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THE ROLE OF ZANZIBAR IMPROVING STUDENTS' PROSPECT (ZISP) PROJECT IN ADVANCING TEACHERS' KNOWLEDGE AND SKILLS

(Research Article)

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Abstract

Education is one of the key elements in a country's development. Therefore, Teacher Professional Development (TPD) has long been promoted as a means to foster the adoption of teaching methods. Tanzania and Zanzibar Governments have implemented several initiatives to improve the quality of education. The ZISP project was a five (5) years project from 2016 to 2021, funded by the World Bank and implemented in Zanzibar. The research objective was to assess the role of ZISP in enhancing teachers' knowledge and skills and identify challenges teachers face. A cross-sectional study design was employed, and data was collected from 69 trainees using a semi-structured questionnaire. Quantitative data were analysed descriptively, focusing on percentages and frequencies, and inferentially using the Wilcoxon signed rank test. Qualitative data collected were analysed using Thematic Analysis. The study's findings have shown that the ZISP Project improved teachers' knowledge and skills in pedagogy, subject matter, and challenges teachers face. In conclusion, the results of the study indicate a significant enhancement in teachers' knowledge and skills, particularly in pedagogy and subject matter knowledge. It is recommended that the government and the development partners should prepare a similar project like ZISP and expand the projects to include teachers from all subjects.

Keywords: Education, Teacher Professional Development (TPD), ZISP Project, subject matter

1.0 Introduction

One of the key elements in a country's development is education; this is why education is a fundamental right recognised by the United Nations and considered essential for nations' social and economic development (United Nations, 2015). Education helps to foster a shared understanding among people worldwide (McKenzie & Dalton, 2020) and is also a valuable tool that increases people's aspirations to perform better in social, economic, and cultural spheres (Nzilano & Mtoro, 2017). Öztürk & Yıldırım (2025) emphasise that, enhancing the quality of preschool education enable children's physical and spiritual development. Moreover, education rules modern society and is a valuable credential, creating opportunities for the group with a particular degree and adapting their lives accordingly (Kingston *et al*., 2015).

Education involves both teaching and learning. The teaching processes, including methods, lesson plans, and materials, are designed to facilitate effective student learning. At times, this preparation and teaching might be poorer than usual, but even then, we can talk about teaching

since the teacher has apparently seriously attempted to contribute to the student's learning (Wang & Cheng, 2022).

Teacher Professional Development (TPD) has long been promoted as a means to foster the adoption of innovative teaching methods, offer continuous learning opportunities for educators, and indirectly boost students' achievements (Polly *et al*., 2015). However, TPD in many educational settings has been criticised due to its lack of depth and efficacy. Many educators find these development opportunities infrequent and insufficient to enhance teaching techniques (DeMonte, 2013). Despite this general sentiment, some districts, schools, and educators are pioneering new approaches to professional learning. These initiatives promise to improve teaching methodologies and subsequently elevate students' performance. As Ikram *et al*. (2020) noted, there is a direct link between effective teacher development and enhanced student performance.

There are global efforts to improve access to education for better student performance and learning outcomes, including assisting educational policy-making in the forms of development assistance, evaluation research, training and capacity-building, and advocacy support (Chinapah *et al*., 2013). Despite these efforts, significant challenges remain in providing quality education to all children, particularly in low-income countries (UNESCO, 2016). Like in many other low-income countries, providing quality education has been a major challenge in Tanzania due to inadequate resources, poor infrastructure, and a shortage of qualified teachers (World Bank, 2016).

In response to these challenges, the Tanzanian government has introduced several education reforms and initiatives aimed at improving the quality of education, including the Primary Education Development Plan (PEDP) and the Big Results Now (BRN) programme (MoEST, 2014). The Zanzibar Government has also implemented several initiatives and programmes to improve the quality of education, including Education for All (EFA), Education Quality Improvement Program (EQUIP), Zanzibar Education Master Plan (ZEMAP), Early Childhood Education (ECE) (MoEVT, 2006), Zanzibar Basic Education Improvement Project (ZBEIP), Zanzibar Education Development Program (ZEDP) and Zanzibar Improving Student Prospect (ZISP) Project (Murphy et al., 2016).

The ZISP project was a five (5) years project from 2016 to 2021, funded by the World Bank and implemented in Zanzibar. The development objectives of the project were to improve the quality of (a) instruction and (b) the learning environment in targeted grades and targeted subjects. For development objectives achievement, the project aimed to provide a cost-effective model for the Government to implement its universal secondary education policy by (a) focusing on the most critical subjects in terms of labour market relevance, (b) improving teacher quality in Mathematics, Science and English through a different approach; (c) addressing incentive and accountability issues; and (d) developing a lower cost approach to infrastructure provision, particularly for Science teaching (World Bank, 2016). The project had four components: effective Mathematics, Science, and English instruction; improved school autonomy and learning environment; hubs for enhanced Mathematics, Science, and English learning; and systems transformation and project management.

In recent years, there has been growing recognition of the importance of effective TPD programmes in improving teacher competence in low-income countries (UNESCO, 2015). However, despite the increasing investments in these programmes, there is limited evidence of their impact on teachers' knowledge and skills, leading to student learning outcomes. One of the key factors contributing to students' low performance, with only a small percentage of students meeting the expected learning standards (MoEVT, 2016), is the lack of effective TPD programmes, which are essential for improving teaching effectiveness and student learning

outcomes (Bashir *et al*., 2018). However, despite the emphasis and financial investments in such programs, the student's academic performances are still low, especially in their national examination results (Ahmed & Ayoub, 2018); also, empirical evidence directly showcasing their influence on teachers' skills and knowledge in pedagogy and subject matter is limited.

This study aimed to assess the extent to which the ZISP project has improved teachers' knowledge and skills in pedagogy and subject matter and to identify the challenges teachers face in applying the knowledge and skills gained from training. This objective is intended to answer the question of to what extent the ZISP Project training has improved teachers' knowledge and skills in pedagogy and subject matter and what challenges teachers face in applying the new knowledge and skills attributed to ZISP Project training.

This study, therefore, aligns with the broader education policy in Zanzibar, which is focused on improving access to education, promoting equity and inclusivity, with the goal of better preparing Zanzibaris for the workforce (World Bank, 2016), Tanzania education and training policy (2014) and Tanzania's national education policy framework emphasises on the importance of science, technology and innovation. It aims to enhance the teaching and learning of science subjects by improving infrastructure and teachers' training and promoting equitable access to quality education in science, technology, engineering and mathematics (STEM) (URT, 2014) as Tekerek & Karakaya (2018) emphases the aim and important of STEM education in fostering students' interest and tendency toward STEM in 21st Century. Globally, the study aligns with the United Nations Sustainable Development Goal 4 (SDG 4), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (Assembly, G. 2015). Therefore, the study findings will contribute to the ongoing efforts to improve the quality of education in Zanzibar by providing evidence-based recommendations for improving TPD programmes that lead to teachers' competencies and ultimately lead to better educational outcomes for students in Zanzibar and Tanzania in general.

2.0 Literature Review

2.1 Theoretical Framework

This study adopted Albert Bandura's Social Cognitive Theory (SCT) to elucidate how TPD programmes, such as the ZISP project, affect teachers' training. The SCT posits that human behaviour is shaped by personal, behavioural, and environmental factors. It specifically focuses on teachers' self-beliefs and expectations influencing teachers' performance while considering the impact of school and classroom contexts on these dynamics (Bandura, 1986).

The Social Cognitive Theory guided this study in ways that emphasised the dynamic interplay of personal, behavioural, and environmental factors contributing to teachers' professional growth. Thus, the core concepts of SCT, such as observational learning, self-efficacy, and reciprocal determinism, have guided the framework toward understanding how the ZISP project influences teachers' knowledge and skills. The project utilised principles of SCT by promoting deep learning and skill building, whereby teachers got to observe an environment that allowed them to try out the reflective use of effective teaching strategies. Finally, the notion of self-efficacy explained how it was possible to enable teachers to feel confident in trying new techniques that would lead to sustained improvements in teaching practices in their classrooms.

The strength of the Social Cognitive Theory (SCT) lies in its wide applicability across various fields, from career choices to classroom behaviour, offering valuable concepts like self-

efficacy, experience, and social influence (Sana'a, 2016). The challenge with the Social Cognitive Theory (SCT) is its broad nature, making it better suited as an umbrella framework for extending concepts into specific models rather than a direct theory for studying human behaviour in particular contexts. Based on this study, it has indicated its concepts to specific contexts within the ZISP Project training to overcome this challenge.

2.2 Empirical Literature Review

Several studies have shown that effective TPD programmes can positively impact teachers' knowledge and skills and student learning outcomes (Thurlings & Brok, 2017; King, 2014; Pehmer *et al*., 2015; Darling-Hammond *et al*., 2017; Jacob *et al*., 2017). For example, a meta-analysis of 90 studies on TPD programmes found that such programmes can positively impact teacher practices and student learning outcomes (Brunsek *et al*., 2020). Similarly, a study in China found that teacher support programmes can positively impact teacher practices and student learning outcomes (Wei, 2018).

In Tanzania, various studies (Komba & Mwakabenga, 2019; Kafyulilo, 2013; Kafyulilo *et al*., 2016; Mduma & Mkulu, 2021; Lawrent, 2022; Mbuli & Zhang, 2020) have underscored the effectiveness of TPD programmes. They used mixed-method cross-sectional designs, revealing systemic challenges like the absence of explicit policies and traditional approaches. Recommendations included strengthening institutions and diversifying providers for self-directed professional development. Several studies have been done to assess the quality of Zanzibar (Doe et al., 2022; Shindano & Babune, 2023; Abdala & Juma, 2024; Ali & Wandela, 2023; Suleiman et al., 2024; Sheha, 2018). These studies revealed the importance of in-service training and factors affecting students' performance, leading to improved quality of education in Zanzibar. For example, the study done by Sheha, 2018 has shown the poor performance of students in their national examination, and Ali and Wandela 2023, assessed the general overview of the ZISP project in education quality in Zanzibar without focusing on detail how this project in-service training impact teacher knowledge and skills which might be one of the reasons of poor performance of the students. Therefore, this study focused on the role of the ZISP Project training in the teachers' knowledge and skills in pedagogy and subject matter since the project had a long life span of implementation from 2016 to 2021.

2. 3 Conceptual Framework

The study has been conducted based on hypothetical relationships between the dependent and independent variables. Based on the topic, the ZISP project was implemented as one of the teachers' professional development programmes based on human behaviour (personal, behavioural, and environmental factors). Based on this study, the ZISP Project intended to contribute to personal factors, including self-efficiency, emotional responses, and willingness, by providing teachers with motivation, behavioural factors, including teacher training and skill development, and environmental factors through building school hubs and classrooms. Arrows have been used to show personal, behavioural and environmental factors influenced by the ZISP Project that directly impact teachers' training outcomes.

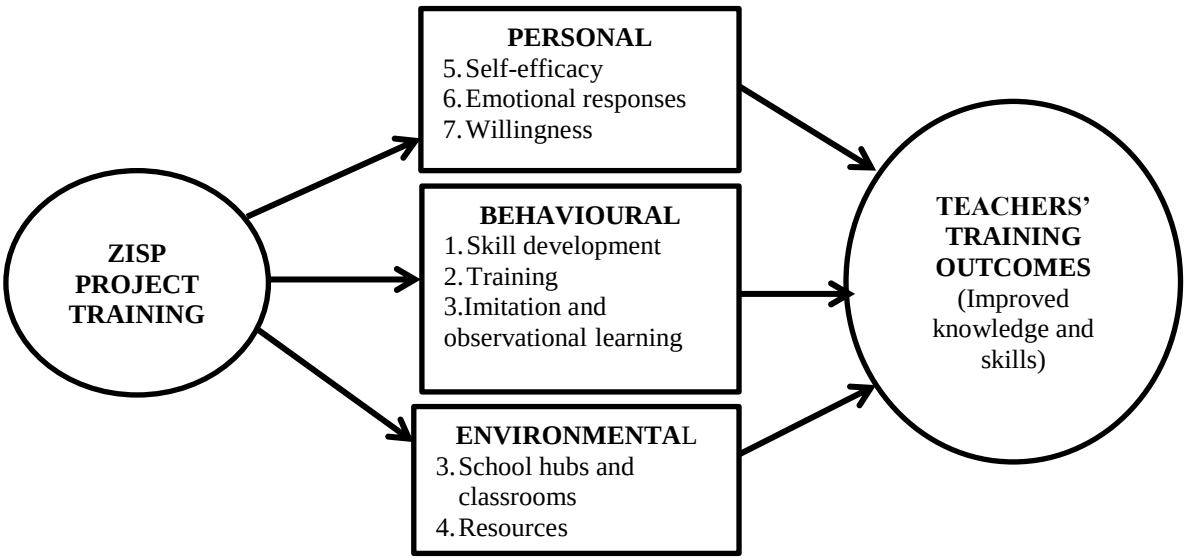

Figure 1: The conceptual framework showing relationships between dependent and independent variables

3.0 Methodology

3.1 Description of the Study Area

The study was conducted in Zanzibar, Tanzania, where the ZISP Project was implemented from 2016 to 2021. The specific area of this study was North Pemba Region in two districts, Wete and Micheweni districts. The region has a total of 50 secondary schools with 773 teachers (Statistics Coordinator Pemba, personal communication, 21st September 2023). This region was proposed as the study site due to the poor performance of the students in Mathematics, English and Science subjects, especially Micheweni district (Sheha, 2018).

3.2 Research Design

The study used a cross-sectional research design, which involves collecting data at a single point in time. This design fits this study because it captured the role of the ZISP project at a single point in time, making it efficient and cost-effective. It allowed for comparisons of knowledge and pedagogical improvements before and after training while identifying key challenges teachers face in applying what they learned from ZISP project training. This design offers several advantages, including timeliness, increased statistical strength due to a large

amount of data collection, and the ability to explore relationships between variables (Kesmodel, 2018), which are the research's primary objectives. Cross-sectional research design is cost-effective, time-efficient, and facilitates generalizability (Spector, 2019).

3.3 Study Population

A purposive sampling technique was used to select the participants for this study. Secondary school teachers were purposively selected and included in this study because they were the study population teaching Mathematics, English, and Science subjects who received training from the ZISP Project; thus, they have great experience and possess enough information on how the ZISP Project training improved their skills and knowledge.

3.4 Sampling Strategy

The study used a purposive sampling technique, and the entire study population included 69 trained teachers from three Teacher Centres (TCs) where training was conducted. Teachers teaching Mathematics, English and Science subjects in secondary schools in North Pemba who got training from the ZISP Project. The researchers used this technique because they intended to reach the trained teachers from the ZISP Project training, and the selected respondents were specific teachers trained in ZISP Project training.

3.5 Data Collection Method

Primary data were collected in this study using the survey method through a semi-structured questionnaire with 44 questions, including close-ended and open-ended questions. The questionnaire had questions designed to collect quantitative and qualitative data related to teachers' knowledge and skills improvements as a result of participating in the ZISP Project. The questionnaire also generated information about the challenges teachers face in applying skills and knowledge obtained from ZISP Project training.

3.6 Data Analysis

The Statistical Package for Social Sciences (SPSS) version 20 has been used to analyse the data. Data concerning teachers' pedagogy and subject matter knowledge were analysed using Descriptive and inferential analysis; during the item analysis in descriptive analysis, the authors calculated each item's frequency and percentage. Inferential analysis using the Wilcoxon Signed-rank test was used to compare teachers' subject matter knowledge and utilisation of pedagogical techniques before and after the involvement in ZISP Project training. Data concerning the challenges teachers face in applying what they learned from the ZISP project were analysed using descriptive analysis, where percentages and frequencies identified the challenges teachers face and the most helpful support for overcoming those challenges.

Qualitative data were analysed using a Thematic Analysis (TA) procedure, following six steps as specified by Braun and Clarke (2006). Firstly, familiarisation with the data was developed through rereading and re-reading the transcripts and jotted notes. Initial codes of key patterns or concepts emerging from the data are generated. Data coding was summarised into themes describing teachers' experiences and perceptions of the project ZISP. Precise accuracy regarding how well the themes reflect the data and relevance to the research objectives of the themes identified was checked. Developing a clear narrative that interpreted

the identified themes in relation to the research question was developed. Finally, the findings were presented, which showed how these themes linked to improvements in teaching practices, teachers' confidence, and the overall impact of the ZISP project. The analysis thus provided a systematic approach to gaining a deeper understanding of the teachers' perspectives and how the project influenced their professional development.

4.0 Results

The study aimed to assess the extent to which the ZISP project has improved teachers' knowledge and skills in pedagogy and subject matter and to identify the challenges teachers face in applying the skills and knowledge gained from training.

4.1 Social Demographic Characteristics of the Respondents

Table 1 indicates that a slight majority of ZISP trainees were female teachers at 53.6%, compared to 46.4% who are male. This distribution indicates a slight majority of women among the teachers involved in the ZISP project training compared to men, potentially influencing perspectives and outcomes related to teacher training and skills development. This distribution is significant as it has influenced the dynamics within the ZISP project, affecting participation levels, collaboration styles, and potentially the project's impact on teaching practices.

Regarding the age distribution of participants, it shows that a substantial majority of the teachers, depending on their age, 79.7%, are between 26 and 44 years old, with the remaining 20.3% falling between 45 and 59 years of age. This age distribution suggests that the study primarily involves younger to middle-aged teachers, potentially impacting the relevance and adaptability of the ZISP project's interventions across different career stages. Younger teachers are more open to adopting new pedagogical techniques and technology integration to be very competent in subject matter knowledge received from ZISP training, potentially leveraging the ZISP project's offerings more actively compared to their older counterparts who brought more experience but seemed less receptive to change.

Participants in the study represent a diverse array of subject expertise, with significant percentages distributed across the following disciplines: Biology (23.2%), Chemistry (20.3%), English (24.6%), Mathematics (14.5%), and Physics (17.4%). This diversity reflects a broad representation across core MSE subjects (Mathematics, Science, and English), highlighting the project's multi-disciplinary approach and its potential impact on pedagogical practices and subject matter across these subjects. This diversity in subject specialisation has reflected the project's broad scope, impacting multiple domains of these subjects. It also suggests that the ZISP project's training modules are likely prepared for the specific needs and challenges teachers across MSE subjects face, aiming to enhance content knowledge and pedagogical skills in diverse educational contexts.

In terms of teaching experience, the distribution shows that 37.7% of participants have less than 5 years of experience, 24.6% have between 6 to 10 years, 11.6% have 11 to 15 years, and 26.1% have more than 15 years. This range suggests a balanced representation of early-career and experienced educators, which influenced the project's effectiveness in addressing both new and planned teachers' professional development training needs. Early-career teachers have benefited more from foundational training from the ZISP Project in terms of pedagogical skills and subject matter knowledge, while experienced teachers contributed insights into advanced pedagogical strategies and subject matter knowledge within the project's framework.

Participants' educational qualifications vary significantly, with 24.6% holding diplomas, 69.6% having bachelor's degrees, and 5.8% possessing master's degrees. This distribution highlights the cohort's overall high level of formal education, which influenced their readiness and willingness to engage with and benefit from the ZISP project's training. This indicates a predominantly highly educated cohort, primarily equipped with bachelor's degrees, which impacted their receptiveness and utilisation of advanced pedagogical skills and subject matter training offered by the ZISP project.

The majority of teachers with bachelor's degrees are likely equipped with foundational knowledge in their respective fields. However, they were supposed to seek further professional development training from the ZISP Project since they were teaching subjects that were not areas of their professions. Further subject matter training offered by the project enhanced their teaching practices and subject matter expertise in science subjects. Those with higher qualifications, such as master's degrees, contributed advanced insights and leadership within the project, potentially influencing its implementation and outcomes.

Thus, ZISP participants were a rather heterogeneous group comprising more females than males, relatively younger teachers, a fairly equal representation of all core MSE subjects, quite diverse experience of teaching, and, lastly, very high levels of educational qualification, an important factor to take into account for understanding the development impact the training given to teachers in the ZISP project had. These demographic variables are applicable in the study in that they influenced how teachers reacted to training and the assimilation of new practices, hence contributing to the overall results of the ZISP project thus giving some insight into the characteristics of the teachers in the success of the PD.

Table 1**:** *Socio-demographic characteristics of the respondents*

Socio-demographic characteristics					
Sex	Female 53.6%(37)	Male 46.4%(32)			
Age	26 to 44 years 79.7%(55)	45 to 59 years 20.3%(14)			
Subject	Biology 23.2%(16)	Chemistry 20.3%(14)	English 24.6%(17)	Mathematics 14.5%(10)	Physics 17.4%(12)
Experience	Below 5 years 37.7%(26)	6 to 10 years 24.6%(17)	11 to 15 years 11.6%(8)	Greater than 15 years 26.1%(18)	
Education Level	Diploma 24.6%(17)	Degree 69.6%(48)	Masters 5.8%(4)		

Note: Numbers in brackets indicate frequencies

4.2 Teachers' Knowledge and Skills in Pedagogy and Subject Matter

This section discusses the assessment of the role of the ZISP project in increasing teachers' knowledge and skills in subject matter expertise and pedagogy by giving insight into aspects like confidence in teaching, utilisation of pedagogical techniques, subject matter expertise, improvements in teaching practices, application of new skills attributed to ZISP project, application of new skills, feedback from students and uses of technology and resources as clearly analysed below**.**

4.2.1 Level of Confidence in Teaching as a Result of ZISP Project

The results show that teachers' confidence in delivering lessons in their subjects' area has been high since the initiation of the ZISP Project, whereby 50.7% of teachers are very confident in terms of clarity in explaining concepts, eye contact and body language, effective use of teaching aids, use of real-life examples in teaching and ability to interact with students properly, 47.8% are extremely confident, and only 1.4% are confident (Table 2). The high level of confidence, which about 98.5% of teachers indicated to be very or extremely confident, shows that the ZISP Project has increased teachers' confidence in delivering lessons, which corresponds to an improvement of knowledge and skills in their pedagogy and subject matter as one of the respondents noted.

> *"Since joining the ZISP project, I have gained a lot of skills in the subject in which I was trained. I have grown in confidence to teach this subject in so many ways: from merely being able to explain concepts to simplifying explanations of hard topics, using examples related to their lives, and ability to handle questions from students."*

In terms of confidence in handling questions from students, it is high due to the improvement in subject matter knowledge attributed to the ZISP Project; 97.1% of teachers have a high level of confidence in handling challenging questions from students.

Also, teachers' confidence in teaching has increased since the initiation of the ZISP Project. 56.5% (39) are significantly increased, and 42.0% (29) are slightly increased. This indicates that the ZISP Project has contributed to teachers' knowledge of their subject matter, as results show that teachers are more confident in their teaching. The analysis of the qualitative data shows that before the implementation of the ZISP Project, many teachers expressed uncertainty in their ability to effectively deliver lessons, especially in science and mathematics subjects. Teachers felt unprepared, struggled with explaining concepts, and lacked confidence in using teaching aids, as one of the respondents noted.

> *"Before the training, I used to feel anxious when I was teaching because I was unsure whether I was explaining them correctly. Now I can confidently control my classroom, break down difficult concepts and engage students more actively."*

These findings indicate that ZISP Project training has significantly improved teachers' subject knowledge and teaching techniques, which has boosted their confidence in teaching. the targeted training provided enhanced teachers' understanding of the key concepts and equipped them with modern pedagogical strategies. As a results. Teachers are now more capable of engaging students, using teaching aids effectively and adapting their teaching methods to meet learning needs.

Table 2*: The level of confidence in teaching*

Level of confidence in teaching			
Confidence in delivering lessons	Confident	Very confident	Extremely confident
	1.4%(1)	50.7%(35)	47.8%(33)
Confidence in handling questions	Confident	Very confident	Extremely confident
	2.9%(2)	58.0%(40)	39.1%(27)
Increment teaching confidence	No change	Slightly increased	Significantly increased
	1.4%(1)	42.0%(29)	56.5%(39)

Note: Numbers in Brackets Indicate Frequencies

4.2.2 Pedagogical Techniques

Teachers were asked about the use of various pedagogical techniques, including think pair share, role play, brainstorming, gallery walk, discussion, asking questions, and jigsaw in their classrooms before and after their involvement in the ZISP project training. Table 3 indicates a significant change in the utilisation of a variety of pedagogical techniques in the classroom before and after the ZISP intervention ($T = 0.00$, $z = -7.061$, $p < 0.05$; $p = 0.00$). The mean of utilisation of pedagogical techniques after the training is greater than before the training (mean after is $3.36 > 1.46$ mean before). The negative Z value suggests that the use of these techniques generally increased after ZISP, as higher usage was more common after the ZISP Project training, and the p-value of 0.00 confirms that this difference is statistically significant.

Qualitative responses by the teachers, further outline that there is an increase in the usage of the pedagogical techniques after the ZISP project training. Most of them claimed that they have actively integrated into their lessons a wider variety than before the training. One of the teachers noted.

> *"Before ZISP, it was mostly lecturing; now, it is think-pair-share and brainstorming to get them engaged, and I see quite a difference in participation."*

This suggests that through the training, the teachers were beginning to include other teaching strategies in their practice that helped improve student engagement. Another teacher shared.

> *"I have started using jigsaw activities and role play in my lessons. These techniques help my students learn through collaboration and help them enjoy the lessons more."*

This evidence shows that the training provided within the framework of the ZISP project introduced teachers to active learning strategies that foster collaboration and deeper learning.

Besides these active approaches, teachers also identified improvements in general classroom dynamics and student engagement. They mentioned that the ZISP training has made a big difference in the way they plan their lessons. They ask more questions, and the children respond more than before, and it appears they are interested and willing to participate. This reflection underlines an increased usage of interactive techniques to liven up the learning environment.

In addition, teachers felt their confidence in the use of such methods grew with time. The teachers themselves commented.

"At first, I was unsure about using these techniques, but after the training, I gained confidence. Now, I'm comfortable using them regularly, and I see my students responding positively."

This would then suggest that, other than improving the frequency of use of pedagogical techniques, the ZISP project actually helped to build confidence among teachers to adopt and sustain the practices.

Table 3: *Shows utilisation of techniques before and after the ZISP training*

		N	**Mean rank**	**Sum of ranks**	**Mean**
Utilisation of varieties of pedagogical techniques before and after the ZISP training	Negative ranks	0[a]	00	0.00	1.46 (before)
	Positive ranks	63[b]	32.00	2016.00	3.36 (after)
	Ties	6[c]			
	Total	69			
	Test statistics[d]				
	Z	Sig.			
	-7.061[e]	0.000			

a. Utilization of pedagogical techniques after ZISP training < utilisation of pedagogical techniques before ZISP training.
b. Utilization of pedagogical techniques after ZISP training > utilisation of pedagogical techniques before ZISP training.
c. Utilization of pedagogical techniques after ZISP training = utilisation of pedagogical techniques before ZISP training.
d. Wilcoxon Signed Rank Test.
e. Based on negative ranks.

4.2.3 Subject Matter Expertise

Trained teachers were asked about the depth of their knowledge in subjects they taught before and after the involvement in the ZISP project. Our results indicate a significant change in the depth of knowledge in the subject taught before and after the ZISP Project ($T = 0.00$, $z = -7.005$, $p < 0.05$; $P = 0.00$). The mean of depth of knowledge in subjects taught after the training is greater than before the training (mean after is $3.35 > 1.43$ mean before). The negative Z value suggests that the depth of knowledge increased after the ZISP Project, as greater knowledge was gained after the ZISP project. The p-value of 0.00 confirms that this difference is statistically significant, meaning the observed increase in depth of knowledge on the MSE subjects teachers teach.

Table 4: *Depth of knowledge in subjects taught before and after the ZISP Project*

		N	Mean rank	Sum of ranks	Mean
Depth of knowledge in subjects taught before and after the ZISP Project	Negative ranks	0[a]	00	0.00	1.43 (before)
	Positive ranks	63[b]	32.00	2016.00	3.35 (after)
	Ties	6[c]			
	Total	69			
	Test statistics[d]				
	Z	Sig.			
	-7.005[e]	0.000			

a. Depth of knowledge in subjects taught after the ZISP Project < Depth of knowledge in subjects taught before the ZISP Project
b. Depth of knowledge in subjects taught after the ZISP Project > Depth of knowledge in subjects taught before the ZISP Project
c. Depth of knowledge in subjects taught after the ZISP Project = Depth of knowledge in subjects taught before the ZISP Project
d. Wilcoxon Signed Rank Test
e. Based on negative ranks

The qualitative data obtained from the trained teachers showed the same consistency in the reports about increased subject matter expertise following the involvement in the ZISP project. Many of the teachers described feeling more confident in their knowledge of the subjects they were teaching after their involvement in the ZISP Project training. One of the teachers noted that.

> *"Sometimes, explaining some issues before the training has been complex; after ZISP training, I feel equipped to engage the learners in discussing the same topics meaningfully."*

Another one reported, *"The project training gave me a deeper insight into my subject area. Now, I am able to teach clearly and answer questions better than before with lots of confidence."*

Quite a good number of them agreed that the training they attended equipped them not only just theoretically but also actually in teaching the students. For example, one of the respondents noted,

> *"The training helped me to understand complex matters more deeply but at the same time showed ways of breaking these topics down into easier ways students could understand them."*

These attest to the fact that the ZISP project substantially enhanced subject matter knowledge among the teachers. Teachers felt more confident and better grounded in the subjects, indicating that the training was appropriate for their professional development.

4.2.4 Improvements in Teaching Practices

The results show that the ZISP project significantly contributed to teachers' knowledge and skills since teachers witnessed changes and improvements in teaching methods and overall satisfaction with the support provided by the ZISP Project (Table 5). The majority of teachers (89.9%) reported either moderate or significant improvements in their teaching methods since the initiation of the ZISP Project, and 86.9% of teachers had a high level of satisfaction with support provided by the ZISP Project for teaching practice improvements. Also, the ZISP Project demonstrated specific improvements in teaching practices, including confidence in subject matter, wide use of pedagogical methods and techniques, and classroom interaction and management. However, specific areas like the improvisation of teaching materials, English language proficiency, and the integration of technology into teaching showed limited improvements.

Table 5: *Improvements in teaching methods since the ZISP project*

Specific improvements attributed to ZISP Project		
Confidence in the subject matter	Yes	No
	47.8%(33)	52.2%(36)
Improvisation of teaching materials	Yes	No
	11.6%(8)	88.4%(61)
Wide use of pedagogical methods and techniques	Yes	No
	33.3%(23)	66.7%(46)
English language proficiency	Yes	No
	4.3%(3)	95.7%(66)
Integrating technology in teaching	Yes	No
	7.2%(5)	92.8%(64)
Classroom interaction and management	Yes	No
	36.2%(25)	63.8%(44)
Teaching methods changes or improvements		
None	7.2%(5)	
Minor	2.9%(2)	
Moderate	43.5%(30)	
Significant	46.4%(32)	
Support satisfaction provided by ZISP in teaching practice improvements		
Not satisfied at all	2.9%(2)	
Satisfied	10.1%(7)	
Very satisfied	50.7%(35)	
Extremely satisfied	36.2%(25)	

Note: Numbers in brackets indicate frequencies

Qualitative feedback from teachers further supports the ZISP project's effective contribution to improving teaching methods. Many of them mentioned increased confidence in using teaching methods and engaging with the students, which well reflects the improvement in their teaching practices. One of the teachers mentioned,

> *"Since joining the ZISP project, I feel much more confident in my teaching. I can explain concepts more clearly, and I have noticed that my students are more interested in learning."*

This reveals a remarkable change in teacher confidence; that is, the project has helped teachers become more confident in regard to their teaching methodologies. One of the teachers noted,

> *"The training has helped me to broaden my teaching techniques, especially in managing my classroom and interacting with students. I now have more kinds of strategies to keep them focused and active in learning."*

This suggests that the ZISP project improved not only subject knowledge but also impinged positively on classroom management and interaction important areas that improve general teaching effectiveness.

The teachers also indicated that the support the ZISP project gave them helped them in improving as teachers. A teacher stated,

"I am very satisfied with the support I've received from the ZISP project. The materials and strategies have helped me improve my teaching, and the ongoing support has been invaluable."

This statement highlights the value of continued support and the practical tools provided by the project, which helped teachers implement the strategies learned during training. Satisfaction with ongoing support was a common thread, as teachers seemed to appreciate that this project of the ZISP did not leave them short in steps toward continuous improvement.

4.2.5 Application of New Skills Attributed to ZISP Project

The ZISP Project intervention involved training teachers to acquire new pedagogical skills and put emphasis on the older ones. The result shows that a large number of respondents (95.6%) are applying frequently or always the new skills or knowledge gained from the ZISP Project (Table 6). Therefore, the ZISP Project has contributed to the acquisition of new skills including improvisation of teaching and learning materials, English language interactions and teaching and learning methods; hence, since the initiation of this project, teachers are increasingly applying especially the skills gained from ZISP training. One of the respondents noted.

"There are many techniques I learned from ZISP project training, but the one on improvisation of teaching aids has given me a peace of mind while teaching. I learned that if the teaching aid I need is unavailable; I can use the skill of improvisation to improve the teaching aid until I get exactly the teaching aid I need."

According to responses, 91.3% of the teachers found the new skills to be either very effective or extremely effective in their teaching practices. This demonstrates that the ZISP project enhanced teachers' pedagogical skills and subject matter knowledge.

Table 6: *The application of new skills gained from ZISP and effectiveness of those skills from the ZISP Project.*

Application and effectiveness of new skills gained from the ZISP project	
Application of new skills	
Occasionally	4.3%(3)
Frequently	47.8%(33)
Always	47.8%(33)
Effectiveness of the new skills gained	
Effective	8.7%(6)
Very effective	55.1%(38)
Extremely effective	36.2%(25)

Note: Numbers in brackets indicate frequencies

4.2.6 Uses of Technology and Resources

Table 7 provides insights into the extent to which teachers incorporate various teaching aids and technology into classroom instructions as trained from the ZISP Project. These results indicate that the minority of teachers (11.6%) frequently or always use teaching aids and technology in classroom, suggesting a low level of integration of these resources into their teaching practices. The qualitative results indicate that a small number of teachers incorporate

and use technology in teaching because their schools are full of technology resources, making it easier for them to apply what they learned from the ZISP Project training. As one of the respondents noted.

> *"I frequently use technology in my teaching activities because I already have learned it from ZISP Project training. Additionally, the necessary technology resources are sufficiently available in our school."*

While a majority of teachers (88.4%) rarely or occasionally use teaching aids and technology in their classroom instruction due to unavailability of technology resources in their schools. Respondents reported having the ability to use technology in teaching gained from ZISP Project training, but they are unable to incorporate technology resources in classroom because necessary resources are not available in their schools. As one of the respondent noted.

> *"The ZISP Project training equipped us with the skills to use technology in teaching and I can do so. But, the challenge arises from the lack of such resources in our school leading to be unable to incorporate them in my teaching activities."*

This indicates that the ZISP Project improved teachers' ability to integrate technology and teaching aids into classroom interactions but the problem comes when some schools don not possess technology resources in their schools.

The effectiveness of these teaching aids and technology is also presented in this result. The result shows that the majority of teachers (65.2%) selected audio-visual materials to be the most effective teaching aids, suggesting that teachers find them engaging and useful for student understanding. Also, online resources perceived as effective by most teachers (55.1%), indicating a favourable view toward their use in the classroom; educational software is somehow accepted (26.1%) by teachers, and lastly, interactive with blackboards are not widely regarded as effective by majority of teachers, with only a few teachers (8.7%) finding them useful.

Table 7: Types and the use of technology and resources in classroom interaction

Types and the use of technology and resources in classroom interaction		
Most effective teaching aids and technology in teaching		
Interactive whiteboards	Yes	No
	8.7%(6)	91.3%(63)
Educational software	Yes	No
	26.1%(18)	73.9%(51)
Online resources	Yes	No
	55.1%(38)	44.9%(31)
Audio-visual materials	Yes	No
	65.2%(45)	34.8%(24)
Incorporate teaching aids and technology in classroom instruction.		
Rarely	43.5%(30)	
Occasionally	44.9%(31)	
Frequently	1.5%(1)	
Always	10.1%(7)	

Note: Numbers in brackets indicate frequencies

4.3 Challenges Faced by Teachers in Applying the Knowledge and Skills from ZISP

This subsection shows the challenges faced by the teachers in implementing subject matter knowledge and skills. A number of challenges identified including lack of time, insufficient resources, resistance from students and resistance from colleagues. Additionally, the type of support that could be helpful in overcoming said challenges.

The results identified several challenges trained teachers faced in applying newly acquired skills and subject matter knowledge. One of significant challenge was the lack of time reported by 33.3% (23 respondents), while 66.7% (46 respondents) as presented in Table 9, reported no challenge of time constraints. It therefore indicates that whereas a good number of participants were able to manage their time effectively, a significant proportion found it difficult to reconcile the demands made by new skills with their current workload. Not surprisingly, insufficient resources emerged as the second strong obstacle with 63.8% (44 respondents) showing the urgent need for better provision of materials and facilities, crucial for teaching. In contrast, 36.2% (25 respondents) felt that they had adequate resources, which is indicative of variability in resource availability within different settings.

Student resistance was also mentioned as one of the challenges with 27.5% (19respondents), reported difficulties in gaining student cooperation. They reported its due to students' unfamiliarity with new methods of teaching and their reluctance toward change. While a majority of 72.5% (50 respondents) did not face the problem, suggesting that many students were neutral or even supportive of new approaches. Resistance from colleagues was the last reported challenge by the respondents effecting only 13% (9 respondents) while many as 87.0% (60 respondents) received no pushback from peers.

Trained teachers were asked about the difficulty in overcoming challenges related to implementing new teaching strategies, participants provided varied responses. The results show that, a small percentage, 1.4% (1 respondent), found it not challenging at all, suggesting that for a minority, the transition to new strategies was seamless. Meanwhile, 11.6% (8 respondents) described the process as challenging, reflecting moderate difficulties. The vast majority, 58.0% (40 respondents), felt that it was very challenging, which means most of the respondents experienced serious difficulties. Another 29.0% (20 respondents) found it extremely challenging, indicating the level of difficulties for almost one-third of the respondents.

Additionally, teachers were asked on the most helpful support or resources to overcome these challenges indicated several areas. The results show that, basic English language for students was helpful only in the cases of 10.1% (7 respondents) while 89.9% (62 respondents) did not find it significant. This could be because the role which language skills can play in the overcoming of broader systemic challenges is limited. Technology materials were seen to be helpful to 49.3% (34 respondents) while 50.7% (35 respondents) reported otherwise. This split in the vote further indicates that technology can indeed be a tool, but one whose effectiveness hinges on accessibility and other factors that govern its integration into teaching practices. Effective teaching and learning resources were stated by 52.2% (36 respondents) against 47.8% (33 respondents), showing further disparities in resource availability and usage.

Table 8: *Challenges in applying new skills and subject matter knowledge, and ways to overcome them*

Challenges in applying new skills and subject matter knowledge and ways to overcome those challenges		
Challenges in applying new skills and subject matter knowledge		
Lack of time	Yes	No
	33.3%(23)	66.7%(46)
Insufficient resources	Yes	No
	63.8%(44)	36.2%(25)
Resistance from students	Yes	No
	27.5%(19)	72.5%(50)
Resistance from colleagues	Yes	No
	13.0%(9)	87.0%(60)
Challenging in overcome challenges in implementing new teaching strategies		
Not challenging at all	1.4%(1)	
Challenging	11.6%(8)	
Very challenging	58.0%(40)	
Extremely challenging	29.0%(20)	
Most helpful support or resources to overcome those challenges		
Basic foundation of English language for students	Yes	No
	10.1%(7)	89.9%(62)
Technology materials	Yes	No
	49.3%(34)	50.7%(35)
Teaching and learning resources	Yes	No
	52.2%(36)	47.8%(33)
Financial resources	Yes	No
	13.0%(9)	87.0%(60)
Support from parents and administration	Yes	No
	13.0%(9)	87.0%(60)

Note: Numbers in brackets indicate frequencies

5.0 Discussion

The research objective was to explore the extent to which the ZISP Project improved teachers' knowledge and skills in pedagogy and subject matter. The findings of this study have clearly shown that the ZISP Project improved the teachers' knowledge and skills in pedagogy and subject matter knowledge attributed to ZISP training to a large extent. The findings answered, "To what extent has the ZISP Project improved teachers' skills and knowledge in pedagogy and subject matter and challenges teachers face?". The ZISP Project aimed to transform teachers from arts subject teachers to science subject teachers (World Bank, 2016); therefore, the results show that the ZISP Project built teachers' confidence in teaching science subjects and improved their pedagogical skills and subject matter expertise after the training. The findings of the study agree with the results of some studies (Gwekwerere et al., 2013;

Kokoç & Karal, 2019; Akram et al., 2024; Lara-Alecio et al., 2021; Zewiel et al., 2015) where the results showed that the teachers training improved teachers' pedagogy and subject matter knowledge and skills in their teaching practices since teachers involved in the training their ability in their subject matter expertise is quite different from teachers who did not participate in any training**.**

The findings also demonstrate that teachers' confidence in delivering lessons in subject areas increased, as well as the utilisation of pedagogical techniques. This indicates that the ZISP Project training helped teachers be competent in subjects they teach, which were not areas of their professions and made them familiar with pedagogical techniques. The results show that the pedagogical techniques were more often used after the training. These findings concur with the study done by (Stutchbury et al., 2023; Woldetsadik, 2024; Yeigh & Woolcott 2015; Bett & Makewa, 2020), which found that the implemented Projects improved teachers' confidence, competence, and pedagogy. The findings reveal that there is increasing in the depth of knowledge in the subjects teachers teach and improvement in teaching practices after the ZISP training, which indicates that the ZISP Project increased teachers' subject matter expertise with knowledge in the subjects they teach and improved teaching practices in teaching methods since the initiation of ZISP training. These findings agree with the study done by Quilapio and Callo (2022), whose findings revealed that teachers showed notable improvements in several areas after attending in-service training programs, including enhancements in content knowledge, teaching methods and better utilisation of teaching and learning resources.

Also, the study findings show that teachers incorporate various teaching aids and technology into classroom instructions after attending the ZISP training, indicating that the training provided them with the knowledge and skills to integrate teaching aids and technology to show their importance in classroom instructions. Our results agree with the study done by Friedrich and Trainin (2014), which emphasises how crucial it is to give teachers the knowledge and abilities they need to successfully incorporate technology into their teaching practices. It emphasises the value of ongoing professional development and assistance to enable teachers to keep up with the quickly changing technological environment and offer students relevant and engaging learning experiences.

Although our results show that ZISP Project training succeeded in improving teachers' knowledge and skills in pedagogy and subject matter, the results also revealed the challenges teachers face in applying pedagogical skills and subject matter knowledge gained from training, as shown above; these challenges seem to be problems in providing to students what teachers learnt from ZISP training leading to low performance to the students. These findings concur with the study done by (Gwekwerere et al., 2013) that the SEITT program helped teachers transform their teaching practice and teaching methods. However, they reported that they faced challenges and impediments to implementing these changes, which were attributed to the program. Their challenges ranged from a) unwillingness by some colleagues to participate in the change process, b) lack of resources for materials writing and supporting students' learning, and c) systemic policy issues such as the national curriculum and examinations that did not support contextualised teaching.

The findings of this study have several practical applications for educational institutions and policymakers. Firstly, institutions can prioritise implementing similar projects that focus on improving teachers' competencies through training programs. These initiatives can lead to the adoption of advanced pedagogical approaches, technology integration, and innovative teaching methods, ultimately promoting quality education and aligning with broader educational goals like the UNSDG-4 (Kulal et al., 2024). Additionally, embracing technology integration, continuous learning cultures, and providing ongoing support mechanisms can

optimise the effectiveness of training initiatives, improve teaching effectiveness, and positively impact student outcomes. By investing in projects like the ZISP Project, institutions can cultivate a more proficient and competent teaching workforce, ultimately advancing the education system and enhancing student learning experiences.

6.0 Conclusion

The results of the study show significant gains in both pedagogic skills and subject matter knowledge for the teachers from the ZISP Project. There is a statistically significant gain in teachers' confidence to teach, use of pedagogical techniques, and depth of subject knowledge. A greater number reported that, as a result of the ZISP Project training, they were more confident in lesson delivery and in handling difficult questions. The observed practices of using various pedagogical methods and enhancement in teaching practices reached statistical significance. Notable development was seen in classroom interaction and management, whereas the integration of technology, improvisation of teaching materials, and proficiency in English showed less progress, thus indicating areas where further improvement is required. In addition, the new skills acquired from ZISP were put to good use highly effectively, evidenced by the frequent usage of the new skills and the positive feedback from the students, to a great extent shaping the teaching methodology.

Despite the successes, constraints in resources, time, and, at times, resistance from both students and colleagues limited full application of the acquired skills. The teachers mentioned that a lack of teaching-learning aids, material of technology use in teaching, and management support are vital to overcome these challenges. Most of the teachers found transitioning toward new techniques, though at most challenging, quite handy with all kinds of support provided from the ZISP Project. The study underlines that further investments in teacher training programs such as ZISP are imperative; support systems at all levels should be fully prepared with the required resources to consolidate and improve the progress made toward raising standards in education and teaching quality.

7.0 Recommendation

Based on the findings, the ZISP Project improved teachers' skills and knowledge in pedagogy and subject matter. It is recommended that the government and the development partners should prepare a similar project like ZISP and expand the projects to include teachers from all subjects. Also, specialised training modules should be developed, and training curricula should be continuously revised to stay current with educational standards. Additionally, mentorship programs should be established, and coaching should be provided to help integrate new strategies, incorporate digital tools, and offer training on educational technology.

In address the challenges identified, the government should adopt a comprehensive and multi-pronged strategy. First, to mitigate the lack of time, the government should streamline teachers' workloads by reducing administrative responsibilities and ensuring adequate time is allocated for lesson preparation and skill application. Instituting flexible schedules or professional development leave would also provide educators with the opportunity to focus on adopting new strategies without additional pressures.

Moreover, to address insufficient resources, the government must prioritize the provision of essential teaching materials and tools. This can be achieved through increased funding for schools, targeted resource allocation, and partnerships with private organizations to supply

educational technology and infrastructure. Additionally, creating centralized resource hubs where teachers can access teaching aids and learning materials would significantly reduce disparities in resource availability.

8.0 Research Ethical Consideration

This research adhered to ethical research principles, ensuring that all participants willingly engaged after being informed (Pietilä, et al., 2020). **The research obtained official approval through permit from Sokoine University of Agriculture and the Zanzibar Research Committee.** The collected data were reliable and free from deception or fraud. Ethical standards were strictly maintained, including informing participants about the study's purpose and their roles, with a commitment to confidentiality and the exclusive academic use of their information. Participant joined voluntarily without harm, and the research upheld integrity by avoiding plagiarism and misconduct in presenting results.

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