provide facilities including digital technologies to support the design and adaptation of teaching materials.

Keywords: *Climate change, space dynamics, competence, teaching and learning*

INTRODUCTION AND BACKGROUND OF THE STUDY

Weather and climate change have a significant effect on both flora and fauna. These include reduced food production, negative impacts on human health, inadequate pasture, and water shortages (Tanzania Meteorological Authority, 2024; United Nations, 2016). The study of space dynamics introduces learners to key competencies related to weather and climate, intending to foster their ability to actively engage in mitigating the negative consequences of climate change on the environment (Ministry of Education and Vocational Training, 2010). In Tanzania, students are expected to develop an understanding of the interrelationship between topography, climate, and natural vegetation (Ministry of Education, Science and Technology, 2023b). Amwata, Tumbo, Mungai, and Radeny (2020) reported that there is a need to create awareness to local farmers on climate and its impact on agriculture and food security. This underscores Tanzania's readiness to prioritize the development of climate change mitigation and adaptive capacity to ensure sustainable development.

Climate change is one of the greatest challenges today that threaten many countries' ability to achieve sustainable development. It causes rise in temperature, sea levels, and ocean acidification, thus endangering the life of living things especially in coastal and low-lying regions (United Nations, 2016). The 2015 United Nations Climate Change Conference (Paris Agreement) emphasized education as a fundamental instrument in advancing global efforts to address climate change (United Nations, 2015). The Sustainable Development Goals (SDGs) for 2025–2030 highlight the pivotal role of education in enhancing public awareness and strengthening institutional capacity for impact reduction, mitigation, adaptation, and early warning systems related to weather and climate change. The global agenda for SDG4-Education aims to eradicate poverty and hunger, safeguard the planet from degradation, and ensure that everyone appreciates a prosperous and fulfilling lives by 2030 (United Nations Educational Scientific and Cultural Organization, 2017).

Tanzania like other African countries, its economy relies on climatic-dependent agriculture, which is more vulnerable to the undesirable impact of weather and climate change (Amwata et al., 2020). Tanzania has recorded an increase in drought and floods causing the destruction of the environment, death of people and animals, thus leading to reduction of agricultural production, food insecurity, malnutrition, and poverty

(Tanzania Meteorological Authority, 2024). Amwata et al. (2020) reported that, most Tanzanians have relatively low weather and climate change resilience and adaptive capabilities. This indicates that education has not been fully tapped to build people's capacity to sustain and mitigate climate change in Tanzania. The introduction of space dynamic topic in Secondary school curriculum is an avenue to develop competences in young people and motivate them to participate actively in the activities that can reduce the adverse impact of climate change on environment.

The Tanzania Meteorological Authority (TMA) predicted that Tanzania will continue to experience adverse impact of climate change on environment (Tanzania Meteorological Authority, 2022). The TMA (2024) reported that heavy rainfall accompanied with widespread floods caused destruction of infrastructure, population displacement, loss of lives, and properties. For instance, the recent tragic mudslide in Hanang-Manyara caused death of 89 people, 139 injuries, and 5600 displacements of people, destruction of 724 houses and 496 acres of farms This is the realization of the TMA (2022) prediction that the adverse impact of climate change in Tanzania and other East African countries may increase in the future. This indicates that peoples' capacity and readiness to participate actively in reducing the adverse impact of weather and climate change is insufficient Thus, teachers in school are required to take part in the action by developing students' knowledge, skills, and abilities to actively mitigate and adapt to climate change.

Climate change education has been a contagious matter worldwide (Amwata et al., 2020; Apollo & Mbah, 2021; Henderson, Long, Berger, Russell, & Drewes, 2017; Kumar, Kumar, Tokas, Lal, & Singal, 2018; Liebhaber, Ramjan, Frick, Mannion, & Keller, 2023; Ochieng & Koske, 2013; Zhao, Pan, Ma, Raza, & Zhou, 2023). The study by Apollo and Mbah (2020) conducted a critical review on the challenges and opportunities of climate change education in East Africa. Zhao, Pan, Ma, Raza, and Zhou, (2023) concentrated on the impact of digital education on tertiary climate change education in China, (Liebhaber et al (2023) concentrated on the developing climate-friendly transformative approach to climate education in Autrian and Germany schools, while that of Ochieng and Koske, (2013 concentrated on the level of students' awareness on climate change in Kenya primary schools. However, there is limited research on the area of teaching and learning space dynamics

i.e. weather and climate in Tanzanian secondary classroom context. This study intended to investigate the practical challenges of teaching and learning of space dynamics in ever-changing climatic conditions in secondary schools in Tanzania. Particularly, it aims to respond to the key research question: What are the challenges associated with teaching and learning strategies, resources and the realization of the intended space dynamic competence in Tanzanian secondary schools?

Constructivism alignment theory can be used to ensure that learners develop the intended competences. Constructivism is an epistemological view which believes that knowledge is developed when the learners are at the heart of the learning process (Ali, 2018). It stands on the belief that efforts should be taken to align learning outcome with the teaching and learning activities, resources and assessment (Loughlin, Lygo-baker, Lindberg-sand, & Loughlin, 2021). Constructivism alignment theory allows learners to engage in individual and group tasks. Since the learning is aligned to a specific learning outcome, teachers and learners are guided to precisely concentrate on learning activities and assessment that can effectively attain the intended learning outcome (Brabrand, 2007). In this sense, the relationship between the teacher and the learner is that of a teacher as a facilitator and the learners an active participant of the teaching and learning process (Zhang, Su, Zeng, & Lam, 2022).

However, studies such as Liu et al,2015 claim that teaching and learning about weather and climate change is constrained by misconceptions from both teachers and learners especially around the areas of the greenhouse effect and ozone layer comprehensively influence atmospheric phenomena. In the same light, research documents corroborate the absence of mitigation strategies, alongside persistent understanding gaps which exist amongst students and teachers with regard to the causes of climate change. (Apollo & Mbah, 2021; Ochieng & Koske, 2013; Silvestri et al., 2012). Additionally, Henderson et al. (2017) reported the presence of knowledge gap among teachers that is associated with a lack of adequate content knowledge. This calls for the need to clearly understand challenges and recommend measures to effectively teaching and learning of space dynamics (weather climate education) in schools.

METHODOLOGY

This study employed a mixed methods research approach to data collection, in which the qualitative approach served as the dominant

method. The study employed an embedded mixed-methods research design, in which quantitative data were incorporated within a predominantly qualitative data to enhance the depth of analysis. Cohen, Manion, and Morrison (2018) suggest that an embedded mixed-methods design allows for the integration of quantitative data into a predominantly qualitative study, thereby giving supplementary insights and a more comprehensive data. Using a mixed methods research approach intended to help offset the weaknesses of one approach and provide a wider picture of the challenges of climate change. It was important therefore to ensure that both quantitative and qualitative data are collected simultaneously and incorporated during presentation and discussion to effectively communicate the findings. The study was conducted in Dodoma Region. Mpwapwa District Council and Dodoma City Council were the study areas. Dodoma City and Mpwapwa Council were purposively selected to be involved in the study to capture the experiences of both urban and rural respectively. The study involved 20 geography teachers who were purposely selected considering their experiences in learning and teaching of space dynamics in all high schools. The sample for the study is indicated in Table 1.

Table 1
Summary of study location, sample and sample size

Region	District	Institution	Participants	Sample size		Total
				Males	Females	
Dodoma	Dodoma District	School 01	Geography teachers	2	1	3
		School 02	Geography teachers	2	0	2
		School 03	Geography teachers	2	0	2
	Mpwapwa district	School 01	Geography teachers	3	2	5
		School 02	Geography teachers	1	2	3
		School 03	Geography teachers	2	0	2
		School 04	Geography teachers	3	0	3
Total				15	5	20

Data collection was conducted through documentary review, interviews, and questionnaires. The study reviewed Geography textbook, syllabus, schemes of work, and lesson plans to assess the alignment of concepts,

objectives, competencies, as well as teaching and learning resources used. Semi-structured interviews were employed to facilitate discussion and clarification, thus allowing for an in-depth exploration of the challenges faced by teachers. This study involved a review of the syllabus to identify the intended competences, objectives, the proposed teaching and learning strategies and resources. Again, a review of geography text book intended to check its alignment with the syllabus while the review of schemes of work and lesson plans intended to check the alignment of competences, objectives and teaching and learning strategies and resources used. Open-ended questionnaires were employed to collect data on the general and specific space dynamic challenges to obtain a comprehensive data and triangulate the findings. An average mean score and some specific item means scores were used to interpret the findings.

To ensure the reliability of the questionnaire, Cronbach's Alpha was calculated to ensure correlation of questionnaire items. The correlation analysis test indicate that an overall alpha maximum value was α=0.914 and a minimum of 0.67 suggesting that the scale used range from highly reliable (strong) to moderate (reasonable) suggesting that they all measured related constructs (See Appendix 1). The study employed a thematic analysis method for qualitative data. The process, involved data transcription from verbatim to text, translating from Swahili to English, studying, segmenting. grouping, and re-reading to create themes and meaningful logical information from the qualitative data (Byrne, 2022). Responses from interviews were coded and analyzed using Microsoft Excel. The Quantitative data were analyzed using figures and tables indicating the percentile (qualitative data) or mean and standard deviation using SPSS version 27. The research ethics committee of the University of Dodoma issued ethical clearance and research permits. The informed consent was obtained from all the participants. In respect of confidentiality and academic honesty, the participants' identities were concealed and instead, code numbers were used. Besides, paraphrasing, and citation were used to avoid plagiarism.

FINDINGS

Perceived general challenges of teaching space dynamics

The analysis indicates that teachers perceived the complexity of the topic (28.79%) and the lack of sufficient teaching and learning resources (21.21%) as the key challenges to effectively teach space dynamics

competencies. According to some teachers, the complexity of the topic is associated with the presence of abstract concepts, such as pressure, which cannot be directly observed or physically manipulated. Additionally, some teachers claimed that students had negative attitude towards learning of space dynamics. They believed that space dynamic was difficult to learn thus making it difficult for them to actively participate in the learning process. Generally, teachers perceived that lack of teaching and learning resources especially weather measuring equipment was impeding teaching and learning of space dynamics. Reflecting on the general challenges on teaching the topic, some teachers stated:

> It is difficult to explain some concepts that are not seen by learners. For instance, the arrangement of air masses, pressure differences.... When you tell them that a given area has high pressure, they don't understand what it is because they cannot see it (TD01-01, 2024).

The other teacher also had these to say on the association between field and teaching of abstract constructs:

> We teach the topic without going to the field. We do not have weather measuring devices to teach the topic practically. The weather measuring devices are expensive and the school has no enough fund to buy the devices. We are forced to take students to a weather station to teach practically. Still the school administration will not give you money… Sometimes, I tried to convince students to contribute but at the end, only few contributed. (TD04-02, 2024).

Also, another teacher gave one's views on the negative perception of students regarding the difficultness of the topics:

> Some students have negative perception of learning the topics. Some concepts are abstract and terminologies used are difficult to students. Even some teachers believe that space dynamics is difficult to teach. The negative perception is communicated from teachers to learners and from learners to learners. Form six students have been telling form five students that space dynamic and surveying are difficult topics (TD01-05, 2024).

The quotations based on what teachers said indicate that the teaching and learning of space dynamics is constrained by complexity of the topic and insufficient teaching and learning resources. For example, nearly 29 percent of the interviewed teachers said that the foundational knowledge necessary for teaching the topic was a key challenge in teaching space dynamics. Teachers associated the difficultness of the topic with its being rooted in poor educational background to the topic during their high school education. The findings further reveal that more than 21 percent of

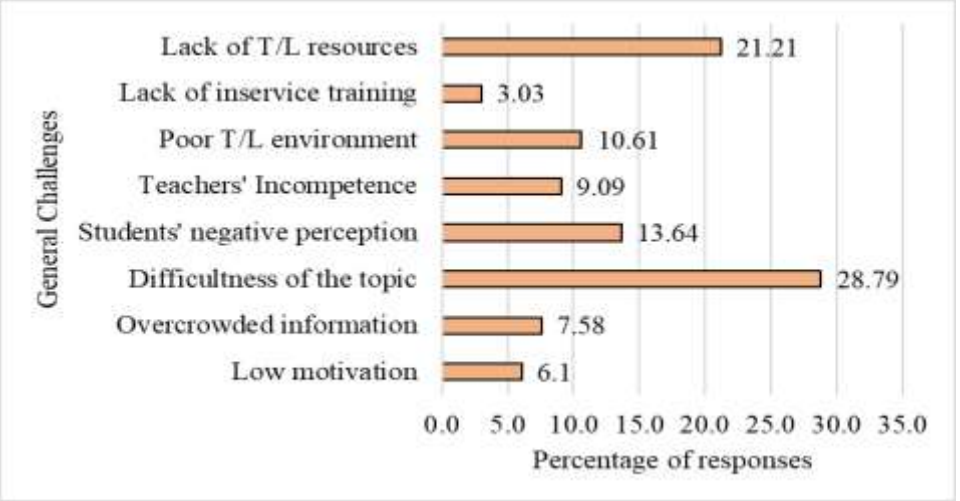
the teachers' responses admitted that insufficient teaching and learning resources was hindering students from accessing hands-on and collaborative learning opportunities that were crucial in the learning process as proposed by the constructivism learning theories. It should be noted that the presence of negative attitude towards learning space dynamic increases the complexity of teaching space dynamics in secondary schools. These limitations underscore the need for an in-service training program for geography teachers. Such professional development initiatives would serve to enhance both their subject-matter expertise and pedagogical capabilities, thus increased motivation to teach the topic. Again, it underlines the need for teachers to collaborate with other stakeholders to develop intervention to improve the pedagogical aspect.

Furthermore, while interview responses reflect a relatively low percentile rate (3.03%) regarding a lack of in-service training as a challenge hindering the teaching and learning of space dynamics, the questionnaire results present a noticeably higher mean score (4.80), hence strongly suggesting that inadequate in-service training is a significant obstacle. This discrepancy may reflect inconsistencies in teachers' responses, lack of confidence, or a lack of self-reflection regarding their teaching practices. Nevertheless, the interview findings indicate that some geography teachers were in eager need of training to improve their knowledge and skills in teaching space dynamics. The findings from teachers highlights the absence of in-service training for geography teachers, which is critical for the effective implementation of a competence-based curriculum. Additionally, there appears to be a perception that geography teachers are marginalized in the allocation of in-service training opportunities. This perceived inequity may contribute to a decline in teachers' motivation to teach the subject. Such disparities reflect unequal and insufficient provision of professional development for secondary school teachers. Emphasizing on this, one of the teachers was noted as saying:

> I have never participated in any seminar…. In our school, we just observe science teachers going to participate in seminars and workshops but we as geography teachers, we have never had that opportunity… But we are still waiting for the Government to remember us (TM02-02, 2024).

Figure 1. Presents the findings from the interviews on the general challenges of teaching space dynamics in secondary schools in Tanzania.

Figure 1
General Challenges of Teaching and Learning Space Dynamics



The findings indicate an average mean score of 4.05, suggesting that teachers generally agree to strongly agree with the identified challenges as presented in Table 2. These results underscore the complexity associated with teaching space dynamics in secondary schools in Tanzania. Specifically, questionnaire findings indicate that teachers agreed M=4.00 that they were constrained by lack of knowledge of some concepts (incompetence) and insufficient teaching and learning resources M=4.65 as they were teaching space dynamics. These challenges may undermine teachers' motivation and confidence both of which are critical for effective instruction. Additionally, the findings suggest that teachers perceived that the curriculum was overcrowded, which might hinder the successful implementation of the intended competencies. These questionnaire results support the interview findings that recognize incompetence and insufficient resources as among the challenges of teaching space dynamics. Table 2 presents the analysis of questionnaire items examining the challenges faced by teachers when planning and delivering teaching space dynamics within the context of ever-changing climatic conditions.

Table 2: General Challenges of Teaching Space Dynamics

Questionnaire items	**Mean**	**SD**
Lack of teaching and learning materials for teaching climate change	3.80	1.01
Lack of clear knowledge of some concepts in space dynamics	4.00	0.56
Overloaded space dynamic content	4.20	0.95
Mismatch between the syllabus and text book	3.90	1.07
Assessing beyond the syllabus in the final examination	3.10	1.41
Insufficient time to effect students' competence	3.85	1.04
Lack of past and current data on climate	3.85	1.09
Poor background of space dynamics topic	3.90	0.97
Lack of teachers' in-service training	4.80	0.41
Lack of some of the instruments used to measure weather elements	4.65	0.75

Key: 1=Strongly disagree 2=Disagree 3= Undecided 4= Agree 5= Strongly agree

Source: field data (2024)

Challenges Associated with Teaching and Learning Strategies

The results from the analysis show that 59.09 percent of the teachers' responses disclosed insufficient facilities as the major challenge associated with space dynamics teaching and learning strategies (figure 2). In the details of their description, they pointed out that insufficient facilities included lack of fund, lack of weather measuring instruments, and other teaching materials. It should be noted that space dynamics need students to engage in activities such as observing, measuring and recording weather parameters. As such, lack of weather measuring instruments, was found to impede teachers' and students' intention to engage in practical activities. This reflects the broader gap in providing practical and interactive learning activities in the school context due to lack of facilities, interest and time. Reflecting on this challenge, one of the teachers said:

> The challenge is on providing practical activities such as measuring and recording weather elements because of lack of the instruments used to measure weather elements. We can borrow from the science laboratory some equipment such as the thermometer and barometer, but other instruments are not found. It is better for the government to buy these instruments to enable us to teach practically (TM01-04, 2024).

On the other hand, another teacher commented on the challenge associated with the content coverage of the topic:

> The content is very wide so, some activities are difficult to provide. For instance, interactive teaching and learning activities take time compared to lectures. A-level students prefer the use of lecture method to participatory methods because it helps to cover the content quickly. Students like to cover the content so as to pass the examination (TM04-03, 2024).

Furthermore, regarding the use of participatory methods, another teacher added that:

> Participatory methods such as discussion are effective in teaching and learning space dynamics. But, if you give them an assignment to discuss and present, they claim that it is difficult to find the materials. This is because some of the information is not included in the text book. We encourage students to buy some pamphlets so as to be able to use participatory methods (TD01-02, 2024).

The findings further emphasize the challenges teachers were facing in implementing practical and interactive teaching methods. Some teachers were avoiding interactive teaching methods because of the overcrowded curriculum that was making it difficult to cover all topics using collaborative learning activities. This reflects a tension experienced in trying to cover the content to enable learners pass examination over practical implementation of knowledge and skills gained. This suggests that teachers were opting to use lectures to complete the syllabus rather than using interactive methods that were more effective for learners to develop a deeper understanding. The reason for not choosing interactive method was that, the method itself required more time to accomplish the teaching. In contexts where student performance is prioritized, teachers may be inclined to adopt instructional strategies that allow them to cover the curriculum quickly, potentially at the expense of competency-based learning.

In addition, the analysis of teachers' explanations revealed that schools lacked sufficient funding to support teachers in implementing various teaching and learning activities. For instance, many teachers expressed a desire to organize study tours to weather stations to provide students with hands-on opportunities to observe and record weather parameters. However, financial constraints prevented them from going to weather station where it could have facilitated such an actual experiential learning activity. Reflecting on a challenge in organizing study tours, one of the teachers, stated that:

> It is difficult to organize a study tour to a weather station because of the distance. The school does not have enough funds to meet expenses of

> such tours. I tried to convince students to contribute money but only few of them managed to do so. However, it is difficult to go with five students. The syllabus suggests students to do some activities such as observing and recording weather elements. However, these activities require students to use weather measuring equipment that are not available in our school. (TM01-05, 2024).

Similarly, another teacher added that:

> There is a challenge in organizing a study tour because students do not have money and the school does not have any fund. Therefore, is a need to have a study tour to a weather station but organizing such a tour is difficult. Apart from lack of funds, there are lots of procedures to follow in getting permission to take students to a study tour. (TD01-02, 2024).

These findings indicate that schools were not supporting teachers in organizing the study tours to weather stations which would provide students with an opportunity for experiential learning. It was noted that teachers recognized the value of study tours in enhancing students' understanding of weather parameters as they would provide real-life experience. However, the use of this method has been hindered by financial constraints. As the findings revealed, some teachers were attempting to overcome the challenge by asking students to contribute money to make it possible to travel to the weather stations but many students could not afford. These findings suggest that the problem was not teachers but it was schools' lack of funding ability to support teachers in the process of attaining the intended curriculum goals and students' desires. This finding underscores the importance of the government to increase institutional funding either by own sources or by collaborating with other agencies to support funding for practical learning experiences.

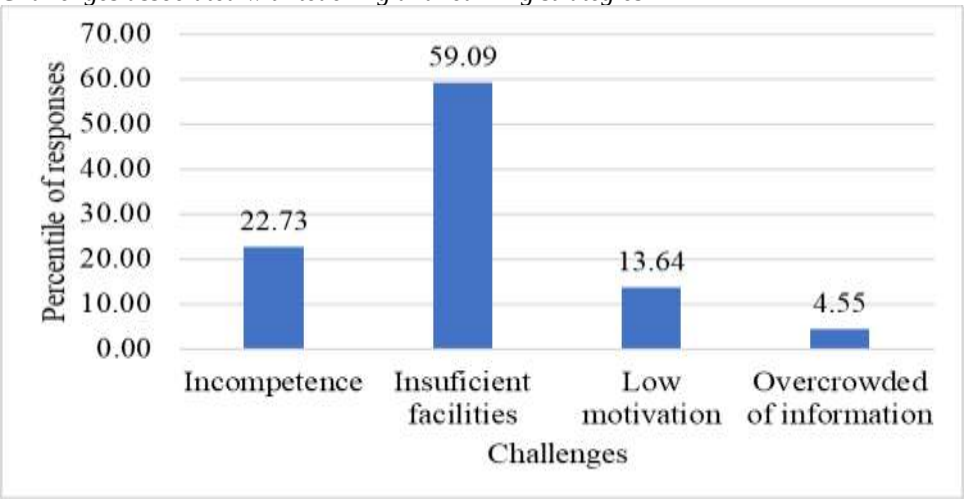
Besides, the findings based on syllabus analysis indicate that the use of teaching and learning strategies such as; watching video clips dynamics, organizing study tour and measuring weather parameters, designing weather measuring instruments using locally available materials were proposed. The findings based on the analysis of documentary review and interview indicate that very few teachers were using these activities. Again, the analysis of schemes of work and lesson plans indicate that teachers did not plan to implement practical activities in their lesson plans. This finding was also noted through the interview where teachers admitted that they were unable to provide practical activities due to lack

of resources. Emphasizing on this, one of the teachers was noted as saying:

> Lack of equipment is a challenge. In teaching, the teacher needs to use teaching aid so that the topic is understood. However, the challenge is lack of equipment. For example, you need measuring devices so as to teach well weather observation and recording. The problem is that many schools do not have the devices. So, the teachers teach more theoretically or superficially (TM02-03, 2024).

Furthermore, the results indicate that low motivation of both teachers and learners is among the challenges of implementing some of the space dynamics' teaching and learning activities. Low motivation was attributed to incompetence on the part of the teachers and negative attitude on the part of learners. It should be borne in mind that students' motivation plays a crucial role for the effectiveness and efficiency of teaching and learning activities in schools On this regard, Natiqi, (2024). proposed that students' motivation plays a crucial role for the effectiveness and efficiency of teaching and learning activities in schools. This reflects ineffective implementation of teaching and learning activities in one hand and on the other, a gap between the intended knowledge, skills and competence in the syllabus and classroom implementation. Figure 2 presents detailed explanations of the interview findings on the challenges facing teachers in executing teaching and learning strategies as they were teaching space dynamics.

Figure 2
Challenges associated with teaching and learning strategies



Challenges associated with teaching and learning resources

Figure 3. presents the challenges faced by teachers regarding space dynamics teaching and learning resources. The results from the analysis show that 53.13 percent of the responses from interviews indicate that lack of weather measuring equipment was a major challenge associated with space dynamics teaching and learning of resources. Other teaching materials that were insufficient included the globe, and world the map. In response to this, teachers had these to say:

> Lack of equipment is a challenge. In teaching, the teacher needs to use teaching aids so that the topic is understood. Now the challenge is the availability of equipment. For example, you need measuring devices so as to teach well. The problem is that many schools do not have the devices, so the teachers teach more theoretical than practical (TM01-02, 2024).

Additionally, another teacher added that:

> The challenge is that teachers do not improvise the devices using the locally available materials. It is difficult to improvise devices such as anemometer, Hygrometer, and barometer. We need to use real devices so that students can read and record weather elements. We expect the school to buy or the government to bring those devices, but they are so expensive. (TM04-02, 2024).

This implies that teachers are not provided with the important resources to effectively teach space dynamics. Additionally, the findings indicate that teachers were not making efforts to find an alternative way to get the required resources. Thus, there is a need to capacitate and facilitate teachers for effective teaching and learning activities that will enable learners to actively participate in the activities that reduce the adverse impact of climate change on the environment. Besides, the teachers were not appreciating the role of improvisation in filling the gap created by insufficient teaching and learning resources. If teachers are not motivated to improvise materials and the school do have the funding ability to buy enough and relevant resources, then students will continue learning without supportive resources. In this context, students may struggle to grasp space dynamics concepts. This gap can lead to a lack of active students' engagement and eventually hinder their overall learning.

Again, the teachers pinpointed that lack of quality reference materials was another challenge associated with space dynamics teaching and learning resources. References such as textbooks and supplementary books were reported to be insufficient. In addition, the references were found to use

difficult language, while missing some concepts. Furthermore, the findings from interviews indicate that schools lacked enough reference materials. This was found to make it difficult for teachers to facilitate learning through giving assignments in order to cover the content as proposed in the syllabus. This was one of the challenges that were restricting students' independent study and classroom learning as well. Reflecting on the challenge of reference materials, one of the teachers had these to say:

> One of the challenges of teaching space dynamics is lack of enough teaching and learning materials. Sometimes you want to give them a task or assignment but they cannot accomplish it because they don't have reference materials. Sometimes there is lack of some concepts in the text book and supplementary materials (TD01-01, 2024).

Additionally, another teacher added:

> Sometimes the text books and supplementary materials lack some concepts and information. Books do not include weather and climatic data. It is difficult to find data on the climate change since 1850s as indicated in the syllabus. We lack books that are straight forward and sometimes the language used in the books is difficult to students (TM02-02, 2024).

The study findings indicate that most schools in Tanzania do not have adequate teaching and learning resources like digital materials and weather measuring instruments. As far as teachers were concerned, they claimed that the absence of activities for teaching either concretely or collaboratively made virtually all hands-on resourceful teaching impossible. Moreover, inadequate technological equipment emerged from the analyzed responses. During the interviews about teaching and learning resources, respondents reported the absence of the internet, video clips, and projectors as critical resources. It therefore follows that the relative effectiveness of teaching and learning of space dynamics is undermined by the absence of adequate teaching and learning resources, as illustrated in figure 3. Moreover, the analysis of the files of lesson plans devoid of the documents showed that there was inadequate provision of resources to be used for teaching and learning.

In addition, the teachers believed that lack of technological devices and services was another challenge in teaching space dynamics. Digital devices such as projectors, computers, and internet service, were a challenge facing the implementation of space dynamics competences.

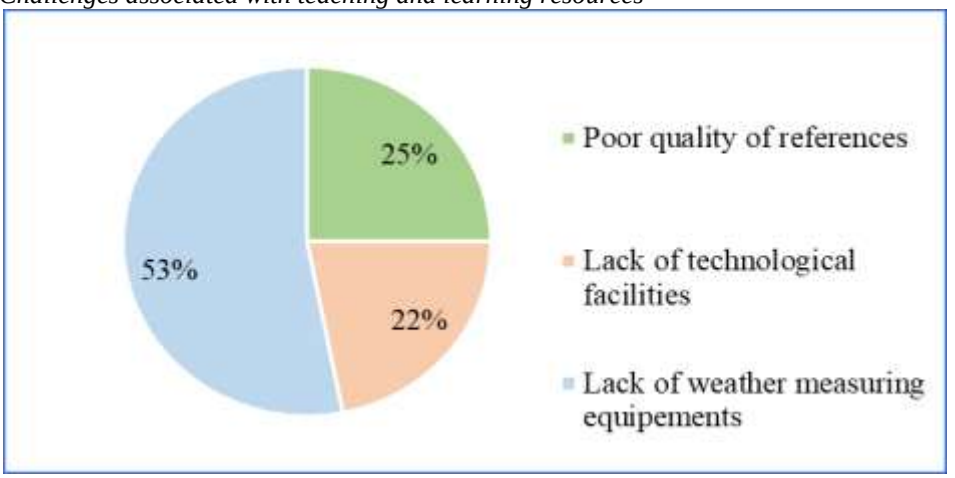
Due to lack of enough and quality reference materials, the remaining option was the use of internet source. If digital tools and internet services were unavailable, then the problem would become worse. In connection to this, one of the teachers had these to say:

> We lack assistive technology for teaching as well as videos that can be used as learning aids. We don't have computer, projector and even internet service. You have to buy you own bundle or else you cannot access the internet sources… Bad enough, most of the relevant online books are sold in dollars. (TM02-02, 2024).

On the same matter, another teacher added:

> We lack of projector which otherwise we would use it as an ICT in teaching of space dynamics. Materials worthy of printing found in the internet can help but the academic master cannot allow you to print the materials every day. There is a problem of depth of information in some concepts or sub topics, therefore, it is important to find some information from the internet (TM04-01, 2024).

Figure 3
Challenges associated with teaching and learning resources



Again, the findings presented in Table 3 show the results of the alignment between the syllabus and textbook. It indicates a minor mismatch between the syllabus and the textbook. For instance, the formulae of how to calculate humidity coefficient, weather data and illustrations on how to plot graphs and/or map, and description of variation of climate since 1850, were not covered in the textbook as indicated in the syllabus. This indicates that teachers had to make efforts to find materials from other

sources such as supplementary books, online books, and other sources. See Table 3:

Table 3
Analysis of the objectives in the A-level Syllabus and content in the text book

Objectives covered in the text book	Objectives uncovered in the text book
By the end of the topic the student should be able to: Distinguish between weather and climate Analyze the major elements of weather Account for instability in the atmosphere Analyze vertical structure of atmosphere Measure weather elements Read record and analyze weather data Differentiate heat from temperature Explain weather forecasting & its importance Define climate change Explain the majour causes of climate change. Describe the impact of climate change Describe the major types of climates Explain climatology and describe the typical characteristics of climatic regions of the world	Calculate humidity coefficient Use weather data to plot graphs and map Describe fluctuation of climatic conditions since 1850 Debate on sustaining and reducing its impact climate change

Table 4 presents teachers' responses from questionnaire on the challenges associated with space dynamics teaching and learning resources. The results recorded an average mean of 2.79 that indicate that generally, teachers were less satisfied with the availability of teaching and learning resources in their schools\. The results indicate that teachers' responses were between neither satisfied nor very dissatisfied. This indicates that teachers needed some improvement in teaching and learning resources available in schools. Specifically, teachers were very dissatisfied with the availability of weather-measuring equipment. Based on the findings generated from questionnaires and interview, this was reported to be the major challenge of teaching and learning resources. as.

Table 4
Teachers' Satisfaction with the Availability of Teaching and Learning Resources

S/N	Questionnaire items	*Mean*	*SD*
1	Availability of equipment used to measure weather elements	1.65	0.75
2	Availability of good textbooks	3.75	0.85
3	Availability of enough supplementary books	3.00	1.03
4	Availability of electronic/digital sources	2.50	1.24
5	Availability of other teaching and learning materials	3.05	1.05

Challenges associated with realization of the intended space dynamics competence

The findings based on the syllabus analysis indicate that generally, the syllabus intends learners to develop competence as they learn space dynamics in schools. The analysis indicates that the syllabus expects students to engage actively in activities which reduce the impact of the adverse effects of weather and climate on environment. This is geared to develop ability among learners to adjust to ever-changing climatic condition for sustainable development. The syllabus adheres to the international agenda indicated in the sustainable development goals (SDGs) Goal number thirteen (13) 2025-2030 which *inter alia,* intends to improve education, create awareness-raising, and peoples' capacity to adapt and reduce the impact of climate change (United Nations, 2016).

Notwithstanding, some teachers were unable to distinguish between competence and objectives. For example, teacher TD03-01 (2024) had written "Students should be able to describe natural and human impacts on weather and climate" as a competence. This indicates that the teacher was unable to distinguish between competence and objective or break down the competence into attainable competences in each specific lesson. A syllabus is just a flexible guide for teachers that prescribes the topic and concepts expected to be implemented in the classroom (Parkes, Harris, Parkes, & Harris, 2010).

On the other hand, the analysis shows that some of teachers' scheme of work and lesson plan were missing space dynamics competences as indicated in Table 5. The analysis of schemes of work and lesson plans indicates that teachers (44%) did not consider competence in their scheme of work and lesson plans. For the case of lesson plans, 'not observed' indicates that the teachers did not consider competence in any of their lesson plans. However, it should be noted that some teachers indicated competence but in relatively few lessons. This indicates that competence was not being prioritized when teachers were preparing their lessons. This finding underscores a gap between implementing the intended curriculum and the actual implementation of the same. This indicates that teachers were choosing and planning to implement the objectives that they could teach comfortably while leaving aside those which they were not comfortable to teach.

Table 5
Teachers' consideration of space dynamics competences in their preparations

Teachers' code	Scheme of work	Lesson Plan
TD01-01	Not observed	Observed
TD01-02	Not observed	Observed
TD01-03	Observed	Not observed
TD02-01	Observed	Observed
TD03-01	Observed	Observed
TM01-01	Not observed	Not observed
TM02-01	Observed	Observed
TM03-01	Not observed	Not observed
TM04-01	Observed	Observed

The results based on interview also noted that teachers were unable or uninterested on the development of competences. For example, the quotation from teacher TD01-02, 2024, indicates that teachers were focusing much on developing learners' ability to answer the examination questions at the expense of developing the intended learning competence in space dynamics. The teacher claimed that questions focusing on competence seemed to be difficult to learners. Besides, the teacher ascertained that learner were not interested in developing the competence because they could opt not to answer space dynamic question. This clearly indicates that learners were not interested in competence development rather examination performance. Emphasizing on this challenge, one of the teachers said:

> When you ask students questions that focus on competence, it becomes very difficult for them…Students concentrate more on their ability to answer examination. Because space dynamics question is optional in national examination, students can opt to answer questions from other topics that are not competence-based (TD01-02, 2024).

On the same line of argument another teacher added:

> Due to time and interest of our students, we are forced to concentrate on helping learners to answer national examinations… We focus much on questions that will appear in the national examinations. Another challenge is that, when you ask students questions that focus on competence, it becomes very difficult for them to attempt them (TD01-02, 2024).

Again, the findings presented in Table 6 show the questionnaire's results on teachers' ability and commitment to effect space dynamics competences. Results show that with a M=2.77 generally, teachers recorded a satisfactory to good ability in aligning the assessments,

resources and activities with the competence. The constructivism alignment theory emphasizes that teachers have to align assessments, resources and activities with the intended learning outcomes to ensure effective learning. Therefore, if the teachers could not align assessments, resources and activities to the intended learning competence, the attainment of the competence would be difficult. This clearly reflects the broader gap between the intended curriculum and the implemented one, thus calling for a closer monitoring and evaluation of teaching and learning in schools.

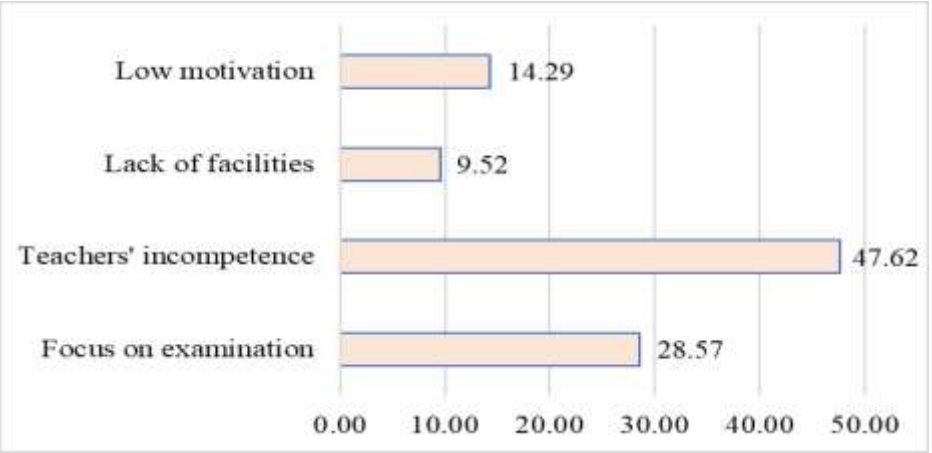
Table 6
Teachers' Ability to Effect Space Dynamics Competences

S/N	Questionnaire items	*Mean*	*SD*
1	Access to past and current data on climate change	2.64	1.28
2	Preparation of space dynamic-teaching and learning resources	3.43	1.02
3	Align teaching and learning resources with the competence	3.14	1.35
4	Align teaching and learning activities, with the competence	2.93	1.14
5	Align teaching and learning assessment with the competence	2.50	1.51
6	Mobilize learners/resources to mitigate climate change	2.64	1.08
7	Recommend teaching and learning resources for learners	2.86	1.23
8	Suggest a specific web site for learners to access	2.00	1.30

The findings show that 47.62 percent of teachers' responses indicated that teachers' incompetence was a great challenge in assessing space dynamics competences. Some of the teachers unveiled that they were unable to construct competence-based questions. However, it should be reiterated that assessing the intended learning outcomes forms an important part of teaching and learning. Assessment is an eye opener to teachers regarding the effectiveness of teaching and learning activities. The challenges in assessing competencies reflect broader gaps in teacher training and curriculum design, thus underlining the need for targeted professional development to sharpen their knowledge and skills. Figure 4. presents the findings on challenges faced by teachers in assessing the intended competences. Regarding this, one of the teachers had these to say:

> Of course, now if I have a challenge to understand some concepts, how can I know whether the students have acquired the competence or not. We need to have workshops to learn some difficult concepts and how to assess students' competence. Most teachers cannot construct competence-based questions. (TM03-01, 2024).

Figure 4
Challenges in developing, and assessing space dynamics competences



DISCUSSION OF THE FINDINGS

First, the findings indicate that complexity and insufficient knowledge and skills constrain space dynamic teaching and learning in Tanzania. These findings relate to the previous studies such as studies by Apollo, and Mbah (2021), Liu et al, (2015), and Henderson, et al, (2017) which emphasized on the complexity of climate change education due to its dynamic nature and the existing knowledge gap among both teachers and students regarding key concepts. This observation also correlates with the work of Mochizuki, and Bryan, (2015); Apollo, and Mbah, (2021) who noted that, the complex nature of climate change poses difficultness in understanding its causes, effects, and the role played by individuals in influencing or mitigating its impact. Similarly, Henderson et al. (2017) identified a knowledge gap among teachers, which may be linked to the fact that climate change was not adequately covered during their formal schooling.

Second the findings indicated that teachers and curriculum developers recognized that collaborative activities such as group discussion, and presentation has the power to effect space dynamics competences in Tanzania. This finding is in line with the findings from different studies such as Belova, Eilks, and Feierabend, (2015); Kisanga and Gabrieli, (2018); Nevenglosky, Cale, and Panesar Aguilar, (2018); who testified that collaborative activities are effective in promoting learning. Similarly, Pham (2011) supports the findings with the view that when students

collaborate with peers and teachers through reflections, they will develop multiple skills and experiences that can be applied to real life in a natural setting. Collaboration is also recommended in the geography syllabus as it gives room for imitation of different practical skills and development of learners' ability to construct knowledge as proposed in constructivism alignment learning theory (Ministry of Education, Science and Technology, 2023a). However, the results revealed that teachers opted to use lecture so that they could cover the content on time for learners to be able to answer examination questions. Thus, teaching and learning in Tanzania should not only be geared towards memorization of facts in order to pass examinations, rather; it should be geared to enable learners apply the knowledge for the benefit of the community (Msuya et al., 2014).

Third the findings indicate that scarcity of resources in teaching and learning of space dynamics in secondary schools in Tanzania is a key challenge that needs to be fixed. The current findings are in line with the report by Mupa and Chinooneka (2015), Nevenglosky et al (2018), and Tambwe, (2019) that insufficient quality teaching and learning resources is a factor leading to ineffective teaching and learning in schools. In specific, Apollo and Mbah (2021) noted that climate change education is hindered by lack of adequate resources. Again, the Tanzania Education and Training Policy 2014 as revised in 2023, acknowledges that there has been a shortage of quality teaching and learning resources that weaken teaching and learning in Tanzanian schools.(United Republic of Tanzania, 2023). The study by De Guzman, Olaguer, and Novera (2017) disclosed that the use of instructional resources is important in improving learning. The challenge of inadequate resources was noted from both interviews and questionnaire responses. It can be argued that the Government, and teachers in collaboration with other educational stakeholders must find solution to scarcity and insufficient resources if space dynamic competences are to be developed.

Insufficient resources can hinder effective implementation of the curricula. The Tanzania Education and Training Policy 2014 as revised in 2023 acknowledges that effective implementation of curricula in various levels depends on the availability of relevant teaching and learning resources although there has been a shortage of quality teaching and learning resources in various levels (URT 2023). Similarly, Nevenglosky et al (2018) pointed out that, for teachers to be efficient in implementing

curriculum, they need a variety of teaching and learning resources. According to Zhong (2019), the use of different teaching and learning resources can raise learners' interest in learning the content and eventually promote effective learning. It thus poses challenges to teachers' selection of learning resources that would appeal to different learning needs of different learners. Therefore, the availability of different teaching and learning resources can appeal to different learning styles and learning needs of different learners in the classroom.

The results indicate that inadequate teaching and learning facilities is an obstacle to the implementation of space dynamics competences (competence-based curriculum) (Tambwe, 2019). It has been argued that insufficient teaching and learning resources particularly weather measuring equipment is a stumbling block to the provision of practical activities that give an opportunity for experiential learning. Practical activities have the potential to help learners reflect on real life environment and develop ability to implement the knowledge and skills gained in the course of study (Millar, 2004). These findings correspond to that of Kisanga and Prosper (2018) which reported lack of practical activities during learning of elementary survey in Tanzania. The use of practical activities promotes experiential learning which is vital in the implementation of the philosophy of education for self-reliance (ESR) as it involves learners into concrete activities that can merge theory and practice (Ahmad, Krogh, & Gjøtterud, 2014). The need for resources not only facilitates practical engagement with the material but also enhances students' conceptual understanding through experiential learning (Tambwe, 2019). Similarly, Mertayasa, Sumarni, and Indraningsih, (2024) reported that when students engage in experiential learning, they develop motivation to learn, develop critical thinking skills while blending real-world experiences.

Fourth, teachers pointed out that inability to construct competence-based questions and poor mastery of space dynamics knowledge and skills were among the setbacks of assessing the competences during teaching and learning. Incompetence in assessing space dynamics competences reflects inadequate training on competence-based curriculum that has prevailed for decades since Tanzania shifted from content-based to competence-based paradigm in 2005. The findings support what was reported by Tambwe, (2019) that among the challenges facing teachers in implementing competence-based curriculum was incompetence. Limited

pedagogical knowledge on how to develop competences among learners is a serious constraint that can hinder learners' ability to counter balance the adverse impact posed by climate change in their lives. This finding implies the need to prepare professional development programmes and digital networking to enhance collaboration among teachers and other educational stakeholders.

Lastly, the findings indicate that focus on examination and teachers' incompetence are among the factors hindering implementation of competence-based curriculum. Some of the teachers claimed that students were interested in the preparation to pass the final examination. This concurs with the report by Lupeja and Komba (2021), who revealed that teachers and learners focused on memorization of facts to pass examination that would qualify them for further studies. Gabrieli and Elisa (2017) asserted that that teachers' inability to effect competence based curriculum has remained a challenge for decades. The findings of this study support the previous findings something that indicates that the focus on examination is still an obstacle to the implementation of competence-based curriculum. This implies that competence-based assessment is not prioritized in continuous assessments in Tanzania. These findings underscore the gap between intended and implemented curriculum. Since competence-based uncovers learners' ability to construct and apply knowledge and skills gained as proposed in constructivism alignment learning theory, efforts need to be made to ensure effective implementation of competence-based curriculum. Nevenglosky, Cale, and Panesar Aguilar, (2018) recommended that alignment between the intended and the implemented curriculum is crucial to the development skills required for learners to succeed in the higher levels of learning.

CONCLUSION AND RECOMMENDATIONS

The study concludes that if measures are not taken, the intended curriculum competence of developing ability to participate in the activities that reduce the adverse impact of climate change cannot be realized. Teaching and learning are geared to enable learners pass examinations at the expense of competences. If learners are unable to develop the intended competence, they will not be able to adjust themselves to weather and climatic changes occurring in their environment. Eventually this will impede their endeavor to ensure sustainable development. The study recommends that the Government,

and schools need to allocate enough budget to buy relevant teaching and learning materials and conduct professional development for teachers to improve their knowledge and skills in space dynamics and other complex topics. The educational administrators should consider professional development for Geography teachers that seem to be inadequate in secondary schools. This will boost their confidence and motivation to teach the topic more effectively. Again, schools should procure digital tools and internet to ensure interconnectedness and collaboration among teachers and other educational stakeholders. This will help teachers to share and gain experience in teaching the topic and other topics as well. Furthermore, teachers need to learn how to design and improvise teaching and learning resources to ensure effective teaching and learning of space dynamics in secondary schools.

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Differentiated Instruction in Teaching Mathematics: Teachers' Understanding and Barriers to Practice in Inclusive Secondary School Classrooms in Makambako Town Council

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Abstract
The study assessed the teachers' differentiated instruction (DI) practices in teaching mathematics in inclusive classes in secondary schools in Makambako Town Council. This study specifically focused on exploring the teachers' understanding and resource limitations towards the practices of DI in teaching mathematics in inclusive classrooms in secondary schools. The phenomenology study design, informed by the qualitative approach, was employed. The data for the study were collected through interviews and classroom observations. Fifteen participants, including eight teachers, four heads of schools, and three ward educational officers, were used as a sample size for the study conducted in 4 public secondary schools. The collected data were analysed thematically. Ethical clearances were obtained from the respective organs to maintain ethical issues, whereby informants filled out informed consent forms. The study findings revealed multiple DI understandings and resource limitations as among the stumbling blocks towards teachers' practices of DI in teaching mathematics in inclusive classes. Resources like the availability of mathematics teachers, materials, and time were found to be the major resource challenges towards the practices of DI in teaching mathematics. Based on the findings, the study concludes that for the successful practice of DI, efforts have to be made to address these resource challenges. Therefore, the study suggests hiring more mathematics teachers in secondary schools and providing them with guidance on implementing DI effectively. The government should provide sufficient materials for improving mathematics teaching in inclusive classes.

Keywords: *Differentiated Instruction, Inclusive Classroom, Teaching, Mathematics, Resource limitation.*

INTRODUCTION

The recognition and celebration of learning diversity is pivotal in fostering an educational environment that honours the unique strengths and needs of every learner. The increase in the student's diverse needs in the classroom is the result of the response to the human rights movement that requires all the learners to have the right to quality education regardless of their disabilities and differences (UNESCO, 2015). Inclusive education stands as a transformative approach that not only embraces diversity but also champions for equity and access within the educational settings. Inclusive education is a system of education in which all children, youths and adults are enrolled, actively participate and achieve in regular schools and other educational programmes regardless of their diverse backgrounds and abilities, without discrimination, through minimisation of barriers and maximisation of resources (URT, 2021). In the dynamic landscape of education, teaching in an inclusive classroom requires a nuanced approach that values diversity, equity, and individualised support to ensure every student has the opportunity to thrive. Differentiated instruction is among the strategies that have been indicated by various researchers that it can be used to address the diversity present in today's classrooms.

Differentiated instruction in an inclusive classroom means that a teachers is consistently and proactively creates different pathways to help all students with different needs in the class to become successful (Muhammad, 2024). In this kind of classroom, teachers do not need any more to teach basing on the media and learning methods they like, but they must adapt to the characteristics of students. According to Thakur (2014), differentiated instruction is an organised, yet flexible way of adjusting teaching and learning methods to accommodate each child's learning needs and preferences in order to achieve his or her maximum growth as a learner. This strategy provides multiple approaches to content, process, and product, is student-centred, a blend of the whole-class, group, and individual instruction.

Empirical studies have revealed that differentiated instruction has brought positive results in teaching in the inclusive classes. The study by Lindner et al. (2021) asserts that the differentiated instruction, when is used in the inclusive and even in the special school, brings positive achievement to the students. The most strategies teachers were found to be usingwere like the groupings in both the inclusive and the special

schools. Also,the study by Letzel-alt et al. (2022) provided the information that the practice of DI was very useful during the period of DI where by the teachers practised it in the form of open education/granting autonomy, which relied on students' own ability to take responsibility of their own learning although it was not effective for the students with special needs as they needed much assistance from the teacher. A study by Rosi (2024) recognises the significance of implementing the differentiated instruction (DI) strategy in an inclusive classroom setting, that it allows for customised learning experiences that can lead to the success of all students in the class as they acknowledge the consequence of integrating the differentiated instruction (DI) strategy in inclusive classroom environments as it caters for the diverse needs of all students, including those with special needs.

In Tanzania, mathematics is among the compulsory subjects in the lower secondary education With respect to its importance, the mathematics instructions in the inclusive classes require that teachers have the knowledge on the students' different needs and for being able to incorporate different approaches to teaching that will help students to have the understanding towards the subject content.

Various empirical studies have mentioned differentiated instruction to be among the successful strategies toward teaching mathematics in different levels of education. A study by Lestari et al. (2024) on the implementation of DI in teaching mathematics in elementary classes found that the students' mathematical critical thinking improved when they were being taught through the differentiated instruction more than when they were not. This study concluded that it was evident that the application of differentiated learning was quite effective in improving students' critical and creative thinking skills in the volume of rectangular prisms and cubes compared to conventional teaching methods.

Furthermore, Padmore and Ali (2024) reported that mathematics teachers agreed that differentiated instruction was important in teaching mathematics. Aguhayon et al. (2023) in their study identified the benefits of using DI in teaching mathematics as it improves students' achievements. The study concluded that differentiated instruction effectively bridges students' mathematical learning gaps, particularly when tackling integer-related issues because DI allows the teachers to tailor the instruction with the consideration of the student's different

needs in their minds. Despite its importance, teachers claim that it is not easy to attend each child's needs because the classes have a large number of students (Padmore & Ali 2024), time constraints (Lavania, & Mohamad 2021) and lack of teaching and learning resources (Onyishi and Sefotho, 2020).

In Tanzania few studies have been done on the teachers' practices of DI in teaching in secondary schools. A study by Nguvava and Meremo (2021) identified that teachers had knowledge about DI and they were implementing the strategy in teaching and learning process through the use of various methods of teaching such as group discussion, think pair and share. Despite the evidence that the differentiated instruction brings positive outcome in teaching in the inclusive classes as well as in teaching mathematics subject, the trends in mathematics performance in the selected Secondary Schools in Makambako Town Council is low. This trend has been exhibited consecutively over years (See Table 1 below).

Table 1

Trends in Mathematics Performance at Sampled Secondary Schools with Inclusive Education in Makambako TC

	Mathematics Pass rates	**Mathematics Competency Level (GPA-Grade)**	**Mathematics Performance National Wise (GPA-Grade)**	**Mathematics Pass rates**	**Mathematics Competency Level (GPA-Grade)**	**Mathematics Performance National Wise (GPA-Grade)**
School A	37%	4.34-D	3.33-D	19%	4.68-F	3.72-D
School B	25%	4.59-D	3.79-D	17%	4.74-F	3.75-D
School C	40%	4.36-D	3.57-D	11%	4.84-F	3.96-D
School D	32%	4.25-D	3.45-D	26%	4.65-F	3.83-D

Source: NECTA Form Four Examination Mathematics Results (2023 & 2024)

Based on Table 1, the findings indicate that mathematics performance in Makambako Town Council declined across all sampled secondary schools from 2023 to 2024, as revealed by this study. For example, in 2023, School C's mathematics performance rate was 40%, but in 2024, it declined to 11%. Therefore, this study was crucial to be conducted in order to assess teachers' understanding of Differentiated Instruction (DI) and to explore the resource barriers they were facing in implementing DI practices in mathematics instruction, particularly in inclusive secondary school classrooms.

Specific Objectives

i) Assess teachers' understanding of Differentiated Instruction (DI) in mathematics instruction.
ii) Explore the resource barriers faced by teachers in implementing DI practices in inclusive secondary school classrooms.

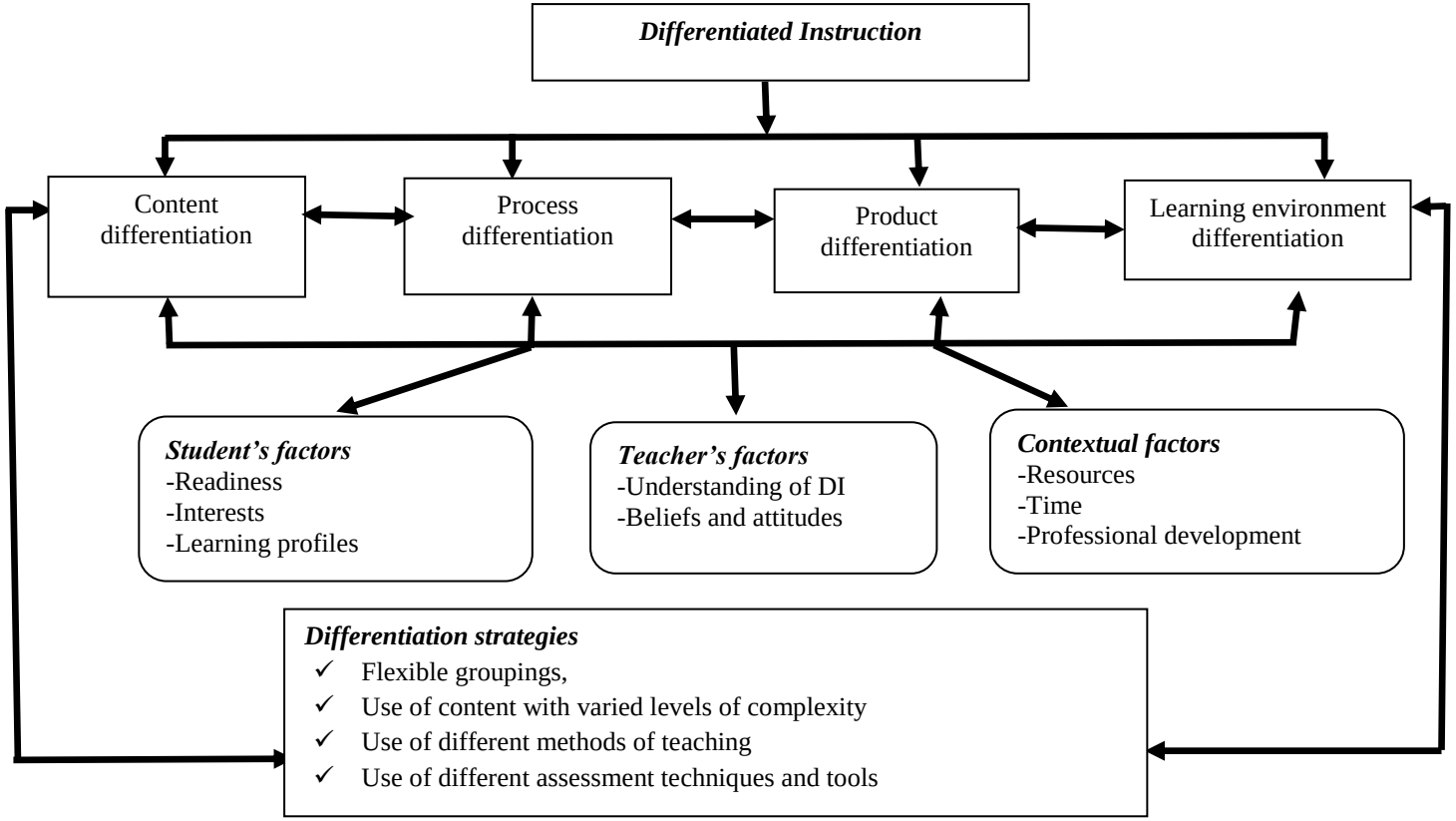
Differentiated instruction Conceptual Model

This Differentiated instruction model shows the interplay of the variables in the stated problem. Explanations of the variables are given below in Figure 1. It has been modified from Tomlinson's model (1999), and modification has been done by adding the two factors for consideration in the implementation of DI: the teachers and context factors. Only the student's interest, readiness, and learning profiles were featured in the Tomlinson model. The model highlighted in Figure 1 illustrates the key elements and their relationship in implementing DI in teaching mathematics in inclusive classes. Where differentiated instruction can be done in the four elements: the content, process, product, and learning environment. Mathematics teachers can differentiate these four elements of DI.

The baseline of differentiated instruction lies in the student's readiness, student learning profiles, and the student's interests. The student's readiness refers to the current knowledge, understanding, and skill level related to a particular learning sequence. Students' interests are what they enjoy learning about and thinking about, and doing that evokes curiosity and passion. Furthermore, learning profiles focuses on a student's preferred learning mode and how students learn best. Considering the students' readiness, interest and learning profiles, implementation of differentiated instruction depends on the teachers' understanding of the concept of DI and how to apply it in the classes. Contextual factors like

resources and time are more important factors for implementing DI in teaching mathematics. As a result of considering the necessary factors for the implementation of DI, mathematics teachers can implement DI through various strategies to differentiate each element. Such strategies are flexible groupings, the use of content with varied levels of complexity, the use of different methods of teaching, the use of different assessment techniques and tools, etc.

Figure 1:
Conceptual model for differentiated instruction adapted from Tomlinson (1999)



STUDY METHODOLOGY

This study was conducted at Makambako Town Council (TC) in the Njombe Region. Makambako TC was selected due to the fact that it has large number of schools that are already implementing the inclusive education compared to other districts in the region. Makambako TC has a total of 11 secondary schools that admit both special needs and non-special needs students. The research involved 15 participants including the mathematics teachers, head of schools and the ward educational officers were selected from 4 public secondary schools. Purposive sampling was used to select the teachers, head of schools and the ward educational officers.

Mathematics teachers are the ones who are involved in the process of teaching and learning mathematics in the classroom. Head of schools were involved in this study because they are the immediate supervisors of the teachers on the day to day activities. They understand the challenges that the teachers face in the implementation of DI. Ward education officers also possess the necessary information on the challenges that teachers face in the teaching mathematics in the classroom because they are the key immediate administrators in the school activities.

To ensure data triangulation, different methods of data collection were used to collect data from the respondents. The semi-structured interview and classroom observation were used. The semi-structured interviews were conducted with mathematics teachers, head of the schools and the ward educational officers. The participatory classroom observations were conducted during the classroom session and the teacher's lessons plans were reviewed to see the teachers' plans for implementation of the DI. The interview guide and observation checklist were used as tools to collect the data. Thematic data analysis was employed in analysing the data. Thus, the researcher familiarised herself with the data, followed by transcription and translations since interviews were conducted in both Swahili and English. Thereafter, the initial codes were generated followed by defining and naming the themes.

RESULTS AND DISCUSSIONS

This section presents the findings that were guided by two research questions which were: how do the teachers understand the concept of DI? and what are the barriers towards the practices of DI in teaching mathematics in inclusive classrooms in secondary schools?

Understanding of the DI in teaching mathematics in Inclusive classes

The study entailed the understanding of the DI and its applicability in teaching mathematics in inclusive classes. The study identified that teachers had varied understanding of the DI. Various ideas were raised by the teachers some of them being the use of different teaching methodologies, use of teaching aids during the process of teaching and other said that it was a new term to them.

DI as the use of different teaching methodologies

The findings generated from the data collected from the respondents revealed that some of the respondents had understanding of DI as the use of different teaching and learning methodologies. This means that when they were teaching while using different teaching methods; to them it was the differentiation of the instruction as they were helping students to learn through different ways. On this regard, during interview, one of the mathematics teachers had these to say:

> To me, differentiated instruction is the use of different teaching methods to teach a single lesson. It is like teaching a certain concept by starting with the question and answers method, followed by lecture method and then students' discussion and lastly presentation (Interview with Teacher 4 in school B, April, 2024).

He further added:

> The use of this strategy is beneficial to the students as the students learn from one another in different ways. So, using this approach is helpful to them as they can understand better through the different methods that are used. But we need trainings about it so that we can understand it clearly what it is and how it is used (Interview with Teacher 4 in school B April, 2024).

This was also supported by another teacher who said:

> I think that this is the use of both modern and traditional teaching methods in the process of teaching and learning. I normally teach using lecture, discussion, questions and answers. In this, I think I am providing different opportunities for the learners to understand the lesson. (Interview with Teacher 6 in school C April, 2024).

DI is the use of teaching aids during the process of teaching

Respondents also said that DI was the use of various resources in the process of teaching. This involved the use of teaching aids during the process of teaching and other resources. In connection to this, during the interview, the respondent had these to say:

> To me I think DI is teaching while using various materials like teaching aids when teaching a certain concept in the classroom. This is helpful to the students because they always understand much when I demonstrate with the teaching aids or real objects. (Interview with Teacher 7 in school D April, 2024).

This also was supported by another teacher who said

> Differentiated instruction is the provision of different instructions to help the students understand the lesson. This involves the use of different teaching aids and techniques to help the students grasp the knowledge of what is being taught (Interview with Teacher 3 in school B, April 2024).

DI is among the learner centred approaches

Some of the respondents also referred to DI tas among the learner centred approaches where by the teacher would needsto understand the students and involve them actively in the process of teaching and learning.

Making a reference to this, another teacher added It is one of the learner centred strategies that require the teacher to understand the students' understanding level and their special needs to be able to teach them all (Interview with teacher 8 school D, April, 2024).

On the same regard, another teacher said that

> DI is among the modern teaching methods or approaches that need a learner to be an active participant in the lesson. It is used in the classroom when we make student do most of the activities. Like teaching using discussion methods, letting them demonstrate I think it is differentiating instruction (Interview with teacher 5 in school C, April 2024)

Despite their positive views concerning the application of DI, the findings revealed that some teachers still lacked the knowledge of DI and its practices. The findings of this study are supported by the findings of Yetnayet (2020) who found out that teachers' knowledge on differentiated instruction was crucial for the effective implementation of DI. Knowledge of what DI is and how it can be applied in a given context is of most significance and has impact on its implementation. This means that teachers' understanding of the DI can determine how they are going to implement it during the process of teaching mathematics. Also the findings by Onyishi and Sefotho, (2020) revealed that, for effective implementation of the DI, teachers needed more information on how to differentiate the instruction without watering down the curriculum.

Barriers towards the practice of DI

Several barriers were identified during the interview and the classroom observation. This paper will shed tlight on the resource related barriers that hinder teachers from the effective practice of the DI. The respondents shared various barriers like the shortage of time, shortage of mathematics teachers, and lack of training and limited resources.

Shortage of mathematics teachers

During the interview, teachers claimed that it was hard for them to reach out to the needs of each and every student due to the large work load that was caused by the small number of mathematics teachers in the school.

Reacting on this, teacher 2 from school C said

> The major challenge is the shortage of the mathematics teachers who would meet needs of different students. This is because teachers need to have enough time to prepare for each class, but teachers here have many lessons to teach that they have to teach even despite the fact that the school has employed some part time teachers. However, despite this, we still have a big load that makes us not concentrate much on assessing the progress of each student in the class (Interview with Teacher 2 in school B, April, 2024).

Also,the WEO from ward B said:

> The schools have less numbers of teachers. This makes the teacher student ratio t be high which makes it difficult for teachers to reach out all students. For the case of one of the schools in my ward, it has only 4 teachers who are employed by the government while the number of students in ordinary level is about 1400 . Thus, I think the government should consider the students' ratio when employing teachers (Interview with WEO 2 in ward B, April, 2024)

The above finding presents that teachers have large workload that makes it difficult for them to differentiate instruction in their classes. This means that meeting the needs of students in the inclusive classroom needs enough time for teachers to design the mathematics instruction that will be easily understood by all the learners with respect to their needs. This also needs a teacher to understand their students very closely to understand their specific needs to make it easy to address them. However, the reality shows that teacherswere few and this was making them have a large number of classes under their care that automatically makes it difficult for them to attend their needs.

The teachers workload as the challenges toward the practice of DI in teaching have also been supported by Njagi (2014) who stated that teachers were claiming that the workload that they had, was giving them a hard time to implement DI in teaching. This is because, the DI requires overtime in planning to be able to support students.

Time Constraints

Through interviews, time limitation also was cited as another barrier in implementing DI in teaching mathematics in inclusive classes. . Teacher respondents claimed that it was difficult for them to consider each and every student's needs in the class when teaching mathematics because they had a lot of classes. Teachers were being triggered by the needs of accomplishing the syllabus in time as it was set by the school. Thus, having enough time to help each and every student in the class was the major challenge to them. This was also accompanied with a larger number of classes a single teacher had to teach.

Regarding this, during the interview, one of the teachers said

> To meet the needs of different students, teachers need to have enough time to prepare for each class considering the different needs of the students and assessing the students. However, teachers here have many classes that they have to teach (Interview with Teacher 5 in school C, April 2024).

In relation to the same matter, another teacher said

> The focus of accomplishing the syllabus is the main challenge to me to focus on each student in my class. We have been given the school plan that at the end of June, the syllabus should be complete and then be able to make revision for the exams. Thus, sometimes, I have to focus on the plan that I have made instead of the needs of the students in the class because of the time limitations (Interview with Teacher 3 in school D, April, 2024).

With a focus on the same issue, the head of school A said

> Dealing with the students with different needs gives challenges to the teachers due to the limited time they have. To make sure all the students have understood in the classroom, they have to spend more time with them. For the case of our school, the students with low vision and hard of hearing are among those with special needs in the classes and they need much more time to accomplish every activity that is done in the classroom. Activities like taking notes on what the teacher is teaching, completing tests and assignments or quizzes have to be done. Thus, sometimes, it is hard for the teachers to consider these students because of the time and the need to accomplish what they have planned (Interview with Head of school A, April 2024).

Teachers claimed that it needed much time to attend the needs of students in the inclusive classes . Teaching mathematics also needed much time to help students understand the concepts being taught . So having the limited time, many of the students in inclusive classes were noted to have been leaving their classes without understanding the mathematics concepts as the teachers did not get enough time to attend their specific needs.

These findings are in line with the findings obtained by Lavania and Mohamad (2021) who identified that the limited time for teachers' preparation and the time to be in the classroom, was the constraining factor towards the implementation of DI. Also, the workload the teachers had included the courses they were teaching, services provided to school and students together with the other administrative roles given to them. Also, the findings by Onyishi and Sefotho (2020) identified time as the major challenge for the teacher to implement DI in teaching in the inclusive classroom. For such teachers, using differentiated instruction was making it difficult for them to cover the syllabus in the stipulated time.

Lack of training

Another concern was the lack of seminars and workshop for the teachers which would make them share experiences and update their strategies towards teaching mathematics. They claimed that if the trainings and workshops that would involve several teachers from different places were conducted, they would help them learn from others how they were doing especially those with good performance in mathematics:

> The main challenge is that we do not have any training on how to deal with the students who are having different needs. Sometimes, they come to class having no mood to learn. Thus, as a teacher, you have to understand that. Otherwise, if you will be harsh to them, you will end up making them hate the class so it needs a teacher to be extra careful. Hence, without training, we cannot be able to help these students with special needs (Interview with Teacher 1 in school A, April 2024).

Also, the WEO of ward C said

> All schools are needed to accept all the students with special and with no special needs. But the main issue is that teachers are not equipped with knowledge on how to accommodate the students with varieties of special needs. This makes it difficult for the teachers to reach out to them as a result they are left behind (Interview with WEO 1 in ward C, April, 2024).

As presented in the above findings, the teachers have less opportunities to trainings and workshops especially on the ways to help the students in the inclusive classes. This limited opportunities to trainings mean that teachers have insufficient knowledge on how to accommodate students with diverse needs in their classes. Thus, this will make it difficult for the teachers to assist the learners and help them thrive in their academic journey.

This finding correlates with Yetnayet (2020) that there is a lack of teachers trainings concerning the DI. Because they lack the understanding of DI and, in the case of new instructors, the expertise to instruct diverse learners, teachers are thereby intrinsically unable to give meaningful and successful instruction for all students unless they receive the appropriate training. Thus, it is imperative that DI be given enough consideration in pre-service education and subsequent in-service teacher training.

Shortage of materials

Another challenge revealed was the shortage of materials. It was found to be one of the major challenges standing in the way of the implementation of DI in inclusive classroom in secondary schools. Teachers claimed that the materials were not enough for all teachers to use during teaching.

On this, during the interview, a teacher from school B said

> Things like rulers and different equipment used in teaching mathematics are scarce in the school. Sometimes, you may need to usethem but you can find that the other teacher has taken them already. Or sometimes, I might need to prepare different teaching aids but the materials like manila and others are not available . So, I have to teach without the teaching aids (*Interview with Teacher 4 in school B, April, 2024).*

As it can be seen above, the teaching materials in the visited schools were not enough for the teachers to use in the classrooms. This shortage of the materials means that teachers could not provide instructions to the students with respect to their needs. This is because, they have to use what is available and not what is needed by the students in their classes.

These findings also support those by the study of Yetnayet (2020) who found that, the availability of instructional resources was another issue brought up as a barrier to the implementation of DI. A greater range of resources, such as a tape recorder, customised sports materials, textbooks,

and pictures prepared with braille orchanged instructional materials, were all mentioned by the supervisors to be very beneficial.

CONCLUSION AND RECOMMENDATIONS

The study concludes that majority of the informants showed clear understanding of the DI although a few of them were not aware of it. Despite their understanding of what DI was, as applied in inclusive classes, they were not able to implement it during the teaching and learning process.. Furthermore, limited materials, time constraints, shortage of mathematics teachers and lack of training were observed to be obstacles in the implementation of DI in teaching mathematics in inclusive classes. Based on the conclusion made, the study recommends teachers to be equipped with enough information on how to implement DI in teaching so as to practise it well during teaching in the inclusive classes.

The study also concludes that there should be the provision of enough resources to support teachers' practices of DI in teaching especially mathematics in the inclusive classes. Teachers should be provided with different teaching materials like books and teaching aids. Also, time is necessary to be made enough for the teachers to implement DI in teaching. This problem can be solved by employing more mathematics teachers to reduce teachers' workload thus making them have enough time to plan and practise DI in teaching mathematics.

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APPENDICES

Appendix 1: Reliability Analysis

The overall alpha maximum value was α=0.914 suggesting that the scale used was highly reliable(strong). The value for each item reached the minimum reliability ($\alpha \geq 0.70$) (reasonable) value suggesting that they all measured related construct.

S/N	Questionnaire items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	Access to past and current data on climate change	0.64	0.91
2	Preparation of space dynamic-teaching and learning resources	0.77	0.90
3	Align teaching and learning resources, with the competence	0.82	0.89
4	Align teaching and learning activities, with the competence	0.79	0.90
5	Align teaching and learning assessment, with the competence	0.91	0.89
6	Mobilize learners/resources to mitigate climate change	0.75	0.90
7	Recommend teaching and learning resources for learners	0.72	0.90
8	Suggest a specific web site for learners to access	0.43	0.93

Overall alpha is 0.67 (reasonable)

S/N	Questionnaire items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	Availability of equipment used to measure weather elements	-0.11	0.78
2	Availability of good textbooks	0.39	0.63
3	Availability of enough supplementary books	0.63	0.52
4	Availability of electronic/digital sources	0.56	0.55
5	Availability of other teaching and learning materials	0.67	0.49

Overall alpha is 0.68 (reasonable)

S/N	Questionnaire items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	Lack of teaching and learning materials for teaching climate change	0.42	0.64
2	Lack of clear knowledge of some concepts in space dynamics	-0.23	0.72
3	Overcrowded space dynamic content	0.59	0.60
4	Mismatch between the syllabus and text book	0.48	0.62
5	Assessing beyond the syllabus in final examination	0.53	0.61
6	Insufficient time to effect students' competence	0.16	0.69
7	Lack of past and current data on climate	0.13	0.70
8	Poor background of space dynamics topic	0.62	0.59
9	Lack of teachers' workshops to improve knowledge on space dynamics	0.53	0.65
10	Lack of some instrument used to measure weather elements	0.21	0.67

Appendix 2: Interview Analysis Matrix

Challenge	Representative quotes
Incompetence	*Of course, now if I myself have a challenge to understand some concepts, how can I know whether the students have acquired the competence or not* ***(TM03-01, 2024).***
	The challenge is that teachers do not understand how to compose questions that measure competence ***(TM01-02, 2024).***
	The challenge is on how to construct question to assess competence. You know that we are in competence-based curriculum and I don't know how to assess the competence ***(TM04-01, 2024).***
Focus on examination	*Due to time and interest of our students we are forced to concentrate on helping learners to answer national examinations. We focus much on questions that will appear in national examinations. Another challenge is that when you ask students questions that focus on competence it became very difficult for them* ***(TD01-02, 2024).***
Lack of Weather measuring instruments	*Lack of equipment is a challenge. In teaching, the teacher needs to use teaching aid so that the topic is understood, now the challenge is the availability of equipment. For example, you need measuring devices so as to teach well. The problem is that many schools do not have the devices, so the teachers teach more theoretically or superficially (****TM01-02, 2024).***
	The modern teachers do not like to prepare the instruments by themselves, we expect the school to buy or the government to bring those devices but they are so expensive. The challenge is that teachers do not make the devices using the local available materials ***(TM04-02, 2024).***

Lack of quality reference materials	*Lack of enough teaching and learning materials. Sometimes you want to give them task or assignment but they cannot accomplish because they don't have reference materials. (**TD01-01, 2024).* *Sometime the text books and supplementary materials lack of some concepts. We lack books that are straight forward and sometimes the languages used in the books are difficult to students. (**TM02-02, 2024).***
Lack of Technological facilities	*Lack of projector so that we can use ICT in teaching space dynamics. There is a problem of depth of information in some concepts or sub topics (**TM04-01, 2024).*** *We lack assistive technology teaching as well as videos that can be used as learning aids (**TM02-02, 2024).***
Insufficient Fund	*It is difficult to organize a study tour to a weather station because of the distance…. I tried to convince students to contribute money only few managed to do so, now it is difficult to go with five students **(TM02-05, 2024).*** *There is a challenge to organize a study tour because the students do not have money and the school does not have fund **(TD01-02, 2024).***
Lack of resources	*There is a challenge of providing activities especially when you want your students to measure and record weather elements. This is because there is no equipments **(TD01-01, 2024)*** *Challenge is on providing practical activities such as measuring and recording weather elements because of lack of the instrument **(TM01-04, 2024).***
Lack of students'	*The students prefer the use lecture method to participatory methods such as discussion in learning*

motivation to learn and incompetence	*space dynamics. If you give them assignment, they claim that it is difficult to find the materials* ***(TD01-02, 2024)***
	Some students have negative perception of learning the topics. Some terminologies used are difficult to students ***(TD01-05, 2024)***
	The content is very wide so, some activities are difficult to provide. For instance, interactive teaching and learning activities because they take time compared to lectures ***(TM04-03, 2024).***
Difficultness	*It is difficult to explain some concept that are not seen by learners. For instance, the arrangement of air masses, pressure differences.... When you tell them that an area has high pressure, they don't understand what it is because they cannot see it (****TD01-01, 2024).***
Inadequate training	*I have never participated in any seminar…. In our school we just observe science teachers going to participate in seminars and workshops but Geography teachers we have never had that opportunity. We are still waiting for the Government to remember us* ***(TM02-02, 2024).***
Inability to effect practical activities	*We teach the topic without going to the field. We do not have devices to teach the topic practically* ***(TD04-02, 2024).***