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Transformative Pedagogies and Practices: The Potential of the School-Based In-service Teacher Training (SITT) Model in Transforming Teaching and Learning in Zambia

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Abstract

In this paper, we examine the influence of the School-Based In-Service Teacher Mentorship and Support (SITMS) pilot project on the teaching and learning environment in the pilot secondary schools in Zambia. Using Mezirow's transformative learning theory as an analytical lens, we examined the data collected from the project activities, including the learning and sharing workshops, midline surveys, monitoring visits and interviews, to uncover significant changes in students' teaching approaches and attitudes towards learning. The findings of the study revealed six salient aspects that exemplify the revolutionary character of the SITMS project, and these include: (1) attitude change as a transformative teaching foundation, which involves a shift from traditional to creative teaching methods; (2) transformational transition to inclusivity, which focuses on adopting inclusive teaching practises and cooperative learning settings; (3) collaborative knowledge construction and experiential learning, which highlight hands-on experiences and active exploration in classrooms; (4) symbiotic teacher-student relationships, which increase students participation in the learning activity; (5)Transformative Communities of Practice and Collaborative Teaching, which encouraged a broad interchange of team teaching and workgroup formation, provided momentum for these joint efforts; and (6) Pedagogical Adaptation with Contextualisation, which promotes use infusion of local context in the teaching and learning environment. These findings highlight the importance of SITMS in promoting a favourable learning atmosphere, emphasising the potential of the SITMS project for broader educational reforms.

Keywords: Transformative learning, transformative pedagogy, SITT Model

1. Introduction

In education, particularly in developing countries like Zambia, enhancing the quality of teaching and student learning experiences is paramount to addressing various challenges the education system faces. Despite the efforts made in preparing pre-service teachers, continuous professional development for in-service teachers plays a crucial role in improving teacher competencies and student outcomes. As noted by Mubanga (n.d.), the Zambian government views "in-service teacher training (INSET) as an indispensable aspect of the enhancement of teachers' knowledge and skills in the quest to assure education quality." There are two types of in-service education and training

programmes in Zambia: long-term courses offered by institutions like colleges of education and universities and short-term programmes known as continuing professional development (CPD) held in teachers' resource centres or schools. These programmes aim to enhance teachers' professional skills and classroom practices. The in-service education programmes, both long-term and short-term, have been instrumental in upgrading the capabilities of teachers and implementing various educational interventions such as the Primary Reading Programme (PRP), Basic School Curriculum Framework (BSCF), Self-Help Action Plan for Education (SHAPE), Programme for the Advancement of Girls Programme (PAGE), Action to Improve English, Mathematics, and Science (AIEMS), and introducing new materials in HIV/AIDS education, Science Kits, School Health and Nutrition, Multi-grade, and Learner-Centred Methodologies (United States Agency for International Development (USAID), n.d.; Mubanga, n.d. Despite these efforts, Zambia, like many other nations, grapples with issues such as low student performance, outdated teaching methods, and limited resources, needing a robust in-service teacher training initiative (Ministry of General Education, Zambia, 2019).

The School-Based In-Service Teacher Mentorship and Support (SITMS) pilot project was introduced in Zambia, aiming to complement efforts to transform teaching and learning environments and elevate teaching practices. Existing literature underscores the significance of in-service teacher training programmes in addressing the gaps in the education system (Smith & Gillespie, 2020). However, there is a noticeable research gap concerning the transformative impact of such initiatives, especially when viewed through the lens of transformative learning theory (Mezirow, 1991).

A study by Hennessy & Hofmann (2015) informs the present study as it evaluates the impact of a teacher professional programme, but not necessarily from transformative theoretical perspectives. Their study reports on the pedagogic changes made by Zambian primary school teachers who participated in the OER4 school's professional development programme for one year. They derived data from observations, lesson and workshop recordings, teacher interviews, portfolios, and audio diaries. The study concluded that through a teacher-led workshop approach and trialling new pedagogical strategies, teachers raised their expectations of pupils, adapted to learners' knowledge

levels, used more practical and group work, and integrated technology use. Pupils built a deeper understanding of the subject matter, were actively engaged, worked collaboratively, and used digital technologies for problem-solving. This study shows how teacher professional programmes can be transformative, justifying the need to evaluate the reformative nature of the SITMS project on secondary school teaching and learning experiences in Zambia.

Further evidence shows how transformative pedagogies in secondary schools can be effectively implemented through in-service teacher training projects. These projects aim to empower teachers and enhance their pedagogical practises to promote positive outcomes in education. One study by Bedford (2022) focused on constructing a transformative sustainability pedagogy through teacher empowerment. The project used an action research approach and found that it successfully empowered teachers to act and promote sustainability in their schools. This highlights the potential of in-service teacher training projects to transform pedagogical practises and empower teachers to make a positive impact. Another study by Bautista (2021) explored the impact of the KINANG project on secondary school teachers. The project aimed to enhance their innovativeness and engagement in teaching and learning. The findings showed that the project provided learning opportunities that revitalised teachers' perceptions and transformed their task approach. This suggests that in-service training projects can foster enthusiasm and commitment among teachers, leading to innovative pedagogical practices.

Mishra and Koehler (2006) discussed the importance of technological pedagogic content knowledge (TPACK) in teacher education. They emphasised that teachers need to conceive of technology uses that align with their existing pedagogical beliefs to effectively integrate technology into their teaching practices. In-service teacher training projects can play a crucial role in developing teachers' TPACK and helping them integrate technology in a transformative way. Similarly, Bentri (2023) focused on improving digital pedagogy competence through in-service training for elementary school teachers. The study emphasised the importance of in-service training in developing teachers' digital competencies, which is essential for effective pedagogical practice in the digital age.

Phusavat et al. (2017) highlighted teachers' constant need for new knowledge and skills, including pedagogical approaches such as collaborative and phenomenon-based learning. In-service teacher training can address these needs and equip teachers with the necessary knowledge and skills to implement transformative pedagogies. Our project model, SITT, acknowledged practice-based learning as a revolutionary approach to teaching and learning. Similarly, Brătianu et al. (2020) regard competency-based education as one of the 21st-century approaches to teaching and learning that emphasises the development of knowledge and abilities that apply to real-world situations. In keeping with the tenets of transformative learning theory, this method strongly emphasises the application of information in real-world contexts and the growth of critical thinking abilities. Innovative teaching strategies, including gamification, coaching, and flipped classrooms, have also been implemented to improve student learning (Gómez-Ejerique & López-Cantos, 2019). These approaches give students chances for problem-solving and self-directed learning while actively involving them in the educational process.

Another innovative strategy Russian institutions have used for teaching foreign languages is peer learning (Bolshak & Voloshina, 2020). Students are encouraged to learn from and alongside their classmates via this approach, which is also the foundation of the SITT model. This promotes cooperation and active engagement. The SITMS project addressed these challenges by implementing innovative teaching strategies and fostering collaborative learning environments. Therefore, this study aims to bridge the existing research gap by investigating the transformative impact of the SITMS pilot project in Zambia. By employing a descriptive phenomenological research design and drawing upon transformative learning theory, this research delves into the lived experiences of diverse participants, exploring shifts in attitudes, teaching methodologies, and student learning attitudes.

2. About the SITMS project

The main aim of the School-Based In-Service Teacher Mentorship and Support (SITMS) project is to address the critical need for continuous professional development among in-service teachers in Sub-Saharan Africa. Focusing on secondary schools in Tanzania, Kenya, and Zambia, the project adapts and scales up the School-Based In-Service

Teacher Training (SITT) Model developed by HELVETAS, an NGO in Tanzania, from 2021 to date. Emphasising the succeeding nine fundamental elements, this initiative aims to enhance the professional growth of teachers, empower students, and improve the overall quality of basic education. The elements are discussed in no order below:

i. **Peer Learning:** One of the core components involves encouraging teachers to engage in mutual knowledge exchange, fostering a sense of empowerment and collaboration within the teaching community. Teachers learn from one another's experiences through this approach, enhancing their teaching methods and effectiveness. Peer learning also applies to learners as the project encourages them to collaborate.

ii. **SITT Team:** The project demands setting up specialised teams within schools, consisting of teachers, administrators, and individuals with organisational skills. These teams work collectively to create a supportive environment conducive to peer learning. By fostering a collaborative culture, these teams facilitate the sharing of innovative teaching techniques and best practices among educators.

iii. **Model Lessons:** Another essential aspect of the project is the organisation of model lessons. Experienced teachers showcase effective teaching methods, inviting feedback from their peers. This process encourages continuous improvement, allowing teachers to refine their skills based on constructive input, leading to enhanced teaching practices in the classroom.

iv. **Team Teaching:** Collaboration among teachers is promoted through team teaching. This method ensures the active participation of every teacher in the teaching process, including the topics they find challenging to teach. Teachers can manage large classrooms effectively by working together, ensuring each student receives personalised attention. This approach benefits students and strengthens the teamwork spirit among teachers.

v. **Pupils Participation:** The project emphasises the active involvement of students in the learning process. Students are encouraged to participate actively, enabling them to develop essential skills and confidence. Teachers recognise and nurture students' potential, fostering a dynamic and engaging classroom environment.

vi. **Use of Local Materials:** Using locally available resources as teaching aids makes education practical and relatable. By incorporating familiar materials, teachers

can create a more engaging learning experience for students, making education accessible and relevant to their everyday lives.

vii. **Practice-Based Learning:** Integrating practical examples from daily life into the curriculum allows teachers and students to learn through hands-on experiences. This approach bridges the gap between theoretical knowledge and practical application, enhancing the learning experience and promoting a deeper understanding of the subject matter.

viii. **Health and Environment:** The project addresses public health issues within schools, promoting hygiene and a clean environment. Additionally, students and teachers collaborate to improve the school environment by planting trees, creating gardens, and implementing sustainable practices. This instils a sense of responsibility and fosters a positive and healthy atmosphere conducive to learning.

ix. **Inclusiveness:** The STMS project focuses on creating an inclusive educational environment. By paying attention to the needs of all students, including those with disabilities, the project ensures that every child has an equal opportunity to gain experience and participate.

Through these efforts, the project promotes a diverse and supportive learning environment that caters to the unique requirements of each student, fostering an atmosphere of acceptance and understanding within schools. Below is the visual representation of the SITT model:

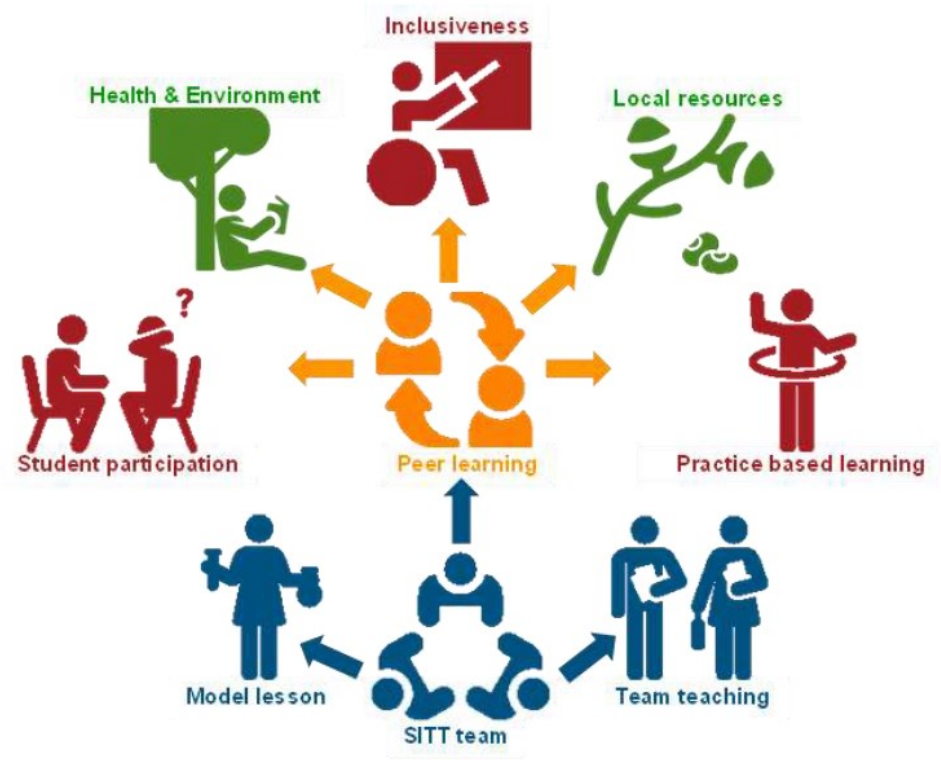

Figure 1: SITT Model from SITT Manual

3. Theoretical underpinning

This study is underpinned by the transformative learning theory, a concept developed by Mezirow in 1991. Transformative learning theory posits that learning is not merely acquiring knowledge but a profound shift in one's perspective and understanding of the world. Transformative learning occurs when individuals critique their beliefs, attitudes, and assumptions, leading to a fundamental re-evaluation of their worldview. In education, transformative learning theory emphasises the importance of challenging existing cognitive structures and fostering a deep, reflective engagement with new knowledge and experiences.

One of the critical concepts in transformative learning is the "disorienting dilemma," which is the first phase of Mezirow's theory (Van Schalkwyk, et al., 2019). A disorienting dilemma is an experience or event that challenges an individual's beliefs and assumptions, creating a sense of confusion, uncertainty, and discomfort. In the case of the SITMS project in Zambian secondary schools, this dilemma could have arisen from the perceived difficulty of the subject, in this case mathematics, or traditional teaching methods that fail to engage students effectively.

Critical reflection is the second tenet of transformative learning (Mezirow, 2018). This involves self-examining and questioning one's assumptions and beliefs (Carter & Nicolaides, 2023). This process allows individuals to critically analyse their experiences, values, and perspectives and consider alternative viewpoints. By engaging in critical reflection, individuals can gain new insights, challenge their preconceived notions, and develop a more nuanced understanding of themselves and the world around them (Carter & Nicolaides, 2023). In the context of this study, teachers and students engaged in critical reflection by questioning traditional teaching methods, exploring innovative pedagogical approaches, and evaluating their influence on learning outcomes.

Dialogue and discourse with others form the third tenet of Mezirow's transformative theory. In Mezirow's theory, critical discourse is seen as an ontological act that supports an individual's critical reflection (Hyde, 2021). It involves engaging in constructive dialogue with others, sharing perspectives, and challenging dominant discourses. Through critical discourse, individuals can gain new insights, expand their understanding, and develop alternative ways of thinking. In the context of this study, collaborative discussions, peer interactions, and mentorship programmes are considered to have played a vital role in challenging existing viewpoints and fostering new ways of thinking. In the SITMS initiative, dialogue and discourse occurred during learning and sharing workshops, mentorship sessions, lesson delivering and collaborative problem-solving activities.

Transformative learning moves beyond reflection and dialogue to action and implementation. Schnepfleitner and Ferreira (2021) believe that to facilitate transformative learning, it is essential to actively engage learners and encourage their participation in the learning process. This can be achieved through experiential and action learning, where learners can apply their knowledge and reflect on their experiences (Preget, 2023). By engaging with the concepts presented in the context, learners can develop a deeper understanding and challenge their existing assumptions and expectations (Schnepfleitner & Ferreira, 2021). In the context of this study, we assumed that individuals could, after transforming, apply their newly acquired knowledge and perspectives in real-life situations. Teachers implemented innovative teaching methods, and students applied new learning strategies, transforming the

classroom dynamics and learning experiences, and some skills became transferable to real-life situations.

The goal of transformative learning is a change in perspective. This is about developing perspectives that challenge established ways of thinking and lead to new ways of understanding the world (Schalkwyk et al., 2019). This change in perspective is characterised by an awareness of one's own and others' perspectives and expectations, followed by a critical evaluation of their relevance (Taimur, Onuki, & Mursaleen, 2022). The transformative learning process can involve two types: one that directly leads to perspective transformation and another that involves critical self-reflection and disorienting dilemmas before reaching perspective transformation (Son, Ishikawa, Yonekura, & Nakayama, 2023). In other words, change in perspective is about individuals developing new ways of understanding, interpreting, and responding to the world around them. In the context of the SITMS project, this change could have manifested as increased enthusiasm for mathematics, improved problem-solving skills, and a positive attitude towards learning.

To sum up, the transformative learning framework provided a lens through which the SITMS initiative's influence on teachers and students could be analysed. By examining how disorienting dilemmas were addressed, observing critical reflection and dialogue among participants, analysing the actions and implementations resulting from the initiative, and assessing the change in perspectives, this study aimed to unravel the transformative potential of SITMS in teaching and learning in secondary schools of Zambia. Through this theoretical framework, the study explored the surface-level changes in teaching methods and the more profound, transformative shifts in attitudes, beliefs, and approaches to learning and teaching mathematics (Mezirow, 1997).

4. Methodology

This qualitative research aimed to investigate how the SITMS pilot project transformed teaching and learning in the pilot schools. The study examined the experiences of participants about their SITMS project.

4.1. Research Design

This study employs a Participatory Research (PR) design to investigate the transformative impact of Zambia's Strengthening In-service Teacher Mentorship and Support (SITMS) pilot project. PR is simply an umbrella term for research designs that involve systematic inquiry in direct collaboration with stakeholders affected by the studied issue, prioritising the co-construction of research for action or change (Cargo & Mercer, 2008).

Participatory Research (PR) is deliberately chosen for this study to actively involve key stakeholders, including college representatives, teachers, and students, in investigating the transformative impact of the Strengthening In-service Teacher Mentorship and Support (SITMS) pilot project in Zambia. PR's emphasis on collaborative inquiry aligns seamlessly with the study's objectives, promoting a comprehensive understanding of diverse perspectives. This approach is particularly apt for the SITMS project, which seeks to observe and actively contribute to positive changes in teaching and learning practices. By fostering the co-construction of knowledge, PR ensures that insights and experiences are collaboratively shaped by those directly engaged in the educational interventions, enhancing the study's validity and depth. Furthermore, PR's focus on contextual understanding, ethical considerations, and holistic examination of transformative processes makes it an ideal framework for capturing the multifaceted nature of educational interventions and their impact on diverse stakeholders (Cargo & Mercer, 2008).

4.2. Participants and Data Gathering Process

To ensure a comprehensive representation of diverse experiences, participants in the SITMS research were purposefully selected from various educational contexts. Each of the seven project colleges, situated in the Zambian provinces of Copperbelt, Lusaka, Central, Luapula, and Southern, contributed three (3) representatives to the project. These individuals, comprising a college principal and two mathematics lecturers, amounting to 21 participants from 7 project colleges. They gave reports and shared their experiences with the STMS project implementors during the interactive learning and sharing workshop. The dialogical nature of these workshops eased the capture of their experiences, particularly concerning the schools affiliated with their colleges. These

participants also served as regular supervisors for secondary school teachers, shaping our data-gathering process.

Additionally, the project implementers included thirty-five (35) headteachers and seventy (70) mathematics teachers from secondary schools who actively took part in various project activities. Each of the seven colleges was associated with five secondary schools, represented by two (2) teachers and their respective headteachers. Consequently, 140 school employees participated in the project activities, providing the primary data source for this study. Furthermore, during the midline survey, focus groups of ten (10) students from each participating school were formed, resulting in thirty-five (35) focus groups encompassing all pilot schools. Additionally, during school monitoring visits, seven (7) students were randomly selected for interviews, with one (1) interview conducted per cluster of five (5) affiliated schools connected to each of the seven (7) institutions. These students played a significant role in the project's implementation, offering testimonies regarding the tangible changes observed in their schools through learning and sharing sessions, monitoring visits, and midline surveys. Their testimonials and responses during the midline survey significantly influenced the emergence of themes in this study.

Furthermore, the programme's execution was overseen by five (5) Provincial Resource Centre Coordinators (PRCCs) and seven (7) District Resource Centre Coordinators (DRCCs), with each of the seven colleges situated within a specific district and province. These coordinators were crucial in coordinating the implementation efforts at the provincial and district levels.

4.3. Analysing the Data

Using a thematic analysis method based on Braun & Clarke's (2006) methodology, themes and patterns were found in the data. Thorough coding and ongoing comparison methods improved the trustworthiness and dependability of the data (Braun & Clarke, 2006). Cross-validation of results across participant categories ensured consistency. Data triangulation improved the findings' robustness by verifying the emerging themes and patterns. The emerging themes related to transformative teaching and learning arranged the interpretations. The themes were presented with great care, providing a thorough description of events that both teachers and students went through.

4.4. Ethical consideration

Informed consent was guaranteed, and ethical clearance was obtained from the participants. Identity protection was provided using pseudonyms.

5. Findings

5.1. Status quo prior to SITMS

Among other things, this initiative started with a baseline to map out the experiences and practises of instructors using transformative teaching approaches. Even though SITT's components were applicable in all classroom situations, the study focused on mathematics teachers who were part of the pilot project. The baseline research revealed a complex scenario where the aspirational objective of transformative teaching practices was far-fetched. The need to use teaching-specific standard teaching aids highlighted the scarcity of resources, the teachers' lack of improvisational abilities and skills, and the students' unfamiliarity with such aids since they did not match their real-life experiences.

Once strong, mentoring programmes were said to be ineffective, with informal efforts struggling with time limits and commitment concerns and formalised programmes losing their attractiveness. The negative attitudes of both teachers and learners hampered mathematics performance.

Before the SITMS initiative was introduced, the transformative potential of teaching was further impeded by gender inequities, lack of gender-responsive pedagogies, limited teacher-student relationship, detachment of mathematics from real-world experiences, dominant theoretical learning through teacher-cantered pedagogies and lack of limited practice-based learning initiatives.

The baseline also uncovered issues related to large class sizes, poor ICT integration, and difficulties with inclusion in the learning environment. Some of these problems were made worse by the COVID-19 epidemic, which further decreased the already scarce meaningful student-teacher contacts and increased task pressure.

Transformative teaching and learning were necessary to address these problems that impeded effective teaching. For these reasons, the transformational character of the SITMS project in Zambia's pilot secondary schools is presented in this study.

5.2. Transformative nature of SITMS project through SITT model in Zambia

The results of the project's learning and sharing workshops, midline surveys, and monitoring visits revealed a change in the pedagogical strategies used in Zambian classrooms. Building on the theoretical foundations of the SITT model and transformative learning, the investigation of these ideas in 35 project schools highlighted their concrete influence on instructional strategies and student experiences, which were covered in six (6) themes:

5.2.1. Attitude Change as a Transformative Teaching Foundation

Our findings from the project monitoring visits, midline survey, the learning and sharing workshop activities and interviews proved how the SITMS pilot project shifted mathematics teachers' attitudes, moving away from traditional and exam-focused methods to more creative and engaging approaches in the classroom. During the enlightening learning and sharing workshop, a teacher articulated:

> The SITMS project rekindled my enthusiasm for teaching. I transitioned from rote methodologies to interactive approaches. Presently, I see my students actively engaged and genuinely excited about learning.

These changes revitalised teachers' enthusiasm for teaching and provided a sense of purpose, creating vibrant and interactive learning environments for their students.

Similarly, students' attitudes towards mathematics point to transformation. As confirmed by a student interviewee, "Math used to be scary, but now it's fun. Our teacher makes it real, showing how it's in everything we do. We're not afraid anymore; we enjoy learning." From this, we can see that traditionally viewed as a daunting subject, introducing real-world applications and practical examples made mathematics more accessible and enjoyable. Students embraced the subject with newfound enthusiasm, recognising its relevance in their daily lives. This positive change in attitude towards learning fostered a more engaging and fulfilling educational experience.

5.2.2. Transformational Transition to Inclusivity

Our research of the project's activities showed a move toward inclusive teaching methods. Equipped with a mentality based on the SITT model, educators actively incorporated inclusive teaching practices into their classrooms. Inclusive methods

created cooperative learning settings where students of all backgrounds and skill levels engaged fully in the instruction. as confessed by one teacher during the learning sharing workshop:

> . . .Inclusivity changed our classroom dynamics. Students collaborate, work in groups to learn from one another, and respect differences. It's not just about teaching but building a supportive community. . ..

The extract above shows how the SITMS project, through its SITT model, potentially encourages collaboration and teamwork, not competition, in the learning environment. The findings prove how this gradual adoption of peer learning resulted in students feeling more accepted and respected by one another. In turn, this improved the learning environment's general inclusiveness.

5.2.3. Collaborative Knowledge Construction and Experiential Learning

One central tenet of the educational revolution this research saw is the development of experiential learning and the collaborative construction of knowledge. Teachers used the SITT model's components, allowing students to participate in practical exercises, solve real-world problems, and think critically. Students gained a more profound knowledge of mathematical ideas via hands-on experiences and active exploration. These experiences were enhanced by incorporating teacher and student-made teaching aids (see Figure 2), which turned them into co-creators of knowledge.

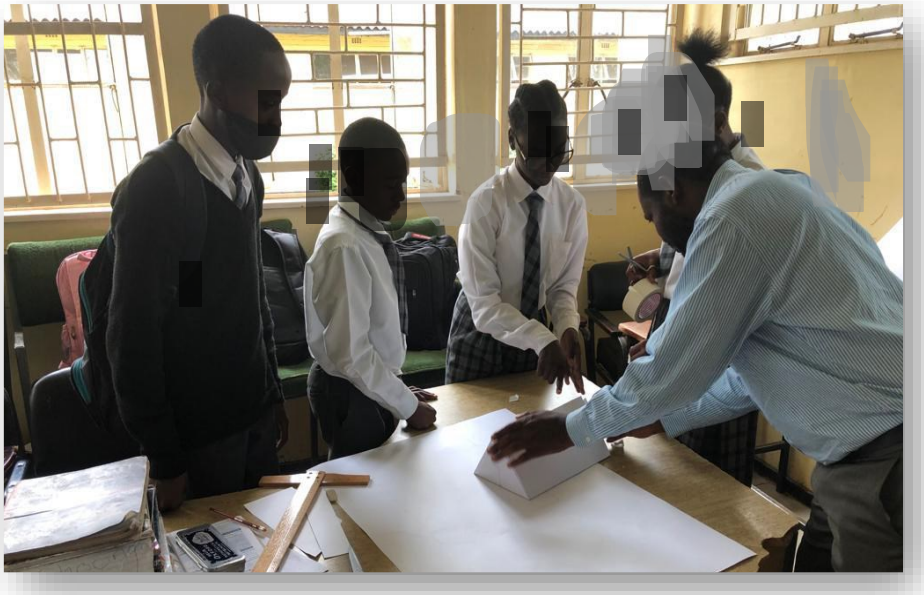

Figure 2: Source- Field Data during monitoring visits

As can be seen even from Figure 2 above, teachers and students engaged in joint sense-making. This made them actively construct knowledge through dialogue, shared experiences, and collaborative activities.

5.2.4. Symbiotic Teacher-Student Relationships

The theme of symbiotic teacher-student relationships emerged as a prominent aspect of the findings. An educational leader who took part in monitoring the project reported,

> I've seen during our monitoring of the SITMS project a positive shift in teaching practices during this project. Teachers collaborate more, adapt their methods to connect with students' backgrounds and foster relationships. It's making education more dynamic and inclusive.

This theme highlights the reciprocal influence between teachers and learners. Teachers, acting as facilitators, nurtured supportive and inclusive environments where students felt empowered to voice their thoughts and contribute to the learning process. This symbiotic relationship fostered a sense of belonging and active engagement among students, enhancing their motivation and learning experiences.

5.2.5. Transformative Communities of Practice and Collaborative Teaching

Our results further suggest that collaborative teaching practices were promoted and woven into the teaching and learning environment. Teachers created working groups,

planned lessons, exchanged ideas, and collaborated to teach and solve issues. The transformative side of these communities of practice can be noted in the words of the head of the mathematics department during the monitoring visit at one project school in the Copperbelt region of Zambia:

> The social SITT model was a game-changer. It pushed us to engage in team teaching and form workgroups. This improved our teaching methods and created a supportive environment where we could collectively address challenges.

The ideas of the SITT model, which encouraged a broad interchange of team teaching and workgroup formation, provided momentum for these joint efforts. Teachers reported increased motivation and participation in school-based mentorship and support initiatives that bolstered their abilities to teach mathematics, reviving the dwindling school-based Continuing Professional Development (CPD) programmes that the baseline had revealed before SITMS implementation. The communities of practice aided in balancing the strengths and weaknesses of mathematics instructors.

5.2.6. Pedagogical Adaptation with Contextualisation

Another emerging theme from our findings was contextualised pedagogical adaptation, emphasising the significance of adjusting instructional techniques to pupils' unique cultural and contextual backgrounds. This highlighted how teachers changed their teaching techniques to suit the needs of their students by bringing in local resources and real-world experiences in the learning environment. In most schools, teachers and students had already started mathematising the environment (see Figure 3), as emphasised in the SITT project.

Figure 3: Mathematising the environment as observed during monitoring visits

The observed trend of mathematising the environment in all pilot schools shows a shift in the pedagogical paradigm from class-centred activities to incorporating the surrounding environment. The visual representation in Figure 3 underscores the tangible manifestation of this thematic adaptation, portraying the integration of mathematics into the everyday surroundings of both teachers and students.

6. Discussion of findings

The shift in teachers' attitudes towards more creative and engaging teaching methods signifies a paradigmatic change in pedagogical approaches. Mezirow's transformative learning theory elucidates this transformation, emphasising the importance of disorienting dilemmas, critical reflection, and dialogue. The teachers' change in attitude aligns with the theory's emphasis on challenging existing beliefs and assumptions. Moreover, it resonates with Bedford's (2022) study, showcasing how teacher empowerment can lead to sustainability in educational practices. This shift is fundamental as it redefines the role of teachers from mere disseminators of knowledge to facilitators of meaningful learning experiences.

The move towards inclusive teaching practices echoes the ethos of collaborative learning environments advocated by Phusavat et al. (2017). Inclusivity fosters students' sense of belonging and acceptance, aligning with Mezirow's focus on critical discourse

and dialogue. The cooperative learning settings facilitated by inclusive teaching methods provide a platform for students to engage actively in the learning process. This theme resonates with Bautista's (2021) findings, emphasising the revitalisation of teachers' perceptions and innovative practices through project-based learning initiatives. It underscores the importance of collaborative efforts in transforming teaching practices, ensuring that no student is left behind.

The emphasis on hands-on experiences and active exploration underscores the SITMS model's commitment to experiential learning. The collaborative knowledge construction mirrors Schnepfleitner and Ferreira's (2021) argument about the importance of actively engaging learners. Mezirow's transformative learning theory comes to life here, where critical reflection and dialogue translate into tangible actions and implementations. The co-creation of knowledge by teachers and students challenges traditional hierarchical structures, fostering a participatory learning environment. This collaborative approach enriches students' learning experiences and empowers them to contribute meaningfully to constructing knowledge.

The symbiotic relationship between teachers and students is a testament to the transformative potential of mutual respect and active engagement. Mezirow's theory emphasises the importance of critical self-reflection and dialogue, and this theme exemplifies the practical application of these principles. The nurturing of supportive and inclusive environments where students feel valued and heard aligns with the concept of transformative communities of practice. Collaborative teaching and problem-solving among teachers further reinforce the idea of shared learning spaces. This theme emphasises the importance of interpersonal relationships in educational transformation, echoing the sentiments of Hyde (2021) about the interplay between ontology and epistemology in transformative learning.

The emergence of collaborative teaching practices within the SITMS initiative signifies a shift from isolated classrooms to interconnected learning communities. The formation of work groups and mentorship programmes highlights the significance of social learning in transformative educational experiences. The emphasis on collaboration and peer interactions resonates with Mishra and Koehler's (2006) emphasis on technological pedagogic content knowledge. By actively engaging in communities of practice,

teachers enhance their pedagogical skills and integrate technology effectively. The collaborative approach fosters a sense of collective responsibility for student learning outcomes, transcending individual limitations.

The theme of contextualised pedagogical adaptation underscores the importance of tailoring teaching techniques to students' cultural and contextual backgrounds. This theme aligns with practice-based learning and competency-based education principles, as highlighted by Brătianu et al. (2020). The emphasis on mathematising the environment and incorporating real-world experiences aligns with the principles of transformative learning theory, emphasising perspective transformation. Students' ability to relate mathematical concepts to their everyday lives challenges the detachment of mathematics from real-world experiences, fostering a deep understanding of the subject.

7. Implications, limitations, and recommendations

7.1. implications

The findings of this study have several implications for educational policy, teacher training programmes, and classroom practices. Firstly, educational policymakers can use the insights gained from this research to design comprehensive in-service teacher training programmes that emphasise transformative pedagogies. The success of the SITMS model highlights the effectiveness of collaborative learning environments and experiential learning methods. Teacher training programmes can integrate these practices, fostering a culture of continuous improvement and innovation.

Secondly, the study underscores the importance of fostering symbiotic relationships between teachers and students. Teacher education programmes should emphasise developing interpersonal skills and effective communication strategies. Additionally, mentorship programmes and communities of practice can be institutionalised to provide ongoing support and professional development opportunities for teachers.

Thirdly, the emphasis on contextualised pedagogical adaptation highlights the need for culturally responsive teaching practices. Teacher training programmes should equip educators with the knowledge and skills to adapt teaching methods to students' diverse

cultural backgrounds. This cultural competence is crucial for creating inclusive and supportive learning environments.

7.2. limitations

While this study provides valuable insights into the transformative potential of the SITMS model, some limitations should be considered. Firstly, the research focused on a specific context (Zambian secondary schools), limiting the generalisability of the findings to other educational settings. Future research could explore the applicability of the SITMS model in diverse cultural and socio-economic contexts. The study also focused on qualitative findings from the project activities. Future studies may consider employing a mixed method to evaluate the impact of the SITMS project on students' academic performance.

7.3. Recommendations for policy and practice

Based on the findings, this study provides the following recommendations:

i. The Ministry of Education should take the lead in integrating the SITT model into teacher training programmes. They should collaborate with educational experts and institutions to design comprehensive curricula on collaborative teaching, experiential learning, and cultural competence.
ii. Teacher training institutions should revamp their curricula to incorporate the SITT model. They should train their faculty members to deliver courses based on collaborative teaching methods, experiential learning approaches, and cultural responsiveness.
iii. Regulatory bodies responsible for accrediting teacher training institutions should update their guidelines to include criteria related to integrating transformative pedagogies, specifically the SITT model. They should monitor and evaluate institutions' compliance with these criteria to maintain the quality of teacher education.
iv. School administrators should encourage and facilitate the formation of collaborative learning communities within schools. They should provide necessary resources, such as meeting spaces and technological support, to enable teachers to engage in collaborative planning and sharing of best practices.

v. Teachers should actively participate in professional development programmes on the SITT model. They should embrace collaborative teaching practices, incorporate experiential learning activities in their lessons, and adapt their teaching methods to their students' cultural backgrounds.

vi. Researchers should conduct longitudinal studies to assess the long-term impact of the SITT model on students' academic achievements, social skills, and overall well-being.

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Declaration of Interest

The authors state no conflicts of interest in publishing this study. The study was done with academic and scientific integrity, and the results and conclusions given in this work are based on examining the obtained data with no outside influence or prejudice.

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