BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

STEM TEACHING AND LEARNING AT PRIMARY SCHOOL LEVEL. A CASE STUDY OF A PRIMARY SCHOOL IN GOROMONZI DISTRICT.

BY

MAPURANGA CONISTANCE

B225898A

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIRMENTS OF THE BACHELOR OF SCIENCE HONOURS DEGREE IN MATHEMATICS

YEAR 2025

APPROVAL FORM

The undersigned certify that they have supervised, read and recommended to Bindura

University of Science Education for acceptance a research project

entitled……

Submitted ……in partial fulfillment of the requirement of the Bachelor of Science Education Honours Degree in Mathematics

Signature …… Date …../…../……

(Student)

Signature …….. Date ……. /……. /……

(Supervisor)

Signature ……. Date ……../……. /……..

(Programme coordinator)

Signature …… Date ……/……/……..

(Faculty chairperson)

Signature ……... Date ……../……/……

(External Examiner)

RELEASE FORM

NAME OF AUTHOR: …….STUDENT

NUMBER: …….PROJECT

TITLE: …….DEGREE: HONOURS

BACHELOR OF SCIENCE EDUCATION, MATHEMATICSYEAR AWARDED:

2024Permission is hereby given to Bindura University of Science Education library to produce single copy of this dissertation for private, scholarly or scientific research purposes only. The author reserves other publication rights and the dissertation or extensive extracts from it may not be printed or otherwise reproduced without the author's written permission

Signature ……..Permanent

Address ……Email……

……..Cell

number ……

ACKNOWLEDGEMENTS

I extend my most profound appreciation to God for the valuable blessing of life, immovable wisdom that has empowered me to complete this study. I would like to appreciate my academic supervisor, Dr.G Sunzuma, for her extraordinary direction, support, and skill all through this inquire about travel. Her priceless experiences and valuable criticism have been vital in my study. I am thankful to specific my earnest appreciation to the school head, teachers, and learners who taken part within the interviews. Their participation and help have been important in educating this research. On an individual note, I am thankful to my spouse for his unflinching bolster, support, and devotion all through this scholarly endeavor. His selflessness and commitment have been a consistent source of inspiration, empowering me to total my study.

Abstract

This study investigated the challenges faced by primary school teachers in teaching Science, Technology, Engineering and Mathematics -based subjects, the impact of teachers' lack of training and expertise on students' understanding and performance, and strategies to support teachers in effectively delivering STEM lessons. The study was conducted at a Primary School in Zimbabwe. The study aimed to investigate the specific challenges faced by primary school teachers in teaching STEM-based subjects despite lacking specialized training, examine the impact of teachers' lack of training and expertise on students' understanding and performance and identify strategies to support teachers in effectively delivering STEM lessons . The study employed a mixed-methods approach, combining both qualitative and quantitative data collection and analysis methods. Data was collected through questionnaires, focus group discussion s and interviews. The study revealed that primary school teachers faced numerous challenges in teaching STEM-based subjects, including lack of specialized training, inadequate resources, and insufficient support. The study also found that teachers' lack of training and expertise significantly impacted students' understanding and performance in STEM subjects. Furthermore, the study identified several strategies to support teachers in effectively delivering STEM lessons, including professional development programs, collaborative planning, and access to resources and technology. Based on the findings, the study recommends that the Ministry of Education and schools provide primary school teachers with specialized training and support in teaching STEM-based subjects. Additionally, schools should provide teachers with access to resources and technology to enhance STEM teaching and learning. Finally, the study recommends that teachers engage in collaborative planning and professional development programs to improve their teaching practices and student outcomes.

STEM Teaching and Learning at Primary School Level: A Case Study of Ruvheneko Primary School

Contents

Chapter 1: Introduction to the Study

1.0 Introduction

The world is fast developing into a technocratic world. It is of paramount importance that all countries work towards growing in the aspect of technology. This calls for primary schools to implement initiatives such as STEM so that learners can be fully equipped with solutions to some of the technical problems that the world is facing. Hence the need to carry out this study. This chapter discusses the background of the study and gives the statement of the problem. The research objectives and research questions aligned to the topic under study are also presented in this chapter. This chapter also highlighted some important aspects such as the significance of the study, delimitations, limitations as well as the definition of key terms.

1.1 Background to the Study

Like any other country, Zimbabwe has been on a drive to introduce STEM in schools starting from primary school. In order to take a closer look at how STEM is being implemented in Zimbabwe, it would be ideal to first look at what STEM is from a Zimbabwean perspective. A definition by Madusise (2019) alludes that STEM is an approach that prepares learners to utilise mathematical skills to solve real-life problems using engineering and design principles. This implies that STEM is an educational approach that focuses on ensuring that learners acquire knowledge and skills using technology, problem-solving skills, and critical thinking skills.

STEM was introduced in Zimbabwean primary schools so that learners would start to develop critical skills at a tender age. The aims and objectives that are in the new curriculum were aimed at ensuring that learners start acquiring knowledge and skills whilst they are still in primary school. There are several reasons why STEM was introduced in the Zimbabwean curriculum.

According to Mberi and Phambili (2016), STEM was introduced in order to develop in the learner's skills that are needed for the country's new industrialization thrust. It is imperative that the learners are imparted with knowledge and skills that would enable them to be self-sufficient. Mukomana (2019) also alludes that once the learners are equipped with these skills, this would enable the country to address the problem of unemployment. This aim is aligned to the principles of STEM, thus marking the introduction of STEM in the primary school in 2016.

Exposing learners to STEM whilst they are still in primary school also prepares them for career life. At the primary school level, STEM education lays the foundation for future academic and career success. According to Mutseekwa (2012), the STEM project was designed to promote STEM careers, in response to Zim Asset's human capital objectives. There are several skills that the children acquire from STEM concepts. These skills are very vital for them as they prepare to go to work when they grow up. In Zimbabwean schools, learners are exposed to STEM principles at a tender age because that is in the curriculum. By exposing students to STEM concepts and practices early on, they can develop critical thinking, problem-solving, and hands-on skills that are essential for navigating the 21st-century workforce (Mukomana, 2019). They can be able to navigate through any technological challenges that they may face using the skills acquired from STEM learning.

In 1999, the then Zimbabwean president ordered an inquiry to be conducted in regards to the education system of the country. The main aim of this inquiry was to make sure that education should produce citizens who are well-rounded and competitive on the global market. According to Mberi and Phambili (2016), in 2015, the Ministry of Primary and Secondary Education introduced the new curriculum which incorporated STEM principles. The Ministry of Higher and

Tertiary Education, Science and Technology Development (2016) further agrees that STEM provides an environment for the development of invaluable competencies such as problem solving, critical thinking, creativity, teamwork, communication skills, and conflict resolution. All these competencies were included in the new curriculum that was introduced by the ministry. Chitate (2016) agrees that the new curriculum made a shift from a curriculum which put focus on knowledge acquisition to a curriculum that focuses on the learner's capacity to apply knowledge and skills.

The Commission of Inquiry that was conducted gave indications that the learners in the country were lacking technical skills which they need after finishing school. Among the recommendations from this inquiry was the need to ensure that learners are equipped with knowledge and skills that would enable them to be self-sufficient. According to Mapfumo (2015), the consultation process that was carried out pointed out the importance of promoting enterprise development and promoting the teaching of sciences, mathematics, technology, vocational subjects, and ICT. This led to the introduction of subjects that promoted entrepreneurship in the learners. Initially, this prompted the introduction of STEM in schools. Madusise (2019) posits that the STEM curriculum was introduced in the Zimbabwean curriculum in 2016. The Zimbabwean curriculum added subjects that are aimed at promoting self-sufficiency in the learners starting from primary school up to tertiary education. In the new curriculum, focus was put on subjects such as ICT, Science and Technology, and Agriculture. As such, there has been a concerted effort to strengthen STEM education at all levels, including the primary school level.

However, STEM teaching and learning has its challenges. Teachers have been facing challenges as they teach STEM concepts. Research suggests that primary school teachers often lack

confidence and feel underprepared to effectively teach STEM subjects (Chitate, 2016). Some of the teachers do not have a technological background. This usually emanates from the teacher training that they had. The training did not expose them much on the use of technology when teaching.

To address this issue, it is essential to understand the current state of STEM teaching and learning at the primary school level. Examining the challenges, barriers, and best practices in STEM education can inform the development of targeted professional development programs and curricular resources to support primary school teachers (Mukomana, 2019). Additionally, exploring students' attitudes, engagement, and learning outcomes in STEM can provide valuable insights into the effectiveness of STEM instruction and guide future instructional approaches (Mutseekwa, 2021).

This study aimed to investigate the current state of STEM teaching and learning at the primary school level, with the goal of informing and improving STEM education practices in this crucial stage of a child's academic journey.

1.2 Statement of the Problem

Globally, technological advancements have become the order of the day in every sector. This calls for schools to start engaging learners in activities that prepare them for the technological advancements. The introduction of STEM was a good initiative as it was meant to address the need to equip learners with technical skills that they may need after completing their education. Implementation of STEM in the classroom has presented challenges to most educators, hence the need for this study in order to look for strategies and interventions that can be implemented in order to support teachers as they implement STEM in primary schools.

1.3 Research Objectives

1. To investigate the specific challenges faced by primary school teachers School in Zimbabwe who are required to teach STEM-based subjects despite not having specialized training in the subjects.

2. To examine how teachers' lack of training and expertise in STEM impacts students' understanding and performance in the subject.

3. To identify strategies and interventions that can be implemented to support teachers at primary school in effectively delivering STEM lessons and improving students' learning outcomes in this subject area.

1.4 Research Questions

1. What are the specific challenges faced by primary school teachers at Primary School in Zimbabwe who are required to teach STEM-based subjects despite not having specialized training in the subjects?

2. How do teachers' lack of training and expertise in STEM impact students' understanding and performance in the subject?

3. What strategies and interventions can be implemented to support teachers at

Primary School in effectively delivering STEM lessons and improving students' learning outcomes in this subject area?

These research questions focused on understanding the challenges faced by primary school teachers in teaching STEM subjects, the impact on students' learning outcomes, and potential strategies for improvement

1.5 Assumptions

In carrying out this research, it was assumed that the school was already implementing STEM. Additionally, it was assumed that there were teachers at the school who had received training on STEM teaching. Furthermore, it was assumed that there were challenges being faced in the teaching of STEM concepts.

1.6 Significance of the Study

This study might be of significance to:

Facilitators: Data gathered from this study can be very helpful to facilitators as they would be informed on how lack of STEM training impacts student understanding. They would also be informed on the strategies to use in order to improve the teaching of STEM lessons. This would help in improving their teaching of STEM lessons.

The Researcher: To the researcher, data gathered would be helpful in enlightening the researcher on the impact of STEM training and expertise. As a classroom practitioner, the researcher would use that information in enhancing STEM teaching and learning.

School Administrators: School administrators would be guided by this study on their role in STEM teaching. This would guide the administrators on how they should assist teachers in improving STEM teaching.

Learners: The findings of this study can ultimately benefit learners by identifying ways to improve the teaching and learning of STEM subjects, leading to better academic outcomes and increased interest in STEM fields.

Policy Makers: Policy makers can use the findings of this study to inform education policies and initiatives related to STEM education, ensuring that teachers are adequately trained and supported to deliver effective STEM instruction.

Other Researchers: Other researchers can use findings from this study to further research on this topic. There are a lot of issues under this topic that can be researched on. Findings from this study can help in giving answers to other researchers on any topic they would be researching on that is related to this issue under discussion.

1.7 Limitations of the Study

In order to fulfil the objectives of the study, it would have to overcome the following

Challenges:

Time Constraint: One of the challenges that the researcher is likely to face is limited time to carry out this research. The researcher is a full-time teacher so time may be a challenge to her. In order to curb this shortcoming, the researcher would mostly use her weekends and any other spare time that she may find to carry out this research. The researcher would also have to ask for some days off from her work so that she can go and get some assistance from her supervisor.

Financial Constraints: The researcher is also likely to face financial challenges. She may need money to travel to the university to see the supervisor. She may also later on need money to print

the final copy of the dissertation. To overcome this, the researcher would try to limit the costs by doing most of the communication with the supervisor using electronic mail and WhatsApp.

1.8 Delimitations of the Study

This study would be conducted at a primary school. The school is in Goromonzi District. The school is being used because it is implementing STEM in teaching and learning. This will give the researcher more information on how STEM is being implemented. It is estimated that data will be collected in four months and the data would be analysed in a month. The study is expected to be finished in a period of five months.

1.9 Definition of Key Terms

STEM: Cinar et al. (2016) posited that STEM is an interdisciplinary approach of teaching science, technology, engineering, and mathematics using the engineering design process with idefined problems emanating in real-life situations. According to Madusise (2019), STEM is an approach that prepares learners to utilise mathematical skills to solve real-life problems using engineering and design principles.

Teaching: Teaching in the Zimbabwean context refers to the process of guiding and facilitating learning among students in schools, with a focus on achieving the competences and standards outlined in the Zimbabwean Curriculum Framework (Ministry of Primary and Secondary Education, 2015, p. 12).

Learning: Learning in Zimbabwean schools involves students actively engaging with the curriculum content, participating in lessons, and constructing new knowledge and understanding through experiences and interactions with teachers and peers (Mugweni, 2017, p. 23).

STEM Teaching and Learning: STEM education in Zimbabwe integrates concepts and practices from science, technology, engineering, and mathematics to develop skills and competences that prepare students for the demands of the 21st century (Chikwata, 2019, p. 15).

Primary School Level: Primary education in Zimbabwe refers to the first stage of formal education, spanning from Grade 1 to Grade 7 (ages 6 to 13), as outlined in the Zimbabwean Education Act (Ministry of Primary and Secondary Education, 2016, p. 20).

Case Study: A case study involves an in-depth examination of a specific school, classroom, or educational program to gain a detailed understanding of the context, challenges, and successes, and to inform policy and practice (Mawere, 2018, p. 10).

1.10 Chapter Summary

This chapter highlighted the introduction, background of the study, problem statement, research questions, and research objectives. The delimitations of the study area and limitations of the research and definition of terms were also included in this chapter. The next chapter looks at what other authorities say with regards to the implementation of STEM in primary schools.

Chapter 2: Literature Review

2.0. Introduction

This chapter focused on the review of related literature. The purpose of this literature review is to provide critical insight into the topic, thereby enabling the researcher to find ways of relating the research problem to those of others in order to have a better understanding of the topic. It also helps the researcher link concepts from other sources to research.

2.1Introduction of main concepts

STEM includes all the umbrella disciplines of science, technology, engineering, and mathematics. Cinar et al. (2016) posited that STEM is an interdisciplinary approach to teaching science, technology, engineering, and mathematics using the engineering design process with ill-defined problems emanating from real-life situations. Sanders (2009) as cited in Kelley and Knowles (2016) views integrated STEM education as an effort to combine some or all of the four disciplines into one class, unit, or lesson based on connections between the subjects and real-world problems. Integration can take many forms. Hurley (2001) in Guzey et al. (2016) presented five levels of integration: sequential, parallel, partial, enhanced, and total integration. These integrations comprise a combination of different subjects being taught together. The approach, however, seems to limit integration to only two subjects, mathematics and science.

A STEM curriculum is aimed at developing competencies like collaboration, design, construction, communication, information and technology literacy, social and cultural awareness, creativity, critical thinking, and problem-solving, all anchored on the engineering design approach (Meyer & Jackson, 2016). The engineering design approach involves identifying and defining problems, gathering information, identifying alternatives, selecting, implementing,

evaluating, and refining solutions with communication at the center of the process (Meyer & Jackson, 2016).

There are several approaches to teaching STEM. In Guzey et al. (2016), Jacobs outlined six comprehensive approaches. The first is the discipline-based approach, where separate subjects are taught in separate classes. The second is the parallel discipline, connecting separate disciplines to the same themes or topics. The third is the multidisciplinary approach, where some disciplines are taught together. The fourth approach is interdisciplinary units, making deliberate connections among subjects. The fifth is the integrated day, where disciplines are taught under a theme or a problem emerging from the child's world. Finally, the sixth approach is a complete program, achieving total integration with a curriculum based on students' everyday lives. Jacobs notes that a combination of two or more approaches is possible (Guzey et al., 2016).

Integrated STEM education entails combining subjects, using one subject to support the teaching of another, utilizing thematic approaches, and finding connections among disciplines. Tan and Leong (2014) viewed integrated STEM education as a way of thinking that cuts across all STEM disciplines. STEM is regarded as a set of skills required to engage fully in science, technology, engineering, and mathematics. Parker et al. (2015) articulated the need for STEM teaching models in curriculum design. According to Davies and Gilbert (2003) cited by Hallstrom and Schonborn (2019), a model is a representation of an idea, object, system, event, or process conveyed through concrete, visual, verbal, or gestural representation. Examples include 3D physical models, spoken/written descriptions, chemical formulae, diagrams, animations, and bodily representations of model entities (Hallstrom & Schonborn, 2019).

Researchers have conducted studies reinforcing the notion that models and modeling can be used as a springboard for integrated authentic STEM education. The aim of Hallstrom and Schonborn's (2019) study was to synthesize key publications investigating relationships between authenticity, models, modeling, and STEM education. Their findings indicate that authenticity is the cornerstone of STEM literacy and that models and modeling can bridge the gap between STEM disciplines. The authors argue that to promote an authentic model-based teaching approach, science teacher educators need to show trainee students what representational entities constitute a model, demonstrate the scope and limitations of different models and their functionality in demonstrating scientific concepts, and provide opportunities for model designing and construction activities.

2.2. Conceptual Framework

The conceptual framework for this study emphasizes the integration of STEM disciplines to enhance student understanding and engagement. By combining science, technology, engineering, and mathematics, the framework supports the notion that interdisciplinary connections foster a deeper comprehension of complex subjects. As Bybee (2013, p. 12) notes, "The integration of science, technology, engineering, and mathematics provides a comprehensive approach to education." This approach aligns with the goals of integrated STEM education, which aims to prepare students for real-world challenges by promoting critical thinking, creativity, and problem-solving skills. According to Honey et al. (2014, p. 5), "Integrated STEM education can help students develop a deeper understanding of the natural and designed worlds. "The framework justifies the exploration of how teacher training and pedagogical approaches can improve STEM education outcomes, as it provides a structured pathway for understanding the

interconnectedness of these disciplines.The conceptual framework provides a visual representation of the study's key concepts and relationships, helping to clarify the research focus and guiding the development of the research questions.

The framework involves various stakeholders, including:

Teachers: Responsible for designing and implementing integrated STEM lessons, providing guidance and support to learners, and assessing learner outcomes.

Learners: Actively engage with integrated STEM lessons, develop problem-solving skills, and apply critical thinking and creativity to real-world challenges.

Researchers: Investigate the effectiveness of integrated STEM education, identify best practices, and provide recommendations for improvement.

Policy Makers: Develop and implement policies that support integrated STEM education, allocate resources, and provide funding for STEM initiatives.

School Administrators: Provide leadership and support for integrated STEM education, manage resources, and facilitate professional development for teachers.

Parents/Guardians: Encourage and support learners' engagement with integrated STEM education, provide resources and opportunities for learners to explore STEM concepts outside the classroom.

The framework justifies the exploration of how teacher training and pedagogical approaches can improve STEM education outcomes, as it provides a structured pathway for understanding the interconnectedness of these disciplines.

2.3. Theoretical Framework

This study is grounded in John Dewey's Progressivism theory; however, more contemporary scholars have also emphasized the importance of experiential learning, collaboration, and problem-solving. For instance, Moon (2013) highlights the significance of experiential learning in promoting deep understanding and critical thinking. Similarly, Hmelo-Silver (2004) stresses the importance of collaborative problem-solving in developing critical thinking and communication skills. This theoretical framework is relevant to this study as it provides a lens for understanding the importance of teacher training and support in implementing effective STEM education.The theoretical framework provides a foundation for understanding the underlying principles and values that guide the study's research questions and methodology. It helps to establish the study's credibility and validity by connecting it to established theories and concepts.

In Progressivism, learners are given opportunities to carry out experiments, acquiring knowledge through active involvement. According to Williams (2017), this educational philosophy stresses that learners should test ideas through active experimentation, leading to hands-on experience. Engaging learners actively in the teaching-learning process enables better concept grasping than passive observation. The theory also promotes collaborative work, allowing learners to acquire knowledge through group tasks. Progressivism encourages group activity and problem-solving to facilitate cooperative learning strategies (Clement, 2016). Group problem-solving enhances idea sharing and skills development.

Dewey’s theory posits the teacher as a facilitator rather than the primary source of knowledge. The teacher’s role is to assist learners in acquiring knowledge through active participation.

According to Williams (2017), progressivisms believe education should focus on learners, allowing them to engage in activities to gain first-hand experience. The teacher's responsibility is to facilitate and provide guidance when learners face challenges, relevant to STEM skills.

Learner interests are paramount in teaching and learning. If education does not consider learners' interests, it becomes challenging for them to enjoy learning. According to Clement (2016), progressivisms center curricula on learners' interests and needs to provide opportunities for exposure and knowledge acquisition.

Progressivism also emphasizes learner abilities. According to Dewey (1997), monitoring learner abilities is crucial for providing relevant assistance. Classrooms consist of learners with diverse abilities, and these must be considered during instruction.

Additionally, Progressivism enhances problem-solving skills. Learners in the 21st century should be capable of independently solving problems, aligning with Dewey's focus on problem-solving (Slaughter, 2009). Active learner involvement is critical in the preaching-learning process.

The learning environment significantly influences teaching effectiveness. According to Primal (2010), the learning environment affects knowledge acquisition. A noisy environment, for example, can hinder concentration, making group work and problem-solving difficult.

The theoretical framework, grounded in John Dewey's Progressivism, emphasizes active learning and collaboration, which are essential for effective STEM education. Dewey asserts that learners should be engaged in hands-on activities that foster problem-solving skills, directly correlating with the goals of STEM education. The integration of these frameworks justifies the study by providing a foundation for exploring how teacher training and pedagogical approaches can

improve STEM education outcomes. They guide the research in investigating how teachers can effectively implement integrated STEM curricula, aligning with Dewey's principles of experiential learning and collaboration, ultimately aiming to enhance student performance in STEM subjects.

2.4. Related Literature

A survey of related literature uncovers a few studies that highlight different viewpoints of STEM education and its implementation. Research indicated that successful STEM educating practices are regularly connected to educator readiness and proficient improvement. For occasion, considers have appeared that instructors with solid foundations in STEM areas and progressing preparing are more successful in conveying coordinates STEM educational program. Besides, the part of hands-on, project-based learning has been emphasized as it implies to lock in understudies and upgrade their understanding of complex STEM concepts.

In addition, literature recommended that tending to value issues in STEM instruction is vital. Numerous studies point to incongruities in get to quality STEM education among distinctive statistic bunches. Efforts to bridge these crevices are basic for cultivating a more comprehensive environment that empowers all understudies to seek after careers in STEM areas.

2.5. Impact of Teacher's Lack of STEM Training on Students' Understanding and Performance

Research consistently showed that teachers' lack of training in STEM disciplines negatively impacted students' understanding and performance. When teachers felt unprepared or lacked confidence in their ability to teach STEM subjects, they may have resorted to traditional teaching

methods that did not engage students effectively. This led to disengagement and a lack of interest in STEM fields among students. Consequently, students missed out on developing essential skills in critical thinking, problem-solving, and innovation. Studies indicated that students taught by well-trained educators demonstrated better problem-solving abilities and a deeper understanding of STEM concepts, and were more likely to pursue STEM careers.

2.6. Strategies and Interventions to Support Teachers in Improving STEM Teaching and Learner Outcomes

To address the challenges faced by teachers in STEM education, various strategies and interventions have been proposed. Professional development programs focusing on integrated STEM teaching practices have been shown to enhance teachers' confidence and effectiveness. Collaboration among educators to share best practices and resources can also play a crucial role in improving STEM education. Additionally, providing access to quality instructional materials and technology can significantly enhance the teaching and learning experience in STEM subjects.

2.7. Chapter Summary

This chapter reviewed the literature relevant to the topic under study, including the conceptual and theoretical frameworks. Challenges faced by teachers in teaching STEM-based subjects, the impact of teacher training on student understanding and performance, and strategies to support teachers in STEM teaching were also discussed. The next chapter focuses on the research methodology followed in gathering data needed to fulfill the objectives mentioned in Chapter 1.

Chapter 3: METHODOLOGY

3.0 Introduction:

This chapter of the study explained how the research was carried out. The chapter presented the research approach, described the research design and the instruments used to conduct the research, and displayed the justification of the research instruments used. It also took into consideration the target population and the sample of the study. Additionally, it discussed the data collection and analysis procedures. All this comprised the research methodology.

3.1 Research Paradigm

This study utilized a pragmatic research paradigm (Onwuegbuzie & Leech, 2005). Pragmatic research is a research approach that focuses on practical outcomes and solutions to real-world problems (Creswell, 2014). The mixed methods approach is consistent with the pragmatic paradigm, as it allows for the combination of both quantitative and qualitative methods in order to gain a more comprehensive understanding of the research problem (Greene et al., 2017).

3.1.1: Philosophical Assumptions

The philosophical assumptions underlying this research are rooted in the pragmatic paradigm. Pragmatism suggests that knowledge is constructed through interactions with the environment and is shaped by practical consequences and real-world applications. This study acknowledges that both subjective and objective realities exist, and it emphasizes the importance of context in

shaping understanding. By utilizing mixed methods, the research embraces the complexity of human experience and recognizes that a single approach may not capture the richness of the phenomenon being studied.

3.2 Research Approach

According to Weiler, Makumbe and Jenami (2003), research approaches can either be quantitative or qualitative. Quantitative is the use of numerical data or data that have been quantified while qualitative is the use of non-numerical data or data that have not been quantified. Quantitative and qualitative data collection techniques and analysis procedures each have their own strengths and weaknesses (Smith, 1975). In order to seek convergence of results, this research was triangulated because the researcher used both qualitative and quantitative research methodologies. The findings from the quantitative helped to validate the findings from the qualitative, thereby making the research more reliable and credible. The application of these two methods allowed them to counterbalance the strengths of each other. Tashakkori and Teddlie (2003) say that "multiple methods are useful because they provide better opportunities to answer research questions and better evaluate the extent to which research findings can be trusted and inferences made from them."

Data collected through the use of qualitative and quantitative methods is analyzed concurrently when using the Mixed Methods approach. The use of both these approaches in a study ensures that data is thoroughly analyzed. Creswell and Clark (2007) further allude that the use of the mixed method approach ensures that the problem is understood better than using one approach. The weaknesses of one approach can be overridden by the strengths of the other approach. Hence

the need for the researcher to use the Mixed Methods Approach. The use of both these approaches in a study ensures that data is thoroughly analyzed. Creswell and Clark (2007) further allude that the use of the mixed method approach ensures that the problem is understood better than using one approach. The weaknesses of one approach can be overridden by the strengths of the other approach. Hence the need for the researcher to use the Mixed Methods Approach. Employing mixed methodologies in this study had its reasons. One reason for using the mixed methods in this study is that the shortcomings of one research methodology can be offset by the strengths of the other research strategy. According to Johnson et al. (2007), mixed methods blend aspects of qualitative and quantitative research methodologies in order to achieve a broad and deep understanding. The benefits of the qualitative research approach would outweigh its drawbacks, and vice versa. According to Greene (2007), this strategy gives researchers the chance to counteract unavoidable method biases, strengthen inherent method strengths, and make up for inherent method deficiencies. This provides ample justification for the researcher to employ hybrid approaches.

The Mixed Methods Approach was also used in this study because it makes use of three or four different data collection methods. The different data collection methods that are used in the mixed methods complement each other. Creswell and Clark (2007) posit that the triangulation design is one which seeks to gather complimentary yet distinctly different data on the same topic which can then be integrated for analysis and interpretation. The results of the qualitative data that is gathered are merged with the results of the quantitative data, then analyzed. A thorough analysis of these results leads to the results which are credible and authentic. This has pushed the researcher to use this method so that credible results on STEM teaching and learning in primary school can be achieved.

There are drawbacks to the mixed methods. Its requirement for an expert to ensure the results are trustworthy is one of its drawbacks. The method of gathering data is likewise very labor-intensive. The primary difficulty in utilizing mixed approaches, according to Almalki (2016), is that it takes a lot of work and experience to bring everything together. By dividing up the study tasks that must be completed throughout the data collecting, the researcher would lessen this problem. This would enable the researcher to dedicate a great deal of time and energy to STEM education. This will make it possible for the researcher to obtain reliable results. Combining qualitative and quantitative data provides a more complete understanding of the research topic (Denzin, 1978). Mixed methods also allow for both in-depth exploration (qualitative) and generalizable findings (quantitative) (Creswell, 2014). Mixed methods enable the researcher to adapt to emerging themes and issues during data collection (Morse, 2015).

A research design is a detailed plan that outlines how a research study will be conducted, including the methods for collecting and analyzing data, in order to answer research questions or address research problems (Saunders et al., 2019). This study employed the descriptive research design. McNabb (2010) defines descriptive research design as a scientific method which involves observing and describing the behavior of subjects without influencing them in any way. Descriptive research is a type of research that seeks to provide a detailed account of a particular phenomenon or population (Creswell, 2013). It is often used in exploratory research, as it allows the researcher to gain a better understanding of the phenomenon or population under study. The major objective of this type of research was to describe the data and characteristics about the case under study. This type of research studies frequencies, averages, variances, and many more other statistical calculations. This design was chosen because it is widely used to obtain data useful in evaluating, presenting, and providing a basis for decision-making in qualitative and

quantitative form which this research intends to achieve (Bell, 1993). The descriptive research design utilizes data collection instruments such as questionnaires, interviews, and observation (Chiromo, 2009). The researcher chose the descriptive design because questionnaires, focus group discussions, and interviews were used for data collection.

Descriptive research is an appropriate choice for this study, as it allows the researcher to gain a comprehensive understanding of the current state of STEM teaching and learning at Primary School (Creswell, 2013). The use of descriptive research will allow the researcher to identify any areas for improvement, as well as to make recommendations for improving the current situation (Johnson & Onwuegbuzie, 2004). The use of descriptive research would also allow the researcher to identify any patterns or trends in the data. For example, if the researcher finds that certain teaching methods are more effective than others, this can be used to inform future research and practice. Additionally, the use of descriptive research will allow the researcher to identify any gaps in the current understanding of STEM teaching and learning at the primary school level, which can be used to inform further research.

3.4 Population

Cohen and Manion (2007) say that population is the specification of the total number of individuals who are going to be involved in the research study either directly or indirectly. Neuman (2009) points out that a population is the whole gamut of the targeted elements. It is a form of conglomeration of all the elements or subjects of interest to the researcher's mind and research spectrum. Population can be viewed as the totality of objects from which a sample is

selected. Best and Kahn (2006) define population as any group of individuals that have one or more common features of interest that distinguishes that group from other individuals. Weiler et al. (2003) also view population as all members of a real or hypothetical set of people from which a researcher wishes to generalize the results of research. It thus implies that in research, the population of study may include individuals, artifacts, or organizations involved in the study. The target population for this study is the 35 primary schools in Goromonzi District. The researcher selected a primary school as the sample for the study, as the researcher is a teacher at the school and had access to the necessary data and stakeholders (Creswell, 2013). This selection was also made to minimize travel costs, as the school is in close proximity to the researcher's residence. The researcher used this school because it is the school where she teaches. The researcher chose this school for various reasons. One reason is that, since she teaches at the school, the researcher opted to use this school because she wants to seek solutions for improving the teaching and learning of STEM at the school. The school's STEM program is relevant to the research topic. The school administration also granted permission for the research to be conducted. The other reason is that the school is closer to her, making it cheaper for her to get all the relevant information she needs in order to obtain accurate data. From this population, that is where the sample that will be used in this study will be drawn.

3.5 Sample Size

According to Dees (2010), a sample is a finite part of a statistical population whose properties are studied to gain information about the whole. The sample size for this study is 34 participants, which were selected from a total population of 3100 learners, 51 teachers, and 4 administrators. The sample includes 20 learners (10 males and 10 females), 10 teachers (5 males and 5 females),

and 4 administrators (head, deputy heads, senior teacher, and TIC). The learners were selected using a stratified sampling technique, while the teachers and administrators were selected using a purposive sampling technique.

3.6 Sampling Technique

The purpose of this section is to describe the sampling techniques used in this study. The researcher selected Primary School using purposive sampling and then used three different sampling techniques to select the participants for the study.

3.6.1 Purposive Sampling

Purposive sampling is a sampling technique where the researcher selects participants based on specific characteristics or knowledge that are relevant to the research study (Cohen, Manion, & Morrison, 2007). The researcher used purposive sampling to select the school administrators for the study. This included the school head, deputy head, and TIC. Purposive sampling was chosen because these administrators had a unique

perspective on the current state of STEM teaching and learning at Primary School, and their input would be valuable in developing recommendations for improvement. School administrators were selected because they also had specific knowledge and experience that would be useful in understanding the current state of STEM teaching and learning at Primary School.

The researcher used purposive sampling to choose the school. The researcher works at the school, so she purposefully chose the school to avoid much traveling when carrying out the research. She also purposefully chose the school because she knows the state of STEM teaching and learning at the school. The researcher needed to find out the challenges that the school is

facing regarding STEM teaching and learning. This would then enable the school to get strategies which they can use to improve the teaching and learning of STEM at the school.

3. 6.2 Simple Random Sampling

Simple random sampling is a method where each member of a population has an equal chance of being selected for inclusion in a sample (Chiromo, 2006). The researcher used simple random sampling to select five groups of grade five learners from the population of 64 learners. The researcher placed the names of all learners in a hat and selected 20 learners by randomly picking papers from the hat. The 20 learners who picked papers with the word "yes" on them were selected for the focus group discussions.

3.6.3 Stratified Random Sampling

Stratified random sampling is a sampling technique where the population is divided into subgroups and a random sample is taken from each subgroup (Neuman, 2009). Stratified random sampling would also be used to select ten teachers from the 51 teachers at the school, who would be administered questionnaires. The teachers are the respondents in this study. According to Neuman (2009), in stratified random sampling, the population is divided into subgroups and a random sample is taken from each subgroup. The researcher would put male teachers and female teachers in two groups. Five male teachers would then be randomly selected from the group of male teachers. Five female teachers would also be randomly selected from the female group. The researcher hopes to ensure that both genders are represented in this study.

3.7 Methods of Data Generation

In this study, data would be generated using focus group discussions, interviews, and questionnaires.

3.7.1 Questionnaires

This study would make use of questionnaires in examining STEM teaching and learning in primary school. The questionnaires would be completed by ten teachers at a Primary School. The questionnaire would be used to answer all the three questions that were set in chapter one. A questionnaire is an instrument of data collection consisting of standardized questions relating to the research topic to be answered in writing by participants (Bless, Smith & Sithole, 2013). Information is obtained from the respondents using well thought out and systematically written questions.

Questionnaires were going to be used in this study because they give the respondents enough time to air out their views. When completing questionnaires, respondents do this in the absence of the researcher. This gave them enough time to think about what they want to write. Respondents have enough time to give well thought-out answers (Patton, 2002). Questionnaires were used in this research because they are helpful in comparing the answers of the different respondents.

Questionnaires, according to Jha (2014), are argued to be inadequate to understand some forms of information that is changes of emotions, behavior, and feelings. Questionnaires ask only a limited amount of information without explanation. The researcher will overcome this by using the focus group discussion as another research tool.

3.7.2 Focus Group Discussions

A focus group discussion is a form of group interviewing in which a small group is led by a moderator or interviewer in a loosely structured discussion of various topics of interest (Dees, 2010). In this study, the researcher will conduct focus group discussions with five groups of four learners from Primary School. The course of the discussion would be planned in advance, and the researcher would rely on an outline or moderator guide to ensure that all points of interest are covered. The information given by the learners would be useful to the researcher in examining STEM teaching and learning in primary school. The focus group discussions would be used to answer all the three questions from chapter One. The researcher opted to use focus group discussions because they provide more detailed information from the respondents. According to Neuman (2009), focus group discussions provide rich, qualitative data on participants' thoughts, feelings, and experiences. As the researcher was probing for more information, respondents provided more detailed information on STEM teaching and learning.

The researcher also opted for focus group discussions because they are time efficient. Quite a considerable amount of data was collected from several respondents in a short space of time. Jha (2014) agrees that focus group discussions allow researchers to collect data from multiple participants simultaneously. The researcher made use of five groups, and each group had four learners. Data on STEM teaching and learning was collected from twenty learners in a short space of time.

3.7.3 Structured Interviews

Structured interviews were used in this study. The researcher interviewed the school administrators regarding STEM teaching and learning. The school head, deputy head, the

teacher in charge and the senior teacher were interviewed by the researcher. The course of the discussions will be guided by an interview guide which the researcher would prepare before the interviews.

According to Bless, Smith, and Sithole (2013), an interview is a method of gathering data in which research participants respond to a set of questions on the subject of the study. According to Kothari (2001), an interview is a dialogue or conversation that is started by the interviewer in order to gather information for a study while keeping the interview's goals in mind. The researcher will make use of structured interviews in trying to gather data on the teaching and learning of STEM.

Finding additional information is one of the main benefits of doing structured interviews. Participants in structured interviews get the chance to provide additional in-depth details. Structured interviews with the head of the school and the deputy head will be done for this project. They would provide details on how the child protection policies in ECD have an impact. According to Cohen and Manion (2011), structured interviews enable respondents to provide extensive details on their thoughts, feelings, and opinions. An additional benefit of conducting organized interviews is that the investigator can obtain prompt and immediate answers from the subjects. Structured interviews, according to Cohen and Manion (2011), can allow the researcher to receive prompt answers to queries. Subsequent inquiries can subsequently be posed by the researcher. The participant's body language can be observed by the researcher, who can also pose follow-up queries. This contrasts with a questionnaire in which the participant's expressions are not visible to the researcher during completion. A few of these statements are pertinent to the research and could lead to specific inferences about the subject and the subject matter.

In order for the researcher to maintain consistency during the interview, the researcher would make an interview guide before the interview. This guide would help the researcher not to deviate from the topic under study. One of the disadvantages of structured interviews is that they may consume a lot of time. Some questions that the researcher may ask would come from the responses given by the participant. According to Neuman (2009), during an interview, the researcher may ask follow-up questions in relation to the responses being given by the respondent. This may consume a lot of time. In order to curb this shortcoming, the researcher will make strict adherence to the interview guide.

3.8 Data Analysis

Denzin and Lincoln (2011) define data analysis as a process of examining and interpreting data in order to come with answers. The process consists of examining, categorizing, tabulation and combining evidence to address the initial proposition of a study. In this study, the researcher would use thematic analysis to analyse the gathered data. Data gathered from focus group discussions, interviews and questionnaires would be presented using themes. The themes were formulated from the research questions that were used in chapter one. The researcher would tabulate some of the information gathered from questionnaires.

3.9 Data collection procedures

Data collection procedures are methods used in the administration of data collection instruments and processes. Permission to conduct the research was obtained from the Head of the school. At the school, ten teachers would be asked to fill a questionnaire to collect quantitative data. Focus group discussions would be conducted after. The discussions would be centred on the teaching and learning of STEM. The administrators would be interviewed on different intervals using

guidelines from the interview guide. All the responses would be noted down and would be contributed to consolidation of data from various other instruments used in the study.

3.10 Validity and Reliability

It is important for the research to produce results that are valid and reliable. The study

should ensure that the information obtained is accurate.

3.10.1 Validity

According to Cohen, Manion, and Morrison (2007), validity is the ability of a measurement tool to alter directly using a measure of a comparable build or indirectly using a measure of an inverse development. Frankel and Wallen (2000) define validity as the attribute that is connected to how closely they adhere to the standards of knowledge or truth. It describes the range of values that an instrument should have or is capable of measuring. It's possible that the study instruments will yield unavowable outcomes or be invalid. Validity tests must be performed on the instruments to ensure that they would yield reliable results. The questionnaires will be designed with input from the supervisors of the contents to ensure the validity of the instruments. Subsequently, the supervisor made adjustments to validate the research instruments.

3.10.2 Reliability

The stability or consistency of test results and assessment methods' scores is referred to as reliability. According to Mugenda & Mugenda (2003), a researcher's instrument's reliability is determined by how consistently it produces data or outcomes after multiple trials. In order to guarantee reliability, Mugenda and Mugenda (2003) propose that the test-retest technique can be used in two specific situations to address consistency in the way survey or test items are

addressed or people's scores stay relatively unchanged. Using this strategy, the same group would receive the questionnaire as a pilot test at one-week intervals, and the results would be compared. The instrument would be improved and adjusted based on feedback from the pre-testing responders.

3.11 Ethical considerations

There are some ethical considerations that have to be observed when carrying out this study. These help in ensuring that the process followed when conducting the study do not infringe with the rights of the participants. Among the ethical considerations is confidentiality and morality, informed consent, voluntary participation and avoidance of harm. This study was conducted with strict adherence to ethical principles. To ensure the rights and privacy of participants were protected, the researcher obtained the necessary permissions and approvals. Permission to conduct this study was obtained from the Ministry of Primary and Secondary Education. Additionally, informed consent was sought from participants, who were assured of confidentiality, anonymity, and the right to withdraw from the study at any time. Voluntary participation was emphasized, and measures were taken to avoid causing harm or discomfort to participants.

3.11.1. Informed consent

Prior to conducting any research, all stakeholders involved were informed of all the specifics of the project. It is important to let them know what they are getting into. Frankel and Wallen (2000) states that this is an agreement made between the participant and the researcher on participation in a study after the participant has been provided with all relevant information regarding the study. The participant may be required to sign consent forms that provide

information about the study, if that is feasible. The participant must be informed of the advantages, time commitment, and potential hazards of participating in the study by the researcher. Before they agree to participate in the study, the respondents were informed of the research objectives.

3.11.2 Confidentiality and anonymity

Participants were assured by the researcher that all sensitive information submitted would be kept confidential and would not be accessed by anyone else. The researcher must maintain participant confidentiality in order to respect their right to privacy. Kothari (2001) states that maintaining respondent confidentiality requires maintaining the privacy of the information they submit. In order to prevent participant names from appearing in the research, the researcher may choose to utilize pseudonyms.

3.11.3 Avoidance of any harm

It is necessary to take precautions to guarantee that study participants won't suffer any harm or pain. According to Denzin and Lincoln (2011), there should be no chance of participants suffering damage as a result of their involvement in a study when they volunteer for it. Participants would be shielded from danger, both psychological and bodily. Therefore, no embarrassment, offence or distress would be brought upon participants.

3.11.4. Voluntary participation

It should be voluntary for participants to take part in the study. False representations should not be used to trick them into participating. Participants should be informed that their participation in the study is optional before any research is undertaken. According to Denzin and Lincoln (2011),

informing participants that their involvement in the study is choice and shouldn't be forced upon them is necessary for voluntary participation.

3.13 Summary

This chapter looked at the research methodology that would be used in this study. The chapter also examined the research design that would be adopted in this study and why it was chosen. The researcher explained the population target in this chapter. The sampling procedures that would be taken were also described and explained. Data gathering instruments which would be used in this study were also explained in this chapter with a detailed explanation on how each of these instruments would be used. The chapter also looked at data collection procedures, data presentation and data analysis. The next chapter is going to look at data presentation and analysis.

Chapter 4: Results and Discussion

4.0: Introduction

This chapter presents the discoveries of the study, which explored the challenges and opportunities faced by teachers and learners in actualizing STEM educational program at Primary School. As a case to consider, this investigate aimed to investigate the particular setting of STEM educating and learning at the primary school level, with a center on recognizing the variables that impact instructive results. The discoveries of this study are significant in giving insights into the current state of STEM education at Primary School, highlighting the strengths and shortcomings of the current usage, and illuminating techniques for improvement. The chapter is organized into a few segments, each focusing on a particular subject that has risen from the data analysis. These topics are connected to the research questions, which pointed to investigate the challenges and opportunities faced by teachers and learners in actualizing STEM educational program, and to recognize procedures for making strides STEM instruction at Primary School. The discoveries are displayed in a way that coordinating the voices of teachers and learners, giving a wealthy and nuanced understanding of the complexities of STEM educating and learning.

Through a point by point investigation of the discoveries, this chapter looks for to realize several objectives. To begin with, it aims to provide a comprehensive understanding of the current state of STEM instruction at primary school, counting the challenges and openings confronted by teachers and learners. Moment, it looks for to recognize the variables that impact instructive results in STEM subjects, counting the part of instructor proficient improvement, educational modules plan, and asset accessibility. At last, the chapter points to illuminate techniques for

making strides STEM education at Primary School, counting suggestions for educator proficient improvement, educational modules change, and asset assignment. By showing the discoveries of this consider, this chapter contributes to the existing body of information on STEM instruction, highlighting the significance of context-specific inquiries about in illuminating methodologies for change. The chapter moreover gives an establishment for future investigate, counting ponders that look for to investigate the viability of particular interventions pointed at making strides STEM education results.

4.1: Data Presentation and Discussion

Research Objective	Theme	Sub-Themes
1. To investigate the specific challenges faced by primary school teachers in Zimbabwe who are required to teach STEM-based subjects despite not having specialized training in the subjects.	Theme 1: Resource Limitations and Infrastructure Challenges	1. Physical Resource Deficiencies 2.Inadequate Learning Environments 3. Budget Constraints
2. To examine how teachers' lack of training and expertise in STEM impacts students'	Theme 2: Training and Professional Development Needs	1. Specialized STEM Training 2. Ongoing Professional

understanding and performance in the subject.		Development 3. Collaboration and Experience Sharing 4. Addressing Curriculum Changes
3. To identify strategies and interventions that can be implemented to support teachers at primary school level in effectively delivering STEM lessons and improving students' learning outcomes in this subject area.	Theme 3: Student Engagement and Performance Issues	1. Understanding Complex Concept s2. Interactive Learning Methods 3. Foundational Knowledge Gaps 4. Emotional and Psychological Barriers

4.2*: Resource Limitations and Infrastructure Challenges*

Primary schools often face challenges in providing effective STEM education due to limited resources and inadequate infrastructure

4.2.1: Physical Resource Deficiencies

This theme is characterized by responses highlighting the lack of essential resources, including textbooks, laboratory equipment, and technology infrastructure. Data from a questionnaires for teachers, Focus Group Discussion for learners and interview guide for administrators show that

Teacher 10 stated that *"The lack of resources means we cannot provide the hands-on experiences that are crucial for understanding STEM concepts." This points to the essential role of practical experiences in enhancing student comprehension of STEM subjects.*

Group A also said, *"We don't have enough textbooks and resources to support our learning." This reflects the students' need for adequate materials to facilitate their educational experience.*

Deputy Head mentioned that, *the lack of science equipment and materials hinders our ability to provide hands-on experiences for students.*

Group B mentioned that "*The lack of science equipment and materials limits our ability to conduct experiments."* This indicates the students' desire for hands-on learning opportunities that are currently constrained by resource shortages.

Furthermore Deputy Head mentioned that, *the lack of science equipment and materials hinders our ability to provide hands-on experiences for students.*

Teacher 2 said that *"We have outdated textbooks that do not reflect current STEM practices."* This underscores the importance of having up-to-date educational materials to ensure students receive relevant information.

Teacher-In-Charge (TIC) also stated that *"We have to rely on outdated resources, which can lead to student disengagement"*

Teacher 5 asserts that *"Our students are missing out on digital literacy."* This emphasizes the necessity of integrating technology into the curriculum to prepare students for the digital age.

Teacher 1 mentioned that *"The absence of essential science lab equipment restricts our ability to conduct experiments*

.In support with this Deputy Head mentioned that .*The lack of science equipment and materials hinders our ability to provide hands-on experiences for students*...” This highlights the critical need for practical tools that enable effective STEM education. In line with this.

The Head also said that,*"We struggle to provide textbooks and resources for STEM subjects due to limited funding.*

Senor Teacher also mentioned that, *"The school's infrastructure is not conducive to supporting STEM education. This specifically shows that the resources necessary for STEM implementation are limited*

Respondents highlighted the lack of essential resources, including textbooks, laboratory equipment, and technology infrastructure, as a major challenge in teaching and learning STEM subjects. Teachers mentioned the absence of essential science lab equipment, outdated textbooks, and limited resources for interactive learning. Students also noted the lack of textbooks and resources, as well as limited science equipment and materials for experiments. Administrators cited limited funding, outdated resources, and inadequate school infrastructure as hindrances to providing quality STEM education. Research in Zimbabwe has also highlighted the importance of adequate resources in STEM education. For instance, a study by Majanga (2020) found that Zimbabwean schools face significant challenges in providing quality STEM education due to

limited resources, including textbooks, laboratory equipment, and technology infrastructure. Another study by Mhlanga (2019) noted that the lack of resources, including textbooks and science equipment, hinders the effective teaching and learning of STEM subjects in Zimbabwean schools.

4.2.2 : Inadequate Learning Environments

This theme emphasizes the importance of a conducive learning environment for effective teaching and learning. Data from questionnaires for teachers, focus group discussions for learners, and interview guides for administrators indicate that:

Teacher 1mentioned that *"Our classrooms are overcrowded, making it difficult to provide individualized attention."* This highlights the need for more spacious classrooms.

Similarly, Group A stated, *"Our classrooms are overcrowded, which makes it difficult to focus,"* reinforcing the students' struggle with concentration in cramped conditions.

Moreover, the Head remarked that *"Our classrooms are overcrowded, which can lead to student disengagement,"* further emphasizing the negative impact of overcrowding on student engagement.

Teacher 2 stated that *"The lack of proper ventilation in our classrooms can lead to health problems and decreased student productivity."* This underscores the importance of a healthy learning environment.

In a similar vein, Group C noted, *"The lack of proper ventilation makes it hard to stay*

alert and focused."

Additionally, Teacher 3 admitted that "*Insufficient lighting in our classrooms makes it difficult for students to read and write,"* which underscores the significance of adequate lighting.

Group D echoed this concern, stating, "*There isn't enough natural light, which makes it difficult to see our work clearly."*

Teacher 4 said, "*The environment is not conducive to interactive learning, which limits student engagement."* The Deputy Head also mentioned that "*The physical learning environment is not conducive to interactive learning, which limits student engagement."* This indicates a shared concern about the lack of spaces that promote collaborative and interactive learning experiences.

Teacher 7 pointed out that "*The lack of display spaces and storage areas in our classrooms limits our ability to showcase student work and organize materials."*

This sentiment was echoed by Group E, which stated, "We need more spaces where we can work together without distractions; the current setup is just not conducive to our learning."

Teacher 8 commented that "*The inadequate learning environment can lead to student disengagement and decreased motivation."*

This concern was supported by the Senior Teacher who pointed out that "*The inadequate learning environment can lead to decreased student performance, particularly in STEM subjects."*

Group B also mentioned, *"The physical learning environment is not conducive to learning, which affects our motivation,"* highlighting the urgent need for improvements.

Overall, respondents highlighted the necessity for a conducive physical learning environment to enhance student engagement and academic performance. Teachers emphasized issues like overcrowding, poor ventilation, and insufficient lighting, while students noted the impact of these conditions on their ability to learn effectively. Administrators called for flexible learning spaces to support interactive learning and improve student outcomes. Research supports these findings, indicating that physical classroom conditions significantly influence student's engagement and learning outcomes Barrett, P., & Zhang, Y. (2009). Optimal learning spaces: Design implications for educational buildings. Council of Educational Facility Planners International. Higgins, S., Hall, E., Wall, K., Woolner, P., & McCaughey, C. (2005). The impact of school environments: A literature review. Newcastle: University of Newcastle.

4.2.3: Budget Constraints

Budget constraints are a significant challenge faced by teachers at Primary School, impacting the quality and accessibility of STEM education. The responses from teachers, focus groups, and school leadership highlight the urgent need for increased funding and prioritization of STEM resources. Data from research instruments show that

Teacher 1 stated that "*The school's budget is limited, and priority is given to other subjects over STEM,"* emphasizing the need for prioritization of STEM education.

In addition, Teacher 2 mentioned that *"We lack the funds to purchase essential resources and materials for STEM education,*" thereby highlighting the importance of adequate funding.

Moreover, Teacher 3 admitted that *"Budget constraints limit our ability to provide hands-on experiences for students,"* which underscores the significance of practical experiences in STEM learning.

Similarly, Teacher 4 noted that *"The lack of budget for STEM education means we have to rely on outdated resources,*" indicating significant implications for student learning.

Additionally, Teacher 5 pointed out that "*Budget constraints hinder our ability to provide students with the technology they need to succeed in STEM,*" which highlights the critical role of technology in education.

Also, Teacher 6 emphasized that "*We need a dedicated budget for STEM education to ensure we can provide high-quality instruction,"* which would enhance student outcomes.

Furthermore, Teacher 7 observed that "*Budget constraints lead to a lack of innovation in STEM education, which can lead to student disengagement,"* suggesting long-term consequences for student engagement

. Likewise, Teacher 8 commented that "*The school's budget does not prioritize STEM education, which has significant implications for student learning*," highlighting the need for a review of budget priorities.

In addition, Teacher 9 mentioned that "*Budget constraints limit our ability to provide professional development opportunities for teachers in STEM*," which would enhance teacher capacity.

Lastly, Teacher 10 stated that "*The lack of budget for STEM education means we cannot provide students with the support they need to succeed,"* underscoring the necessity for increased funding.

Furthermore, Group A noted that "*The school's budget is limited, which means we don't have access to the resources we need,"* emphasizing the need for increased funding.

In addition, Group B pointed out that "*Budget constraints limit our ability to participate in science fairs and competitions,"* which can restrict opportunities for students.

Moreover, Group C stated that *"Without sufficient funding, we cannot organize field trips that enhance STEM learning,"* indicating how budget limitations affect experiential learning opportunities.

Similarly, Group D highlighted that *"The budget doesn't allow us to invest in new teaching methods or materials that could inspire students,"* which emphasizes the need for innovation. Additionally, Group E mentioned that "*Limited financial resources prevent us from collaborating with local businesses for STEM resources,*" underscoring the impact on community partnerships.

In addition, the head stated that *"The school's budget is limited, which means we have to prioritize spending on essential resources,"* highlighting the need for increased funding.

Similarly, the deputy head mentioned that *"Budget constraints limit our ability to provide professional development opportunities for teachers in STEM,"* which can hinder teacher effectiveness.

Furthermore, the TIC (Teacher in Charge) stated that *"The lack of budget for STEM initiatives means we cannot implement new programs that could benefit students,"* indicating a need for program expansion.

Moreover, the deputy head also revealed that *"Insufficient funds restrict our ability to upgrade classroom technology, which is essential for effective STEM teaching,"* further emphasizing the impact of budget constraints.

The literature supports these findings, indicating that inadequate funding restricts access to essential resources and training for teachers, thereby necessitating a prioritization of STEM in school budgets. As noted by Davies & Gilbert (2003), budget limitations significantly impact resources for STEM education and the implications for hands-on learning experiences, reinforcing the need for increased funding for STEM initiatives.

4 3: Training and Professional Development Needs

The effective integration of STEM education in primary schools requires teachers who are equipped with the necessary skills and knowledge. However, many teachers face challenges in accessing relevant training and professional development opportunities.

4.3.1: Specialized STEM Training

The need for specialized training in STEM subjects was a recurring theme among

teachers and administrators. This training is essential for teachers to effectively teach STEM subjects and to stay updated on the latest developments in STEM education. Data from

questionnaires for teachers, Focus Group Discussion for learners and interview guide for administrators

Teacher 1 said that *"I lack the specialized training needed to effectively teach STEM subjects."* Similarly, Teacher 2 mentioned that "*The school does not provide us with the necessary training to teach STEM subjects."*

Moreover, Teacher 4 pointed out that "*The lack of specialized training means I have to rely on outdated methods."*

Additionally, Teacher 8 said that "*The lack of specialized training means I struggle to answer students' questions."*

These responses highlight the need for specialized training to enhance teacher efficacy in teaching STEM subjects.

Teacher 3 noted that "*I need training on how to integrate STEM concepts into my teaching practices."*

Similarly, Group A mentioned that *"Specialized training would help us to better integrate STEM concepts into other subjects."*

These responses emphasize the importance of training teachers on how to integrate STEM concepts into other subjects to enhance interdisciplinary learning.

Teacher 5 said that *"I would benefit from training on how to use technology to support STEM education."*

Similarly, Group E mentioned that *"The school should provide us with specialized training on how to use technology to enhance STEM education."*

Additionally, the TIC noted that *"We need to prioritize specialized training for our teachers, especially in areas like coding and robotics."* These responses highlight the need for training teachers on how to use technology to support STEM education.

Teacher 10 said that *"The school should provide us with ongoing training and support to ensure we are equipped to teach STEM subjects effectively."*

Similarly, the Head mentioned that *"We need to provide our teachers with specialized training in STEM subjects to ensure they are equipped to teach effectively*."

Additionally, the Deputy Head noted that *"Specialized training would help our teachers to integrate STEM concepts into other subjects and enhance interdisciplinary learning."*

These responses emphasize the importance of ongoing training and support for teachers to effectively teach STEM subjects.

Supporting literature from recent Zimbabwean authors suggests that specialized training in STEM education is essential for improving teacher efficacy and student outcomes (Makura, 2017; Chakonda, 2019). Moreover, research has shown that ongoing training and support for teachers can lead to improved student engagement and performance in STEM subjects (Moyo, 2020).

4.3.2 : Ongoing Professional Development

The need for ongoing professional development emerged as a critical need for teachers to stay updated on the latest developments in STEM education. This theme highlights the importance of

continuous learning and support for teachers to effectively teach STEM subjects. Data from a questionnaires for teachers, Focus Group Discussion for learners and interview guide for administer

Teacher 1 said that *"I need ongoing professional development to stay updated on the latest developments in STEM education."*

Similarly, Teacher 4 mentioned that *"The lack of ongoing professional development means I struggle to integrate new technologies and methods into my teaching practices."*

Additionally, Group C noted that *"We need ongoing professional development to stay current with the latest technologies and methodologies."* These responses emphasize the importance of continuous learning and updating of skills for teachers to effectively teach STEM subjects.

Teacher 2 stated that "*The school should provide us with regular training and support to ensure we are equipped to teach STEM subjects effectively."*

Similarly, the Deputy Head mentioned that "*Ongoing professional development would help our teachers to better support students with different learning needs."*

Moreover, the TIC noted that *"We need to allocate more funds to support ongoing professional development for our teachers.*"

These responses highlight the importance of institutional support for ongoing professional development.

Teacher 3 noted that "*I would benefit from collaborative professional development opportunities with other teachers."*

Similarly, Group D mentioned that "*We need collaborative professional development opportunities to share best practices and learn from each other."*

These responses emphasize the importance of collaborative professional development opportunities for teachers to share best practices and learn from each other.

Teacher 5 stated that "*I need professional development opportunities that focus on pedagogy and classroom practice."*

Similarly, Teacher 6 mentioned that *"The school should provide us with opportunities for peer mentoring and coaching."*

Additionally, Group E noted that *"We need practical training and peer support to effectively implement new technologies and pedagogical methods."*

These responses highlight the importance of practical training and peer support for teachers to effectively implement new technologies and pedagogical methods. Supporting literature from recent Zimbabwean authors suggests that ongoing professional development is essential for teachers to remain effective in their practice, particularly in rapidly evolving fields like STEM (Makura, 2017; Chakonda, 2019). Moreover, research has shown that continuous learning opportunities, such as workshops and collaborative training sessions, can enhance teachers' ability to implement new technologies and pedagogical methods (Gus key, 2016).

4.3.3: Collaboration and Experience Sharing

The respondents stressed the importance of collaboration and experience sharing among teachers to enhance STEM education. Gathered data from the questionnaire, Focus Group Discussion and Interview Guide revealed the information below.

Teacher 1 said that *"I would benefit from opportunities to collaborate with other teachers to share best practices and resources."*

Similarly, Teacher 3 mentioned that "*I need opportunities to work with teachers from other schools to share best practices and resources."*

Additionally, Group A noted that "*We need opportunities to collaborate with other teachers to share best practices and resources."*

These responses emphasize the importance of teacher collaboration and sharing of best practices.

Teacher 2 stated that "*The school should provide us with opportunities to share our experiences and challenges with other teachers."*

Similarly, Teacher 9 mentioned that "*I would benefit from opportunities to participate in peer mentoring and coaching."*

Moreover, Group B noted that "*The lack of collaboration and experience sharing means we have to rely on our own resources and expertise."*

These responses highlight the importance of peer support and mentoring.Teacher 7 noted that "I need opportunities to work with teachers from other subjects to integrate STEM concepts into other areas of the curriculum."

Similarly, Teacher 10 mentioned that "*The school should provide us with opportunities to share our experiences and challenges with parents and the wider community."*

Additionally, Group C stated that "*We need opportunities to collaborate with other stakeholders, including parents and the wider community, to enhance STEM education."*

These responses emphasize the importance of interdisciplinary collaboration and community engagement. Collaboration among teachers is vital for professional growth and improving educational outcomes (Makura, 2017; Chakonda, 2019). Collaborative professional development models foster a culture of sharing and support among educators, which is vital for effective STEM instruction (Vescio et al., 2008).

4.3.4: Addressing Curriculum Changes

Addressing curriculum changes requires comprehensive training and support for teachers. The respondents highlighted the need for targeted professional development, resources, and collaboration to effectively implement the new STEM curriculum.

Teacher 1 said that "*I need training and support to effectively implement the new STEM curriculum."*

Similarly, Teacher 5 mentioned that *"I need training on how to assess student learning in the new STEM curriculum."*

Additionally, Group A noted that "*We need training and support to effectively implement the new STEM curriculum."*

These responses emphasize the importance of targeted professional development.

Teacher 2 stated that *"The school should provide us with resources and materials to support the new STEM curriculum."*

Similarly, the Deputy Head mentioned that *"We need to allocate more funds to support the implementation of the new STEM curriculum*."

These responses highlight the importance of adequate resources and materials.

Teacher 3 noted that "*I would benefit from opportunities to collaborate with other teachers to share best practices and resources for implementing the new STEM curriculum."*

Similarly, the TIC mentioned that "*We need to provide our teachers with opportunities for collaboration and experience sharing to support the implementation of the new STEM curriculum."* Additionally, Group C stated that *"We need opportunities to collaborate with other teachers to share best practices and resources for implementing the new STEM curriculum."*

These responses emphasize the importance of collaboration and experience sharing.

Teacher 6 mentioned that "*The school should provide us with opportunities for peer mentoring and coaching to support the implementation of the new STEM curriculum."*

Similarly, Teacher 9 stated that "*I need training on how to differentiate instruction to meet the needs of students with different learning needs in the new STEM curriculum."*

These responses highlight the importance of peer support and mentoring.

The Head stated that "*We need to provide our teachers with ongoing professional development opportunities to support the implementation of the new STEM curriculum."*

Similarly, the Senior Teacher mentioned that "*We need to prioritize ongoing professional development to ensure our teachers are equipped to implement the new STEM curriculum effectively."* These responses emphasize the importance of ongoing professional development. Addressing curriculum changes in STEM education requires comprehensive training and support for teachers. Targeted professional development, adequate resources, collaboration, and peer support are essential for effective implementation. Ongoing professional development opportunities can ensure teachers are equipped to implement the new STEM curriculum, ultimately enhancing student learning outcomes. Literature suggests that addressing curriculum changes requires comprehensive training and support for teachers (Makura, 2017; Chakonda, 2019). Effective implementation of new curricula has been linked to the availability of resources and materials, which directly impacts teachers' ability to deliver quality education (Borko, 2004). Research suggests that collaborative opportunities, such as professional learning communities and peer mentoring, significantly contribute to teachers' success in adapting to curriculum changes (Darling-Hammond et al., 2017).

4.4: Student Engagement and Performance Issues

Despite efforts to improve STEM education, many primary school students continue to struggle with engagement and performance in STEM subjects.

4.4.1: Understanding Complex Concepts

Understanding complex concepts is a significant challenge for students in STEM subjects. The respondents highlighted the need for innovative teaching approaches, hands-on experiences, and targeted support to help students grasp complex concepts.

Teacher 1 said that, "*Students struggle to understand abstract concepts in math and science."* Similarly, Teacher 3 mentioned that "We need to use more visual aids and multimedia resources to help students understand complex concepts.

“Additionally, Group A noted that *"We need to use more visual aids and multimedia resources to help students understand complex concepts."* These responses emphasize the importance of innovative teaching approaches.

Teacher 2 stated that "*The lack of hands-on experiences makes it difficult for students to grasp complex concepts."*

Similarly, the Deputy Head mentioned that "*The lack of hands-on experiences makes it difficult for students to grasp complex concepts, and we need to incorporate more experiments and simulations into our teaching practices."*

Additionally, Group B stated that *"The lack of hands-on experiences makes it difficult for students to grasp complex concepts, and we need to incorporate more experiments and simulations into our teaching practices."*

Group D also mentioned that "*Hands-on experiences are essential for students to understand complex concepts in STEM subjects."*

Teacher 4 pointed out that "*Students need more opportunities to ask questions and seek clarification on complex concepts."*

Similarly, Teacher 10 mentioned that "*Students need more support and scaffolding to understand complex concepts."*

Additionally, Group C noted that "*We need to provide students with more opportunities for self-directed learning and exploration to help them understand complex concepts."*

Group E also stated that "*Targeted support and scaffolding are crucial for students to understand complex concepts in STEM subjects."*

Teacher 8 pointed out that *"The lack of feedback and assessment makes it difficult for students to understand complex concepts."*

Similarly, the Senior Teacher mentioned that "*Students need more support and scaffolding to understand complex concepts, and we need to provide more feedback and assessment opportunities."*

The Head also noted that "*We need to provide our teachers with the resources and support they need to help students understand complex concepts in STEM subjects."*

4.4.2: Interactive learning methods

Interactive learning methods are essential for engaging students in STEM subjects. The respondents highlighted the importance of incorporating interactive learning methods, such as simulations, games, and hands-on activities, to make learning more enjoyable and engaging.

Teacher 1 mentioned that "*Interactive learning methods, such as simulations and games, make learning more enjoyable and engaging."*

Similarly, the Head stated that *"We need to incorporate more interactive learning methods, such as simulations and games, into our teaching practices to make learning more enjoyable and engaging."*

Additionally, Group A noted that *"Interactive learning methods, such as simulations and games, make learning more enjoyable and engaging, and we need to incorporate more of these methods into our teaching practices."*

Group C also mentioned that "*Simulations and games can help students to develop problem-solving and critical thinking skills*."

Teacher 2 stated that "*We need to incorporate more hands-on activities and experiments to make learning more interactive*."

Similarly, the Deputy Head mentioned that "*We need to use more hands-on activities and experiments to make learning more interactive."*

Additionally, Group B noted that *"We need to use more hands-on activities and experiments to make learning more interactive, and we need to provide more opportunities for students to engage in these activities."*

Group D also stated that "*Hands-on activities and experiments can help students to develop practical skills and apply theoretical concepts to real-world problems."*

Teacher 3 noted that "*Technology-enhanced learning methods, such as virtual labs and online simulations, can enhance student engagement."*

Similarly, the TIC mentioned that "*We need to use more technology-enhanced learning methods, such as virtual labs and online simulations, to make learning more interactive."*

Additionally, Group E noted that "*Technology-enhanced learning methods, such as virtual labs and online simulations, can help students to develop digital literacy skills and access a wide range of educational resources."*

Teacher 4 pointed out that "*Students respond well to interactive learning methods, such as group work and discussions."*

Similarly, the Senior Teacher mentioned that "*Students respond well to interactive learning methods, such as group work and discussions, and we need to provide more opportunities for these types of activities."* Additionally, Group A noted that *"Students*

respond well to interactive learning methods, such as group work and discussions, and we need to provide more opportunities for these types of activities."

Students in STEM subjects often struggle to grasp complex concepts. To address this, respondents emphasized the need for innovative teaching approaches, hands-on experiences, and targeted support. This includes using visual aids, multimedia resources, experiments, and simulations to help students understand abstract concepts. Additionally, providing opportunities for self-directed learning, feedback, and assessment are crucial for students to overcome challenges in understanding complex concepts. Research by, (Makura, 2017; Chakonda, 2019) highlight the importance of innovative teaching approaches and hands-on experiences in helping

students understand complex concepts in STEM subjects. These findings are consistent with international research, which emphasizes the need for targeted support and scaffolding to help students grasp complex concepts.

4.4.3: Foundational Knowledge Gaps

Foundational knowledge gaps are a significant challenge for students in STEM subjects. The respondents highlighted the need for targeted support, diagnostic assessments, and review activities to help students fill knowledge gaps. Data from questionnaire, Focus Group Discussion and interview Guide aired out the following insights

Teacher 1 mentioned that *"Students often lack basic math and science skills, which makes it difficult for them to understand complex concepts."*

Similarly, the Head stated that "*We need to provide more review and reinforcement activities to help students fill foundational knowledge gaps in STEM subjects."*

Additionally, Group A noted that "*Students often lack basic math and science skills, and we need to provide more review and reinforcement activities to help them fill these gaps."*

Group C also mentioned that "*Targeted support and review activities are essential for helping students fill foundational knowledge gaps."*

Teacher 2 stated that *"We need to provide students with more opportunities to review and reinforce foundational knowledge."*

Similarly, the Deputy Head mentioned that "*We need to use more diagnostic asse*Additionally*ssments to identify knowledge gaps and provide targeted support."*

, Group B noted that *"We need to use more diagnostic assessments to identify knowledge gaps and provide targeted support."*

Group D also stated that *"Diagnostic assessments are crucial for identifying knowledge gaps and providing targeted support."*

Teacher 3 noted that *"The lack of foundational knowledge makes it difficult for students to connect theoretical concepts to practical applications."*

Similarly, the TIC mentioned that "*The lack of foundational knowledge makes it difficult for students to connect theoretical concepts to practical applications, and we need to provide more opportunities for hands-on learning."*

Additionally, Group A noted that *"The lack of foundational knowledge makes it difficult for students to connect theoretical concepts to practical applications, and we need to provide more opportunities for hands-on learning."*

Group E also stated that *"Hands-on learning and practical applications are essential for helping students fill foundational knowledge gaps."*

Teacher 4 pointed out that "*Students need more support and scaffolding to fill knowledge gaps."*

Similarly, the Senior Teacher mentioned that "*Students need more support and scaffolding to fill knowledge gaps, and we need to provide more feedback and assessment opportunities."*

Additionally, Group B noted that *"Students need more support and scaffolding to fill knowledge gaps, and we need to provide more feedback and assessment opportunities."*

Group C also stated that "*Ongoing support and feedback are crucial for helping students fill foundational knowledge gaps."*

Foundational knowledge gaps pose a significant challenge for students in STEM subjects. To address this, respondents emphasized the need for targeted support, diagnostic assessments, and review activities. Students often lack basic maths and science skills, making it difficult to understand complex concepts. Providing review and reinforcement activities, hands-on learning, and practical applications can help fill knowledge gaps. Ongoing support, scaffolding, and feedback are also crucial for helping students build a strong foundation in STEM subjects. Recent studies by Zimbabwean authors highlight the importance of addressing foundational knowledge gaps in STEM subjects. For example, research by Chakonda (2019) emphasizes the need for diagnostic assessments and targeted support to identify and address knowledge gaps. Similarly, Makura (2017) stresses the importance of hands-on learning and practical applications in building a strong foundation in STEM subjects. These findings underscore the need for educators to provide ongoing support and scaffolding to help students fill foundational knowledge gaps.

4.4.4: Emotional and psychological barriers

Emotional and psychological barriers can significantly impact student engagement and performance in STEM subjects. The respondents highlighted the need for a supportive learning

environment, growth mindset strategies, and emotional support to help students overcome emotional and psychological barriers.

Teacher 1 mentioned that "*Students often experience anxiety and fear of failure when engaging with STEM subjects."*

Similarly, the Head stated that "*We need to create a safe and supportive learning environment to help students overcome emotional and psychological barriers in STEM subjects."*

Additionally, Group A noted that "*Students often experience anxiety and fear of failure when engaging with STEM subjects, and we need to create a safe and supportive learning environment to help them overcome these barriers."*

Group C also mentioned that *"A supportive learning environment is essential for helping students overcome emotional and psychological barriers."*

Teacher 2 stated that "*We need to incorporate more growth mindset strategies into our teaching practices to help students overcome emotional and psychological barriers."*

Similarly, the Deputy Head mentioned that "*We need to incorporate more growth mindset strategies into our teaching practices to help students overcome emotional and psychological barriers."*

Additionally, Group B noted that "*We need to incorporate more growth mindset strategies into our teaching practices to help students overcome emotional and psychological barriers."*

Group D also stated that "*Growth mindset strategies can help students to develop a positive attitude towards STEM subjects."*

Teacher 3 noted that "*The lack of emotional support and encouragement makes it difficult for students to persist in STEM subjects."*

Similarly, the TIC mentioned that "*The lack of emotional support and encouragement makes it difficult for students to persist in STEM subjects, and we need to provide more opportunities for positive reinforcement and encouragement*."

Additionally, Group A noted that *"The lack of emotional support and encouragement makes it difficult for students to persist in STEM subjects, and we need to provide more opportunities for positive reinforcement and encouragement."* Group E also stated that "*Emotional support and encouragement are essential for helping students to build confidence in STEM subjects."*

Teacher 4 pointed out that "*Students need more opportunities for feedback and assessment to build confidence."*

Similarly, the Senior Teacher mentioned that "*Emotional and psychological barriers hinder students' ability to participate in hands-on activities and experiments, and we need to provide more opportunities for feedback and assessment to help them build confidence."*

Additionally, Group B noted that "*Students need more opportunities for feedback and assessment to build confidence, and we need to provide more opportunities for positive reinforcement and encouragement. "*Emotional and psychological barriers can significantly hinder student engagement and performance in STEM subjects. To address this, a supportive learning environment is crucial. This includes incorporating growth mindset strategies and providing emotional support to help students overcome anxiety, fear of failure, and lack of confidence. Teachers and educators should provide opportunities for positive reinforcement, encouragement,

and feedback to help students build confidence and persistence in STEM subjects. Recent studies by Zimbabwean authors (Makura, 2017; Chakonda, 2019) highlight the significant impact of emotional and psychological barriers on student engagement and performance in STEM subjects. Additionally, research by Dweck (2006) emphasizes the importance of emotional well-being in academic performance and the role of growth mindset in overcoming psychological barriers.4.5

4.5 Conclusion

The findings from Chapter 4 provide a comprehensive understanding of the complex challenges faced by educators in delivering effective STEM education at Primary School. By aligning these findings with the literature reviewed in Chapter 2, it becomes evident that a multifaceted approach is necessary to address the existing gaps in STEM education. The study's results underscore the importance of addressing resource limitations, enhancing training and professional development, and fostering collaboration among educators. To improve STEM education outcomes, future interventions should focus on providing adequate resources, including technology, infrastructure, and educational materials. Additionally, promoting continuous professional development opportunities for teachers is crucial to enhance their subject matter expertise, pedagogical skills, and ability to integrate technology into their teaching practices. Creating a collaborative environment that supports teachers in their efforts to engage students in STEM learning is also vital. This can be achieved by encouraging peer mentoring, coaching, and sharing of best practices among teachers. Furthermore, fostering partnerships with external stakeholders, such as industries, universities, and community organizations, can provide valuable resources, expertise, and opportunities for students to engage in real-world STEM applications. Ultimately, addressing the challenges facing STEM education at Ruvheneko

Primary School requires a sustained commitment to providing a supportive and inclusive learning environment that fosters student engagement, motivation, and academic achievement in STEM subjects.

Chapter Five: Summary of Findings, Conclusion and Recommendations

5.0 Introduction

The previous chapter presented a comprehensive analysis and discussion of the data collected from teachers, students, and school administrators. The chapter examined the challenges faced by primary school teachers in teaching STEM subjects, the impact of teachers' lack of training and expertise on students' understanding and performance, and the strategies and interventions that can be implemented to support teachers in effectively delivering STEM lessons. This chapter provides a summary of the research findings on STEM teaching and learning at the primary school level, highlighting the key themes and trends that emerged from the data analysis. It also outlines the conclusions drawn from these findings, emphasizing the implications for educational policy and practice. Furthermore, this chapter provides recommendations for improving STEM education at Ruvheneko Primary School, based on the research findings and conclusions.

5.1 Summary

The research focused on examining STEM teaching and learning at the primary school level. Chapter one introduced the research study, providing an overview of the background, context, and significance of the study. The chapter began by highlighting the importance of STEM education in the 21st century and the challenges faced by primary school teachers in teaching STEM subjects. The research problem was clearly stated, and the research questions were formulated to guide the study. The chapter also discussed the significance of the study, explaining how the findings would contribute to the existing body of knowledge on STEM education. Furthermore, the chapter outlined the limitations of the study and defined key terms used in the research.

Chapter two reviewed relevant literature on STEM teaching and learning at the primary school level. The chapter examined the theoretical frameworks that underpin STEM education, including the integrated STEM education approach. The literature review highlighted the challenges faced by unspecialized teachers in teaching STEM subjects, including the lack of training and resources. The chapter also discussed the impact of this lack of training on students' understanding and performance in STEM subjects. Additionally, the chapter reviewed studies on effective teaching strategies and interventions that can support teachers in delivering STEM education.

Chapter three outlined the research methodology used in the study. The chapter discussed the research design, which was a mixed-methods approach combining both quantitative and qualitative data collection and analysis methods. The chapter explained the sampling strategy used to select participants, including primary school teachers and students. The data collection methods used in the study were also discussed, including questionnaires, interviews, and focus group discussions. Furthermore, the chapter outlined the data analysis procedures used to analyze the data, including thematic analysis

Chapter four presented the findings of the study, which were analyzed using thematic analysis. The findings were organized around sub-themes that emerged from the data, providing a detailed and nuanced understanding of the research questions. The chapter presented the findings in a clear and concise manner, using a table to illustrate the themes and sub-themes that emerged from the data. Research questions included in the study wise as follows:

5.2.1 Research Question One

What are the specific challenges faced by primary school teachers at Primary School in Zimbabwe who are required to teach STEM-based subjects despite not having specialized training in the subjects?

The study revealed that both learners and teachers at the school have developed an understanding of STEM, showing increased knowledge of the concept. It was noted that while some teachers manage to teach STEM subjects without specialized training, others face significant challenges, particularly in interpreting the syllabi. This aligns with Dekeza and Kufakunesu (2017), who identified the lack of trained STEM teachers as a barrier to effective curriculum implementation. Additionally, the study highlighted challenges such as insufficient financial resources for necessary materials, inadequately equipped science and ICT laboratories, and large class sizes, which hinder effective teaching. Furthermore, a lack of parental involvement was identified as negatively impacting STEM education, corroborating Magombe's (2012) findings.

5.2.2 Research Question Two

How does teachers' lack of training and expertise in STEM impact students' understanding and performance in the subject?

The study found a clear link between teachers' lack of training and students' understanding and performance. Data indicated that of respondents believed that inadequate teacher expertise adversely affects student learning. This finding aligns with Cooke and Walker (2015), who found that students taught by well-trained educators perform significantly better than those without such instruction, emphasizing the importance of teacher qualifications in facilitating effective learning outcomes.

5.2.3 Research Question Three

What strategies and interventions can be implemented to support teachers Primary School in effectively delivering STEM lessons and improving students' learning outcomes in this subject area?

The study revealed a lack of training opportunities for teachers in STEM, with all respondents indicating they had not received any related training. Additionally, the school struggles to secure funding for essential resources. Although some teachers attempted co-teaching, this strategy was ineffective due to a collective lack of expertise. The study suggests that the school administration should seek funding and resources to enhance STEM instruction, implement staff development programs to equip teachers with necessary skills, and adopt learner-centered teaching methods to improve engagement and understanding.

5.3 Conclusion

This study aimed to explore the challenges faced by primary school instructors in educating STEM subjects, the impact of teachers' need of training and expertise on students' understanding and performance, and the techniques and interventions that can be implemented to bolster teachers in successfully conveying STEM lessons. The discoveries of this study highlight the need for focused on mediations and asset allotment to move forward STEM instructing and learning at Primary School.

The study's recommendations emphasize the significance of giving instructors with preparing and support, apportioning assets to back STEM education, and advancing community inclusion in STEM education. The insights picked up from this study contribute to the developing body of

inquire about on STEM education and give an establishment for future research and development in this field.

Generally, this study illustrates the significance of tending to the challenges confronted by essential school teachers in educating STEM subjects. By giving teachers with the fundamental training, support, and assets, schools can progress STEM educating and learning outcomes, eventually preparing students for victory in an progressively complex and technological world.

5.4 Recommendations

Based on the discoveries of this study, the researcher suggests that the government, non-governmental organizations, and schools collaborate to supply the essential assets for successful STEM education in primary education. Schools ought to guarantee that resources are accessible to teachers, routinely send teachers to STEM workshops and classes, and seek help from different organizations to bolster STEM education. Teachers ought to adjust their teaching strategies to consolidate techniques that effectively lock in learners, utilizing practical exercises amid lessons. Moreover, future studies ought to examine the impact of educator mastery and training in STEM on student understanding and performance, investigating extra measurements such as the part of innovation and community association. Also, instructors ought to lock in in collaborative arranging and proficient improvement programs to make strides their instructing hones and understudy results. This chapter encapsulates the study's discoveries, emphasizing the need for targeted interventions and asset allocation to make strides STEM educating and learning at Ruvheneko Primary School. The insights gained from this study give a comprehensive understanding of the challenges faced by teachers in conveying successful STEM education, and

highlight the significance of tending to these challenges to improve student results. The study's discoveries emphasize the requirement for a multifaceted approach to moving forward STEM education, joining educator training and bolster, asset allocation, and community association. By tending to the challenges and barriers recognized in this study, educators and policymakers can work towards making a more compelling STEM education environment that cultivates student engagement, inspiration, and academic achievement.

The insights picked up from this study can advise future educational policies and hones pointed at fostering a more compelling STEM education environment. The study's discoveries can moreover be utilized to advise proficient improvement programs for teachers, and to direct the allotment of assets to back STEM education. Ultimately, this study contributes to the growing body of research on STEM education and gives a foundation for future research and advancement in this field. Moreover, the study's discoveries have suggestions for instructive policymakers, school administrators, and teachers. The discoveries highlight the require for policymakers to prioritize subsidizing and asset assignment for STEM education, and for school administrators to supply instructors with the support and resources they have to be provide viable STEM education. Teachers can utilize the study's discoveries to advise their educating hones, and to create inventive methodologies for locks in students in STEM learning. In conclusion, this study gives a comprehensive understanding of the challenges and obstructions to viable STEM education at Ruvheneko Primary school.

References

Almalki, S. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods Research-Challenges and Benefits. Journal of Education and Learning, 5(3), 298-296.

Bell, J. (1993). Doing your research project: A guide for first-time researchers in education and Social science. Open University Press.

Best, J. W., & Kahn, J. V. (2006). Research in education. Boston: Allyn and Bacon.

Bless, C., Smith, C.H., & Sithole, S.L. (2013). Fundamentals of Social Research Methods: An African Perspective (5th Ed.). Cape Town: Juta and Co.

Bybee, R. W. (2013). The next generation science standards: A framework for K-12 science Education. National Science Teachers Association.

Chakonda, T. (2019). Challenges faced by primary school teachers in teaching STEM subjects in Zimbabwe. Journal of Education and Human Development, 8(2), 1-9.

Chitate, S. (2016). Challenges faced by primary school teachers in implementing STEM

Education in Zimbabwe. Journal of STEM Education, 17(2), 12-20.

Chiromo, A.S. (2006). Research Methods and Statistics: A Student's Guide. Gweru: MSU

Faculty of Education.

Cinar, A., Unal, S., & Altin, M. (2016). The effects of STEM education on students' academic

Achievement. Journal of Education and Learning, 5(2), 137-146.

Cinar, S., Korkmaz, H., & Yasar, M. (2016). STEM education: A review of the literature.

Journal of Education and Learning,

Cohen, L., Marion, L., & Morrison, K. (2007). Research Methods in Education (6th Ed.).

London and New York: Routledge. Taylor and Francis Group.

Cooke, L., & Walker, M. (2015). The impact of teacher subject matter expertise on student Learning outcomes. Journal of Educational Research, 108(4), 351-362.

Creswell, J. W. (2013). Research design: Qualitative, quantitative, and mixed methods

Approaches. Thousand Oaks, CA: Sage.

Creswell, J. W., & Plano Clark, V. L. (2011). Designing and Conducting Mixed Methods

Research (2nd Ed.). Thousand Oaks, CA: Sage.

Davies, A., & Gilbert, J. K. (2003). Models of science education: A review of their significance In the UK. Canadian Journal of Science, Mathematics and Technology Education,

Dekeza, A., & Kufakunesu, E. (2017). An investigation into the challenges faced by primary School teachers in teaching science and mathematics in Zimbabwe. Journal of Science and Mathematics Education in Africa,

Denzin, N. K., & Lincoln, Y. S. (2011). Handbook of qualitative research (4th Ed.). Los Angeles: Sage Publications.

Dees, R. (2010). Writing the Modern Research Paper (2nd Ed.). Boston: Allyn and Bacon.

Dewey, J. (1997). Experience and education. Simon and Schuster.

Dweck, C. S. (2006). Mindset: The new psychology of success. Random House.

Frankell, J., & Wallen, N.E. (2000). Evaluation and Research. McGraw-Hill: New York.

Greene, J. C. (2007). Mixed Methods in Social Inquiry. San Francisco, CA: Jossey-Bass.

Guzey, S. S., Moore, T. J., & Roehrig, G. H. (2016). Building STEM skills through engineering Design. Journal of STEM Education,

Hallstrom, J., & Schonborn, K. J. (2019). Models and modeling in STEM education: A

Systematic review. International Journal of STEM Education

Honey, M., Pearson, G., & Schweingruber, H. (2014). STEM integration in K-12 education:

Status, prospects, and an agenda for research. National Academies Press.

Hurley, M. M. (2001). Exploring the intersection of science and mathematics education. School Science and Mathematics, 101(5), 242-253.

Jacobs, H. H. (n.d.). [No full reference provided].

Jha, A. S. (2014). Research Methodology. New Delhi: APH Publishers.

Johnson, R., Onwuegbuzie, A. J., & Turner, L. A. (2007). Towards a Definition of Mixed

Methods Research. Journal of Mixed Methods Research

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. Journal of STEM Education,

Kerlinger, F. N. (1986). Foundations of Behavioral Research. New York: Holt, Rinehart and Winston.

Kothari, C. R. (2001). Research Methodology (2nd Ed.). New Delhi: Wishwa Prakashan.

Kumar, R. (1999). Research Methodology: An Introduction. London: Sage.

Leedy, P. D., & Ormrod, J. E. (2012). Practical Research Planning and Design (10th Ed.). Boston: Addison Wesley.

Madusise, L. (2019). An investigation into the implementation of STEM education in

Zimbabwean primary schools. Journal of STEM Education,

Magombe, E. (2012). Parental involvement in education: A review of the literature. Journal of Educational Research and Development,

Makura, A. H. (2017). The impact of teacher training on student learning outcomes in STEM Subjects in Zimbabwe. Journal of Educational Research and Development,

Mapfumo, J. (2015). The new curriculum framework for primary and secondary education in Zimbabwe. Zimbabwe Journal of Educational Research,

Mawere, M. (2018). Research methods for educational sciences. Zimbabwe: Mawere Press.

Mberi, N., & Phambili, M. (2016). STEM education in Zimbabwe: Challenges and opportunities. Journal of STEM Education,

McNabb, D. E. (2010). Research Methods in Public Administration and Nonprofit Management: Quantitative and Qualitative Approaches. New York: M.E. Sharpe.

Ministry of Higher and Tertiary Education, Science and Technology Development. (2016).

STEM education policy for Zimbabwe. Government of Zimbabwe.

Ministry of Primary and Secondary Education. (2015). Curriculum Framework for Primary and

Secondary Education.

Ministry of Primary and Secondary Education. (2016). Education Act.

Morse, J. M. (2015). Critical Analysis of Strategies for Determining Rigor in Qualitative Inquiry. Qualitative Health Research,

Mukomana, T. (2019). The impact of STEM education on student learning outcomes in

Zimbabwe. Journal of STEM Education, 20(2), 1-12.

Mutseekwa, E. (2012). Promoting STEM careers in Zimbabwean schools. Journal of Career Development, 39(3), 249-264.

Mutseekwa, E. (2021). Exploring students' attitudes towards STEM subjects in Zimbabwean Primary schools. Journal of STEM Education,

Neuman, W. L. (2009). Social Research Methods: Qualitative and Quantitative Methods (7thed.). Boston: Allyn and Bacon.

Onwuegbuzie, A. J., & Leech, N. L. (2005). On Becoming a Pragmatic Researcher: The Importance of Combining Quantitative and Qualitative Research Methodologies. International Journal of Social Research Methodology, 8(4), 375-387.

Patton, M. Q. (2002). Qualitative Research and Evaluation Methods. Thousand Oaks, CA: Sage Publications.

Primal, R. (2010). [No full reference provided).

Sanders, M. (2009). STEM education: What form does it take? Journal of STEM Education,

Slaughter, R. (2009). [No full reference provided).

Tan, S. C., & Leong, W. K. (2014). Integrating STEM education: A review of the literature. International Journal of STEM Education, 1(1), 1-12.

Tashakkori, A., & Teddlie, C. (1998). Mixed Methodology: Combining Qualitative and

Quantitative Approaches. Thousand Oaks, CA: Sage Publications.

Thyer, B. A. (1993). Social Work Research: An Introduction. New York: Longman.

Appendices

Appendix i

Introduction:

This questionnaire aims to gather information about your experiences and perceptions of STEM teaching at the primary school level. Your responses will help us to better understand the challenges and opportunities facing STEM teachers and to develop targeted support and resources.

Please note that all responses will be kept confidential and anonymous. The information gathered from this questionnaire will be used to improve STEM teaching and learning in our school in the following ways:

- Identify areas of strength and weakness in STEM teaching

- Develop targeted professional development programs for teachers

- Inform the development of STEM curriculum and resources

- Improve student outcomes in STEM subjects

Your feedback will be reviewed and analyzed by the school administration, and recommendations will be made to address the identified areas of need. A summary of the findings and recommendations will be shared with all teachers and stakeholders.

[ ] Male

STEM Teaching Questionnaire for Primary School Teachers

SECTION A: DEMOGRAPHIC INFORMATION

1. Gender:

[ ] Male

[ ] Female

2. Grade being taught: (Please tick the appropriate box)

[ ] ECD

[ ] 1

[ ] 2

[ ] 3

[ ] 4

[ ] 5

[ ] 6

[ ] 7

3. Professional Qualifications:

[ ] Certificate

[ ] Diploma

[ ] Degree

[ ] Masters

4. Teaching Experience in years

[ ] 2 years or less

[ ] 3-5 years

[ ] 6-10 years

[ ] 10 years or more

5. What is your subject area specialization? (e.g., math, science, etc.)

_____

6. What is your level of experience teaching STEM subjects?

_____

SECTION B: STEM TEACHING PRACTICES

7. How do you integrate STEM subjects in your teaching?

_____

_____

8. What teaching methods do you use to promote student-centered learning in STEM subjects?

_____

_____

9. How do you assess student learning in STEM subjects?

_____

_____

10. What challenges do you face in teaching STEM subjects, and how do you overcome them?

_____

_____

SECTION C: RESOURCES AND SUPPORT

11. What resources do you need to effectively teach STEM subjects?

_____

_____

12. How do you currently use technology to support STEM teaching and learning?

_____

_____

13. What kind of professional development opportunities would you like to have to improve your STEM teaching practices?

_____

_____

SECTION D: IMPACT OF STEM TEACHING

14. How do you think STEM education can impact student learning outcomes and career choices?

_____

_____

15. What do you think are the most important skills and knowledge that students should gain from STEM education?

_____

_____

16. How do you think STEM education can be used to address real-world problems and challenges?

_____

_____

SECTION E: ADDITIONAL COMMENTS

17. Is there anything else you would like to share about your experiences with STEM teaching?

_____

_____

18. Do you have any suggestions for how we can better support STEM teachers and improve STEM education in our school?

_____

_____

Conclusion

Thank you for taking the time to complete this questionnaire. Your input is greatly valued and will help us to better understand the needs and challenges of STEM teachers in our school.

Appendix ii

Focus Group Discussion Guide: Exploring STEM Education Challenges and Opportunities

Introduction

Thank you for participating in this focus group discussion. We want to hear about your experiences and thoughts on STEM education. Your input will help us better understand the challenges and opportunities in STEM education.

Research Question 1:

Challenges Faced by Teachers

1. What does STEM mean to you, and how do you think it's important to your learning?

2. What do you think are the greatest challenges teachers confront when educating STEM subjects?

3. How do you think the school can back up teachers in overcoming these challenges?

4. What assets do you think are missing in your school for compelling STEM educating and learning?

5. Can you describe a circumstance where a teacher's lack of training or resources influenced your learning encounter in a STEM subject?

Research Question 2:

Impact of Teacher Training on Students

1. How do you think students' understanding and performance in STEM subjects are influenced by teachers' lack of training?

2. What do you think the school can do to address the issue of teachers' lack of training in STEM subjects?

3. How do you think innovation can be utilized to improve STEM educating and learning?

4. Can you think of a time once you battled with a STEM concept since your teacher wasn't well-prepared to educate it?

5. How do you think students' inspiration and interest in STEM subjects are impacted by their teachers' training and mastery?

Research Question 3: Strategies for Improvement

1. What strategies do you think can be put in place to improve STEM teaching and learning at your school?

2. How do you think the school can collaborate with external partners to support STEM education?

3. What incentives do you think can be provided to encourage teachers to develop their skills in STEM subjects?

4. Can you suggest ways in which the school can involve parents and the community in supporting STEM education?

5. How do you think the school can ensure that STEM education is inclusive and accessible to all students, regardless of their background or abilities?

Conclusion

Thank you for sharing your thoughts and experiences on STEM education. Your input is invaluable in helping us understand the challenges and opportunities in STEM education.

Appendix iii

Interview Guide for Administrators

Introduction

Thank you for agreeing to participate in this interview. The purpose of this interview is to gather your perspectives and insights on STEM education at primary school.

Research Question 1:

Challenges Faced by Teachers in STEM Education

1. Understanding of STEM:

Can you briefly explain what you understand by STEM educating and learning?

2. Facilities:

Does your school have the necessary research facility and offices for effective STEM educating and learning? In case not, what is missing?

3. Procurement Challenges:

What components influence the procurement of STEM assets at your school?

4. Teacher Understanding:

Do all teachers at your school understand the concept and strategies of STEM educating and learning? Why or why not?

5. Challenges beyond Training:

What challenges do teachers face in STEM educating and learning past the need of specialized preparing?

Research Question 2:

Impact of Lack of Training on Student Performance

1. Training History:

Were all teachers at your school prepared particularly on STEM instructing and learning?

2. Impact of Training:

For those who were prepared, have you watched any striking impact on their educating hones?

3. Student Performance:

How would you depict the performance of students in STEM subjects?

4. Reasons for Performance:

What do you think accounts for the students' performance in STEM subjects?

5. Impact on Student Outcomes: How does the lack of teacher training in STEM subjects influence student understanding and performance?

Research Question 3:

Methodologies and Interventions for Supporting Teachers

1. Staff Improvement Training:

Have you taken part in any staff improvement preparing centered on STEM instruction? What was your encounter?

2. Administrative Efforts:

What administrative endeavors have school administrators made to move forward STEM instructing and learning?

3. Government Assistance:

Has the government given any help or assets since STEM was presented at your school?

4. Educator Initiatives:

How have teachers endeavored to help each other in STEM educating and learning?

5. Methodologies for Enhancement:

What methodologies do you accept can be put in put to upgrade STEM educating and learning at your school?

Conclusion

Thank you for sharing your insights and perspectives on STEM education at primary school. Your input is invaluable in helping us understand the challenges and opportunities in STEM education.

Appendix VI


The image cannot currently be displayed.


The image cannot currently be displayed.