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INVESTIGATION INTO SOCIAL FACTORS AFFECTING EFFECTIVE TEACHING AND LEARNING OF STEM EDUCATION IN RURAL SECONDARY SCHOOLS IN ZIMBABWE: A CASE STUDY OF TWO RURAL SECONDARY SCHOOLS IN ODZI CIRCUIT, MUTARE DISTRICT.

BY

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DEDICATION

This study is dedicated to all my family members and friends who gave me unwavering throughout the course this research project.

ABSTRACT

This study investigated the social factors affecting the effective teaching and learning of STEM (Science, Technology, Engineering, and Mathematics) education in rural secondary schools in the Odzi Circuit of Zimbabwe. Using a social-cultural theory as the theoretical framework, the study employed a mixed-methods research design targeting a population of 32 Ordinary Level students doing STEM subjects at Lorn Secondary School and Odzi high School. Stratified sampling was used to select the participants, and data was collected through surveys and interviews. The findings revealed several key social factors impacting STEM education in the rural schools. Poverty and limited household resources were major barriers, as students often lacked access to basic school supplies, technology, and learning materials needed for STEM subjects. Cultural norms and gender stereotypes also played a role, with girls facing greater discouragement and lower expectations in pursuing STEM fields. Teacher qualifications, training, and morale emerged as crucial factors, as many rural schools struggled to attract and retain well-prepared STEM educators. Additionally, the remoteness of the schools and lack of community engagement hindered students' exposure to STEM opportunities and role models. The study concludes that multilevel interventions are needed to address the complex web of social influences on STEM education in Zimbabwe's rural secondary schools. Recommendations include improving access to STEM resources, challenging gender biases, investing in STEM teacher development, and fostering stronger school-community partnerships. By understanding and addressing these social factors, educational stakeholders can work to enhance the quality and equity of STEM learning for all students, regardless of their geographic or socioeconomic backgrounds.

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CHAPTER ONE

1.1 Introduction

The government of Zimbabwe's thrust through STEM subjects was to industrialize the economy and create the much needed employment in line with ZIMASSET (Makoshori, 2017). STEM skills were envisaged to empower the young graduates through the promotion of science and innovation. STEM is not new, it had been in the traditional system but it becomes a new initiative in the sense of being a new paradigm shift and focus in what Parawira (2016) calls "integrated manner interdisciplinary and applied approach". The purpose was to show students how the skills and concepts of STEM could be used in problem solving and to help them have hands on experience and apply knowledge to work and life after school. The expectation of the progression of STEM was agreed upon by all respondents to be from start to finish in the schooling years of any individual, (Falloon et al, 2020). It should be from infant and preschool education, to primary school where basic sciences match the concepts taught since the grounding was required at an early age. STEM should then progress to secondary schools, technical and vocational colleges and universities (Falloon et al 2020). Gadzirayi et al, (2016) cited that the initiative would help close the gap between the products of education and training and the industry where there appears to be a mismatch of the two and there is a record of high unemployment. He also argues that it would then take strides in curbing unemployment and improves the industrialization process since the graduates would be expected to have acquired innovations that provide practical solutions to problems.

1.2 Background to the Study

Science, technology, engineering and mathematics (STEM) education is defined as an educational program developed to prepare primary and secondary students for college, graduate study and careers in the field of science, technology, engineering and mathematics (Dekeza 2017). He argues that it aims to foster inquiring minds, logical reasoning and collaboration skills. What can be learned from this view is that STEM education aims at teaching learners to solve real-world problems, collaborate, integrate these four disciplines, and not to learn them separately, just as they are not separate disciplines in the real world (Mutambara & Bayaga 2021). Chitate (2016) cited that "*In September 2013 and as a backdrop to this multimedia initiative, His Excellency the*

President of Zimbabwe, Cde Robert Gabriel Mugabe, introduced the STEM revolution through the merging of the Ministry of Higher and Tertiary Education with that of Science and Technology Development".

According to ZIMSEC spokesperson Nicholette Dhlamini, for the past four years, the pass rate for mathematics, excluding that for private candidates, has remained at slightly below 20 percent. In 2019; 19, 23% of public candidates passed O-level Mathematics and the figure went down to 18, 21% in 2020 and slightly up to 18,71% in 2021. In 2022; 18, 03% candidates passed Mathematics.

Gadzirayi et al, (2016) pointed out that November 2015 ZIMSEC 'O' Level results can assist in getting a clear picture of what the performance in STEM was by school candidates (private candidates are excluded from the data). For the purpose of this study, the term "sciences" was categorized for STEM that ZIMSEC itself uses, that is the subjects; Mathematics, Biology, Integrated Science, Physical Science, Physics, Chemistry, Human and Social Biology and Geography.

Below is a table (**Table 1.1**.) showing how many candidates sat for a subject, how many of them got a grade C or better and what percentage pass rate that represents therefore. STEM subjects are highlighted in orange.

Table 1.1 : November 2015 O level pass rate

Subject Name	Total Candidates	C or Better Results	% Pass Rate
Mathematics	114236	29891	26%
Integrated Science	77265	49145	32%
Biology	20634	11054	54%
Physical Science	7261	5197	72%
Computers	3978	3194	80%
Physics	5191	4450	86%
Chemistry	5175	3500	58%

Human and Social Biology	532	184	35%
Geography	130759	50885	39%
English Language	164867	44829	27%
Shona	118583	48081	41%
History	114551	55579	49%
Commerce	93029	35981	39%
Agriculture	46861	27560	59%
Principles of Accounts	32295	18233	57%
Religious Studies	31719	18644	59%
Ndebele	22970	13251	58%
Fashion and Fabrics	21676	11440	53%
Literature	12097	6077	56%
Building	9038	4899	54%
Food and Nutrition	4710	3578	76%
Woodwork	3772	1695	45%
Statistics	396	362	91%
Music	262	182	69%

Source: Gadzirayi et al, (2016)

The table above shows that a few students took up some key STEM subjects such as Physics and Chemistry. According to Gadzirayi et al, (2016) the same trend was noticeable in 2015 for all STEM subjects (except Mathematics and Geography). In general, more students sat for art and commercial subjects like History, Religious Studies, Literature, Accounts and Commerce than do STEM subjects. Those huge disparities meant that even though the Physics and Chemistry pass rates seemed higher 86% and 58% respectively than the English Language pass rate of just 27%, the comparison did not tell the full story. Very few students took up Physics and Chemistry, and are star students who are generally expected to pass the subjects. On the other hand, every student, whether they are good at it or not, were required to sit for the English exam; The STEM subject that had the most students sitting was Geography.

The academic pass rates at Ordinary level in STEM subjects have remained low for many schools, especially in rural areas as evidenced by Manicaland 2023 Ordinary level results as there was no rural day school in the top 10**.** According to the Manicaland Provincial Education director Mr Edward Shumba, 30 rural secondary schools in Manicaland recorded zero percent in Ordinary level November 2023 results and hence calling for investigations to be made to determine the impacting factors. Munaka, (2016), complemented other research conducted by reflecting that learners in rural communities are not only disadvantaged in terms of learning institutions but they also do not have adequate learning materials in their communities, for example, they lack access to science laboratories and libraries.

Many factors have been put forward to explain the poor academic performance in STEM subjects at Ordinary level, but with no empirical support. For example, staffing challenges; however, it seems as if though staffing problems have been resolved, there could be other important factors determining achievements of students in STEM subjects. Meanwhile, the Ministry of Primary and Secondary Education (MoPSE) has assured the nation that "there will be enough teachers, proficient with the new palate of the curriculum" (Mukondiwa, 2015). "There is capacity building going on as we speak, even among line managers. In fact, 2,500 teachers have been enrolled, so far, to equip them with the tools to bring about the positive change of the curriculum. Their retention is crucial (Mukondiwa, 2015). For instance currently in 2024 a teacher capacity development programme is running at Bindura University of Science Education for STEM subjects.

According to (Kadziya & Ndebele,2020) the school needs to take into account the various social factors characteristic of students being admitted into the schools so as to plan on how subdue its impact on the teaching and learning endeavour. There is great diversity in cultural backgrounds, social conditions and family arrangements. Munaka (2016) pointed out that the relationship between family socio-economic status and the learning outcomes of students is well established in sociological research. He also argues that while there is disagreement over how best to measure social factors, most studies indicate that students from low social status families do not perform as well as they potentially could at school compared to students from socially high background.

Poor performance of learners in rural schools motivated the researcher to look closely at social factors affecting effective teaching and learning of STEM education in rural areas. The research is interested in assisting learners to come up with strategies which will help to mitigate those social factors. Teachers are also not left out. They need to be quick in identifying strategies so that the social factors are rectified at an early stage hence high performance in pupils which will finally have a positive impact on the pass rate of STEM subjects at school and national level.

1.3 Purpose of the study

This study is mainly for finding the ways which help to improve the national pass rate in STEM subjects in Zimbabwe's rural secondary schools for learners who sit for both local and international examinations after the end of their courses.

1.4 Statement of the Problem

A notable exception to the lack of research about rural STEM participation is a recent study by Saw and Agger (2021), who find that rural students have consistently fewer local STEM education opportunities and resources than suburban students and as a result, tend to be underrepresented in college STEM programs. There is low uptake in STEM subjects in rural secondary schools compared to urban secondary school at Ordinary level (Kadziya & Ndebele, 2020).

According to Munaka (2016) students in rural local communities are experiencing broken homes, illiterate parents, poverty, to mention but few. It is a common notion that students in such situation are constantly under threat of distraction at school. (Mutambara & Bayaga 2021) viewed that this makes it easier for people to predict possible poor academic performance in STEM of such students. On the other hand, teachers struggle to motivate and sustain the interest and attention of such group of students towards available learning experience of STEM subjects. It is on the basis of these alarming issues that this study is set to investigate the effects of social factors on effective teaching and learning of STEM education in rural secondary schools.

1.5 Objectives of the study.

The main objectives of the study are:

1. To identify and examine the social factors influencing the teaching and learning of STEM education in rural schools,

2. To examine the relationship between these social factors and student outcomes in STEM subjects,
3. To propose recommendations for improving STEM education in rural secondary schools based on findings.

1.6 Research questions.

1. What are the social factors affecting effective teaching and learning of STEM education in rural Secondary schools in Zimbabwe?

2. How do these social factors affect student engagement motivation and achievement in STEM subjects?

3. What measures or strategies can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools?

1.7 Assumptions

- Rural secondary schools face more challenges in terms of resources, infrastructure and teacher training which may impact STEM education.
- Students from low socio-economic backgrounds may face more barriers to accessing quality STEM education due to limited resources and support at home

1.8 Significance of the study.

The current study will be of greater importance by investigating various possible social factors driving poor performance in STEM subjects at Ordinary level in Mutare district..

This research will help in planning among the school's various departments such as the academic board, subject specific departments, the administration, sports department, the district at large and most importantly help in improving students' achievement in STEM subjects at ordinary level in Mutare district as measures or strategies that can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools will be highlighted.

1.9 Limitations of the study

The research might be affected by shortage of funds to widen the area hence the study is focused on two schools only.

1.10 Delimitation of the study

The research focused on teachers and learners at Lorn secondary school and Odzi High School in Odzi circuit, Mutare district.For this reason the research is only confined to only those teachers and learners at Ordinary level who teach and learn STEM subjects. The research is limited at Lorn secondary and Odzi high because the researcher is familiar with the students, teachers and parents there. Limited resources, time and financial constraints restricted the researcher to carry out the research in other secondary schools.

1.11 Definition of terms

1. STEM – an approach to learning and development that integrates the areas of science, technology, engineering and mathematics. Through STEM students develop key skills including problem solving, creativity and critical analysis .Chitate, H. (2016).

2. Education – the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or others intellectually for mature life or for a profession. Wijaya, et al, (2022).

3. Social factors - the effects of people and groups influencing one another through culture and subculture, social class, reference groups, and family.

4. Mitigate - the process or result of making something less severe, dangerous, painful, harsh, or damaging.

5. Teacher - A person who teaches, especially one employed in a school.

6. Learner - a person who is learning a subject or a skill.

1.12 Chapter summary

The chapter introduced the topic under research and highlighted the general view about effects of social factors on STEM education. Major assumptions of this study were given as well as questions upon which the research will progress were outlined thereby giving specific objectives of the study. Some important key terms were defined according to how they will be used in the research. The next chapter will dwell on literature review.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The chapter focuses on theoretical framework and reveal what other authorities and previous researchers say about social factors affecting effective teaching and learning of STEM (Science, Technology, Engineering, and Mathematics) subjects in rural secondary schools. It is stratified in sections and sub-sections exploring the social factors and strategies that can be employed to mitigate these social factors. In a nutshell, this chapter reviews relevant literature related to factors that have an effect towards teaching and learning of STEM education in rural secondary schools in Zimbabwe.

2.2 THEORETICAL FRAMEWORK

2.2.1 Sociocultural Theory

Sociocultural theory is a sociological and psychological theory that emphasizes how important culture and society are in influencing how people develop as individuals (Glăveanu, 2020). It highlights the ways in which interactions with parents, peers, and society impact sociocultural, cognitive, and learning processes. Daneshfar & Moharami, (2018) supported that since the 1990s, the idea has gained popularity and been used in play, socialization, and educational contexts. It emphasizes the significance of sociocultural beliefs and values in these processes.

The sociocultural theory of Lev Vygotsky emphasizes the significance of social interactions and cultural background in cognitive development (Ameri, 2020). This theory asserts that social relationships between students and their teachers, as well as the community at large, influence their learning experiences in STEM education. Habeeb & Kiazai, (2022) acknowledges that STEM knowledge acquisition and retention can be improved by promoting collaborative learning environments where students solve issues and share knowledge.

According to Avery, (2015) cultural values have a big influence on how students feel about STEM courses. For example, rote memorization may be valued more highly in certain cultures than problem-solving and critical thinking abilities in others. These variations may have an effect on students' interest in STEM subjects and their desire to work in these professions (Stevenson & Stigler, 2017).

Social norms can influence how students perceive themselves as learners in STEM classrooms. For example, girls may be less likely to participate in STEM activities due to societal stereotypes that portray these subjects as being for boys (Ceci & Williams, 2019). Similarly, students from marginalized backgrounds may face additional barriers to success in STEM education due to systemic biases and lack of representation (National Research Council, 2015).

In addition Guthrie et al., (2018) highlighted that language use has an impact on how well pupils comprehend and articulate difficult STEM subjects. For example, students from low-income families or non-native English speakers who may not have been exposed to such language previously may find it difficult to understand technical jargon in STEM subjects. Friendly classroom environments where all students feel respected and encouraged can be created by teachers using inclusive language (National Research Council, 2015).

2.2.2 Social Cognitive theory

The social cognitive theory, sometimes referred to as social learning theory, is a psychology perspective that emphasizes the importance of modeling, imitation, and observational learning in human behavior (Luszczynska & Schwarzer, 2015). Albert Bandura established this theory in the 1960s and it states that in addition to direct experience, people can learn from observing other people and the outcomes of their actions (Ceci & Williams, 2019). The social cognitive theory states that conduct is mostly determined by cognitive processes such as motivation, memory, and attention. Ceci & Williams, (2019) supported that people are more likely to imitate the behaviors they witness if they think the model is credible and the behavior results in the intended outcomes. The core of this idea is based on Bandura's concept of self-efficacy, which expresses an individual's belief in their ability to perform a particular task or behaviour (Habeeb & Kiazai, 2022).

A key component of effective teaching and learning in STEM education understands how social factors influence students' engagement, motivation, and success in these subjects (Habeeb & Kiazai, 2022). Albert Bandura's social cognitive theory highlights the significance of social factors in learning and behaviour. It suggests that people learn not only from their own experiences but also from observing others and their surroundings (Moyo & Hadebe, 2018). According to Avery, (2015), children may learn a lot from seeing role models who are skilled in STEM fields Teachers should appreciate the view that setting a good example and social modeling are two very effective teaching strategies when it comes to STEM education. Positive role models in the classroom can encourage students to dive further into STEM subjects and adopt a growth mind set in their approach to learning (Ceci & Williams, 2019), in the sense that if students see their peers paying attention, they are more likely to do the same. Constructive criticism is another useful tactic that the social learning theory uses to increase self-efficacy. Students are more motivated to repeat tasks when they receive positive feedback since it boosts their self-esteem and confidence in their skills (Avery, 2015).

Social cognitive theory also highlights the part that social support plays in the process of teaching and learning (Han et al 2021) in the sense that fostering a supportive learning environment where students feel comfortable asking for help from teachers, collaborating with peers, and sharing their ideas might improve learning outcomes in the context of STEM education. Garira, (2020) supported that positive interactions with teachers and fellow students can boost students' self-efficacy, confidence, and overall academic accomplishment in STEM subjects.

2.2.3 Community of practice

A community of practice, as defined by Jean Lave and Etienne Wenger's theory, is a collection of individuals who value social ties among themselves and share a common interest or line of work (Barakabitze, 2019). Members of these groups collaborate on joint projects, share knowledge among them, and encourage collective understanding of their specialized professions. Participation in these groups is said to foster learning more naturally than independent study or traditional schooling (Farnsworth et al, (2016). According to the community of practice theory, engaging in a community of practice allows individuals to grow professionally, learn from one other, and enhance their knowledge and skills (Barakabitze, 2019). Members of these groups frequently engage in informal learning activities such as exchanging stories, having discussions about best practices, and working together on projects. Through this process, people can learn explicit knowledge, like facts and processes, as well as tacit knowledge, like judgment and intuition, both of which are essential for success in their area of work (Pyrko et al, 2017).

In STEM education, being a part of a supportive community can provide students with access to mentorship, teamwork, and shared learning opportunities as cited by Moyo, (2022) in the sense that by taking part in a community of practice, students can gain a deeper understanding of STEM subjects and a sense of belonging in the area.

According to Munaka, (2016) communities of practice give teachers and students the chance to work together, exchange best practices, and gain knowledge from one another. A sense of belonging and respect for one another among participants can be fostered in this way, which is beneficial for teaching and learning in STEM education (Moyo, 2022).

Communities of practice facilitate peer-to-peer learning through discussions, brainstorming sessions, and project work. Peer learning has proven to be an effective tactic for raising students' understanding of difficult STEM subjects as they learn from each other's perspectives and experiences (Kadziya, & Ndebele, 2020).

Mutambara & Bayaga, (2021) supported that communities of practice provide sustained chances for professional growth by means of frequent exchanges with peers, resource availability, and practice reflection opportunities. This can offer possibilities for ongoing improvement while also keeping educators abreast of current research and trends in STEM education.

2.3 SOCIAL FACTORS AFFECTING TEACHING AND LEARNING OF STEM EDUCATION

2.3.1 ACCESS TO RESOURCES

A good STEM education requires a sufficient infrastructure, which includes libraries, technology centres, and laboratories with the necessary equipment (Zhao et al, 2022). Inadequate resources can make it difficult to apply theoretical knowledge in real-world settings and to engage in experiential learning.

2.3.1.1 Infrastructure

Kelley & Knowles, (2016) supported that many secondary schools in rural areas are devoid of the tools that are required for success in STEM education, such as modern classrooms, well-stocked science laboratories and internet connection. This makes it more difficult to provide the practical learning experiences that are essential for STEM subjects. Inadequate infrastructure limits teachers' ability to do demonstrations, conduct experiments, and successfully incorporate technology into their lesson plans (Jeffries et al 2020).

2.3.1.2 Teaching materials.

Getting the most recent textbooks, laboratory equipment, and other teaching tools required for a successful STEM education can be difficult for rural schools as highlighted by Gweshe & Chiware, (2023). Students may find it difficult to understand complex STEM concepts or to remain interested in their studies if they do not have access to the right instructional resources.

2.3.1.3 Technology access

Dudu & Mashoko, (2024) supported that the lack of access to computers, software, and internet connectivity in rural schools frequently results in a digital divide between pupils in urban and rural areas. Incorporating digital tools into STEM lessons might be hindered by limited access to technology, which can limit students' opportunities for participatory learning (Mutambara & Bayaga, 2021).

2.3.1.4 Financial restrictions.

Garira, (2020) pointed out that rural schools may not have as much money as schools in urban areas, which can restrict their ability to purchase STEM resources that are essential, such as lab equipment, field excursions, or extracurricular activities. Zhao et al, (2022) also supported that due to budgetary differences, learners in rural areas may encounter different obstacles than their urban counterparts when it comes to accessing high-quality STEM education.

2.3.2 CULTURAL BELIEFS AND PRACTICES

Nugent et al, (2015) highlighted that attitudes toward education, especially STEM disciplines, can be influenced by cultural practices and beliefs in rural communities. Sometimes people could opt to work in traditional fields rather than in STEM fields. Aspirations and interests of students in STEM education can also be influenced by gender stereotypes (Qureshi, 2021).

2.3.2.1 Cultural relevance in curriculum design

The curriculum's design is one way that cultural attitudes affect STEM education. Students' involvement and comprehension of STEM subjects can be improved in rural locations where communities may have unique cultural values and practices by adding local knowledge and traditions into the curriculum (Nugent et al, 2015). STEM subjects become more approachable and meaningful for students when teachers make the material culturally relevant. This helps close the gap between students' real-world experiences and academic learning as viewed by Zhao et al (2022)

2.3.2.3 Gender roles and stereotypes

STEM education in Zimbabwe rural secondary schools may be impacted by cultural perceptions of gender roles. Falloon et al, (2020) supported that in some communities there may be misconceptions that boys are more suited for particular STEM fields than girls. These prejudices may restrict female students' possibilities in STEM fields or deter them from pursuing STEM degrees (Gweshe, & Chiware, 2023). They further cited that promoting diversity and equity in STEM education requires addressing gender stereotypes through inclusive teaching methods.

2.3.2.4 Language and communication

Kelley & Knowles, (2016) states that, language is essential to the transmission and understanding of knowledge in teaching and learning. Language limitations might make it difficult to teach and understand STEM subjects effectively in remote locations in Zimbabwe with a varied population (Madusise, 2019). Acknowledging the significance of language diversity and offering assistance to those who speak other languages might enhance students' access to STEM education (Kelley & Knowles, 2016).

2.3.2.5 Traditional teaching methods vs. innovative approaches

Teaching strategies used in secondary schools in rural areas may be influenced by cultural views. Habeeb & Kiazai, (2022) pointed out that traditional teaching methods based on regional traditions are valuable, but incorporating cutting edge pedagogical approaches specific to STEM subjects is crucial to preparing students for a quickly changing technological environment. Moyo & Hadebe, (2018) also supported that the delivery of STEM education can be made more effective by combining traditional knowledge with contemporary teaching methods.

2.3.3 TEACHER QUALITY

The effectiveness of STEM teaching in rural schools is highly influenced by the quality of the teachers (Moyo & Hadebe, 2018). Teacher shortages, a lack of chances for professional development, and a lack of professional networks can all hinder an educator's capacity to provide high-quality STEM education. Kadziya, & Ndebele, (2020) supported that motivated and well-trained educators are critical to igniting students' interest in STEM subjects, stimulating their curiosity, and creating a love of learning.

2.3.3.1 Restricted Access to Professional Development

Rural teachers frequently have less access to chances for continuous professional development compared to their urban colleagues. Kadziya & Ndebele, (2020) viewed that teachers may find it more difficult to keep up with the most recent developments in STEM education, cutting-edge teaching strategies, and curricular modifications as a result of this lack of training and assistance. Students might thus receive out-of-date or subpar teaching that leaves them unprepared for STEM employment in the future (Habeeb & Kiazai, 2022)

2.3.3.2 Teacher turnover and inexperience.

Moyo, (2022) supported that high-quality STEM education teachers are difficult to recruit and retain in rural schools. Teachers in remote locations frequently have greater turnover rates because of things like lower salary, resource scarcity, and isolation. According to Nugent, (2015) due to the high rate of turnover, there may be an ongoing supply of inexperienced educators who lack the knowledge and abilities needed to successfully instruct students in challenging STEM subjects. The quality of STEM education that students get can be adversely affected by a shortage of competent educators (Habeeb & Kiazai, 2022).

2.3.3.3. Technology Access

Barakabitze et al, (2019) cited that teachers can improve student learning by integrating technology and other resources into their lessons. Teachers may find it challenging to use the newest technologies in rural schools due to the frequently scarce resources in these settings. According 2022 Ministry of primary and secondary education (MOPSE) report, out of the total number of schools in Zimbabwe 47, 49% has internet access and only 13% of rural secondary schools had access to broadband internet compared to 34,49% of urban schools. Teachers without strong content knowledge cannot find creative ways to use limited resources to enhance student teaching (Ruiz & Gallagher, 2018).

2.3.4 PARENTAL INVOLVEMENT

According to Walker (2017), parental participation is extremely important for students' academic progress and interest in STEM subjects. Ntekane, (2018) agrees by stating that learners get motivated to learn and develop responsibility when their parents are tremendously involved by constantly monitoring their school interests. The extent of parental involvement might influence learner’s motivation and achievement in STEM education, especially in rural locations where access to resources and educational support is restricted Newman et al. (2019).

2.3.4.1 Limited expertise

Parents in remote locations may lack the requisite STEM expertise or understanding to successfully assist their children's education (Ntekane, 2018). This ignorance may make it more difficult to give pupils the kind of help they need, particularly when it comes to difficult STEM subjects, Nugent, (2015)

2.3.4.2 Mismatched Teaching approaches.

Moyo & Hadebe, (2018) pointed out that parents may unintentionally employ outmoded or inadequate teaching approaches when attempting to assist their children with STEM subjects. Students may become confused and misunderstand this mismatch between the methods used in the classroom and the assistance they receive from their parents (Falloon et al., 2020).

2.3.4.3 Pressure and Expectations.

According to Ntekane, (2018), students who have too much parental engagement may feel too much pressure to perform well in STEM classes, which can cause stress and anxiety. Parents' high expectations might cause pupils to fear failing, which will ultimately have a detrimental effect on their performance. Kadziya & Ndebele, (2020).

2.3.5 SOCIOECONOMIC STATUS.

The socioeconomic status of pupils is one of the main social elements influencing STEM education in rural secondary schools According to (Garira, 2020), the educational experiences of students are significantly shaped by their family's socioeconomic condition (Nugent et al, 2015) mentioned that low-income students may encounter difficulties that impede their learning in STEM subjects including restricted access to resources, insufficient parental support for their education, and limited financial means. Students may have difficulties like poor nutrition, lack of medical care, and restricted access to after-school educational resources in rural locations where poverty is common (Qureshi, 2021). Lack of exposure to STEM-related events outside of the classroom may have an effect on these students' interest in and aptitude for these subjects (Zhao et al, 2022).

2.3.5.1 Restricted Exposure to STEM Opportunities

Nugent, (2015) highlighted that students from lower socioeconomic backgrounds might not have as much access to extracurricular STEM activities, internships, or mentorship programs. These chances may be rare or unattainable for pupils with little means, despite the fact that they are essential for promoting interest and aptitude in STEM areas (Qureshi, (2021).

2.3.5.2 Stereotypes and Bias

Social and economic issues can be blamed for the stereotypes and biases influencing how STEM education is perceived by rural students (Falloon et al., 2020). For students who wish to pursue STEM careers, negative perceptions about their intelligence or capacity based on socioeconomic class may create barriers that affect their confidence and motivation (Mutambara & Bayaga, 2021).

2.3.5.3 Lack of Support for Advanced level Readiness.

Ntekane (2018) noted that the lack of resources for guidance counselling may make it challenging for children from low-income households in rural locations to prepare for advanced level STEM subjects, however if insufficient support systems are in place, students like these may find it challenging to meet the academic requirements for pursuing additional education in a STEM education (Moyo, 2022).

2.3.6 Peer influence

Peer influence can significantly impact STEM education in both positive and negative ways in rural secondary schools. Munaka, (2016) refers peer influence to the way students interact with and are influenced by their peers, shaping their attitudes, behaviours, and academic performance. Peer pressure can have a detrimental effect on the attitudes and aspirations of other students who look up to their peers if they do not prioritize or respect STEM education as evidenced by Nugent et al, (2015).

2.3.6.1 Limited Exposure to Diverse Perspectives.

Madusise, (2019) noted that peer pressure can limit exposure to a range of viewpoints and ideas at rural schools with small student populations. This lack of diversity might impede the development of critical thinking and creative thinking abilities, which are vital in STEM disciplines that depend heavily on innovation (Zhao et al, 2025).

2.3.6.2 Stereotyping and Social Pressure

Peer pressure may promote social stigmas and misconceptions about specific STEM areas or career prospects in a small and tightly connected community (Gweshe & Chiware, 2023). Students could feel pressured to adhere to cultural or gender norms, which could deter them from pursuing a wider range of STEM subjects, Kadziya & Ndebele, (2020.

2.3.6.3 Inadequate support for academic growth

Qazi, (2023) noted that a lack of support for academic progress and accomplishment can be a symptom of negative peer influence in STEM education. Students may deter one another from taking on difficult assignments or asking for assistance when necessary, which would result in poorer overall academic achievement (Svodziwa, M. 2021).

2.3.6.4 Resistance to change and innovation

Peer groups that oppose innovation or change might foster a culture of complacency in the classroom, Munaka, (2016). Such opposition can obstruct advancement and impair students' preparedness for future professions in STEM education, where flexibility and inventiveness are highly valued, Quresh, (2021).

2.4 MEASURES OR STRATEGIES THAT CAN BE EMPLOYED TO MITIGATE THE NEGATIVE IMPACT OF SOCIAL FACTORS AND ENHANCE THE TEACHING AND LEARNING OF STEM EDUCATION IN RURAL SECONDARY SCHOOLS

Numerous tactics and initiatives can be put in place to lessen the negative consequences of social factors in order to enhance STEM education in Zimbabwe's rural secondary schools. Below are measures that can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of stem education in rural secondary schools:

2.4.1 Access to resources

A prerequisite for successful learning is giving students access to high-quality textbooks and other educational tools, Murphy, (2020). Enhancing access to STEM education can also be accomplished by giving financial aid or scholarships to underprivileged students, Marongedza et al, (2023).

Gomba, (2015) noted that equitable resource availability in secondary schools in rural areas facilitates the closing of the opportunity gap that exists between pupils from urban and rural areas. Closing educational gaps can result in more equal outcomes for all learners by guaranteeing that all students, regardless of geography, have access to high-quality STEM education resource, Gadzirayi et al, (2016).

Student participation in practical activities is made possible in remote secondary schools by the provision of resources including computers, internet connectivity, labs, and instructional materials Falloonet al, (2020). Hence this improved student's comprehension of STEM ideas and their interest in these disciplines is piqued, by this experiential learning opportunity.

2.4.2 Community engagement

The effectiveness of STEM education in rural locations depends on community engagement. A supportive atmosphere that appreciates and encourages STEM learning can be established by incorporating parents, local groups, and community leaders in the educational process Han et al, (2021). Engaging in the community can help students understand how STEM ideas are applied in real-world situations, which will make their education more engaging and relevant. Their motivation and involvement in their academics may rise as a result, Jeffries et al (2020).

The workforce is changing quickly, thus it is critical that students acquire skills that will prepare them for it, Fraser et al, (2019). Students who participate in STEM education through community collaborations can work on real-world projects with professionals in the field, gaining practical experience that will be helpful when they enter the job market after graduation Jeffries et al (2020).

2.4.3 Teacher training and support

Chimbunde, (2019) supported the view that, it is crucial to give educators sufficient expertise in STEM disciplines and pedagogy. Teachers can stay current on the newest teaching techniques and technological advancements in STEM education with the support of programs for continuous professional development Fraser et al, (2019)

Mutambara and Bayanga, (2021) asserts that the government can help close the educational gap between urban and rural schools by investing in teacher training and support in rural communities by providing rural teachers with access to high-quality professional development opportunities will help pupils in marginalized places compete on an equal playing field.

Teachers can enhance their ability to teach STEM subjects to their students by taking part in training programs that increase their knowledge and proficiency in these areas, Moyo and Hadebe, (2018). Teachers with the right training are better equipped to conduct insightful experiments, simplify complex concepts into digestible bits, and design interactive educational settings as supported by Svodziwa, (2021).

Expert teachers are more likely to use innovative methods that spark students' curiosity about STEM subjects and make them more relevant to their daily lives Habeeb & Kiazai, (2022).This increased involvement may lead to higher levels of student excitement, participation, and accomplishment in STEM education. Teachers who have opportunities for ongoing support and professional development are better able to identify and cater to the individual learning needs of each student. Qazi, (2023). Hence this tailored strategy can improve academic performance, particularly in challenging subjects like math and science.

2.4.4 Infrastructure development.

Enhancing STEM education can be substantially improved by improving infrastructure in remote schools by giving students access to contemporary facilities, labs, and technology (Jeffries et al, 2020). This involves making certain that schools have dependable internet access, electricity, and well equipped scientific labs.

2.4.5 Curriculum adaptation.

Creating a curriculum that is more relevant to the community will help students become more engaged and interested in STEM subjects Moyo, (2022). Learning can become more meaningful when real-world examples from the students' environment are incorporated.

Han et al, (2021) highlighted that STEM education can be made more relevant and interesting for students growing up in rural areas by adapting the curriculum to the needs and environments of the community. For instance, including community-based problems or projects in the curriculum may help students understand how STEM ideas are used in practical contexts.

Through curriculum modification, students in rural areas who might not have the same resources or opportunities as their urban counterparts could have better access to high quality STEM education, Hasanah, (2020). For example, schools and students may have less financial burden if they use open educational resources (OERs) or inexpensive technologies.

2.4.6 Promoting Gender Equality.

The pursuit of STEM fields by females must be encouraged if gender equality in education is to be realized, Gweshe & Chiware, (2023). Gender disparities in science, technology, engineering, and mathematics can be closed by implementing initiatives that encourage females to pursue these careers Falloon et al, (2020). Gender equality in STEM education benefits rural communities overall in addition to specific pupils. More students with STEM skills will be able to advance technology, participate actively in the neighbourhood economy, and promote community development, Habeeb & Kiazai, (2022).

Promoting gender equality in the classroom allows for the inclusion of varied viewpoints Gweshe & Chiware, (2023). This raises student engagement in these vital fields overall and aids in closing the gender gap that has historically existed in STEM fields. Garira, (2020) noted that male and female students who are actively involved in STEM disciplines contribute diverse perspectives, life experiences, and problem-solving strategies that enhance the learning environment for all students.

Classrooms with a gender balance encourage creativity and innovation Han, (2021) in the sense that they bring a greater variety of ideas to the table, diverse teams are more inventive and creative, according to research. A culture of innovation among students can be fostered in rural secondary schools by advocating for gender equality in STEM education, Moyo (2022).

2.4.7 Partnerships with Industries and Universities.

Students can gain practical exposure to STEM professions and opportunities through collaborating with universities as well as business partners Madusise, (2019). Students might be encouraged to pursue professions in STEM sectors through guest lectures, mentorship programs, and internships.

Partnerships with companies and universities can supply remote schools with innovative technology, labs, software, and other resources that might otherwise be unavailable, Avery, (2015). This exposure to cutting-edge tools can improve students' learning experiences and prepare them for future STEM employment.

Teachers in rural secondary schools can gain professional development opportunities through relationships with industry professionals and university academics Moyo & Hadebe, (2018). Workshops, training sessions, mentorship programs, and collaborative projects can assist educators improve their teaching skills, stay current with industry innovations, and increase their overall efficacy in delivering STEM education Chimbunde, (2019).

2.4.8 Parent involvement

Kadziya & Ndebele, (2020) supported that parents that take an active interest in their children's education can create a welcoming environment for STEM subjects even outside school hours. They can assist with homework, take part in discussions about STEM, and encourage chances for experiential learning to enhance classroom curriculum. Parental involvement is also crucial for motivating students and fostering an interest in STEM subjects, Ntekane, (2018). Parents who are enthusiastic about STEM can inspire their children to share that enthusiasm, Nugent et al, (2015). Parents can help their children understand the value of STEM subjects in their daily lives by participating in STEM-related activities with them and exposing them to real-world applications of STEM principles, Kadziya & Ndebele, (2020).

2.5 CHAPTER SUMMARY

This chapter reviewed literature review to social factors such as gender stereotypes, peer pressure, parental engagement, cultural views, resource availability, and family support which make it difficult for Zimbabwe's rural secondary schools to provide successful STEM education. It is essential for students to have access to resources and infrastructure investment in order to apply concepts in real-life situations. Cultural customs and beliefs have the power to shape pupils' perspectives, influencing some of them to favour traditional over STEM vocations. Partnerships with industry, training for educators, curriculum revision, infrastructure development, and lobbying for gender equality are all necessary to improve STEM education. Collaborations with academic institutions and real-world examples are equally crucial in STEM education.

CHAPTER 3: RESEARCH METHODOLOGY

INTRODUCTION

In this section, the researcher will focus on the plan of gathering data and the procedures for conducting the research. The research paradigm, the research design, research methods, reliability and validity, ethical issues, sampling procedure and research instruments will be deliberated on with the benefits and limitations of using each being spelt out. The data collecting plan and data analysis plan will be discussed.

3.2 RESEARCH PARADIGM

A research paradigm is the set of common beliefs and agreements shared between scientist about how problems should be understood and addressed (Kivunja & Kuyini, 2017). According to Kaushik & Walsh, (2019), a research paradigm refers to the conceptual structure upon which an investigation is predicated. It provides a framework of assumptions and knowledge that a research project's theories and procedures are based on.

Pragmatism as a research paradigm can be suitable for investigating social factors affecting the effective teaching and learning of STEM education in rural secondary schools in Zimbabwe in the sense that it places a strong emphasis on problem-solving, practical applications, and the value of experience in directing research. Pragmatism in education research enables academics to concentrate on real-world problems and solutions (Maarouf, 2019), which makes it particularly important for researching the complex relationships between social factors affecting effective teaching and learning of STEM education in rural Zimbabwean secondary schools.

The emphasis placed by pragmatics on practical results is a good fit for the objective of enhancing STEM education teaching and learning processes. The effectiveness of STEM education in rural Zimbabwe can be impacted by social factors such as cultural norms, economic conditions, infrastructure limitations, and resource access. To better understand these effects, a pragmatic research paradigm can be adopted and engage directly with teachers, students, parents, and community members, (Brierley, 2017). Through the process of data triangulation (Sileyew et al 2019), a thorough understanding of the potential and problems related to STEM education in this particular environment can be developed.

A strong framework for examining the social variables influencing the successful teaching and learning is provided by pragmatics (Maarouf, 2019). Through the implementation of mixed methodologies approaches, direct stakeholder engagement, and a focus on practical outcomes, insightful findings can be produced that guide future directions in this crucial field of study as well as policy choices and educational interventions.

3.2.2 RESEARCH METHODOLOGY

Research methodology refers to the techniques and approaches utilized to find and analyze data relevant to a specific study topic (Creswell & Creswell, 2017). It's a process by which researchers organize their study to achieve specific objectives using specific research instruments, Tuffour, (2017) asserts that research methodology includes the overarching framework for carrying out the study as well as the research design and methods for collecting and analyzing data. A good research methodology helps ensure the validity and reliability of study findings by supporting researchers in selecting the most appropriate methodologies to answer their research objectives (Sileyew, 2019). There are three main types of research methods based on the type of data required namely quantitative, qualitative and mixed methods.

A mixed methods research method would be best suited in this study, where the goal is to identify and examine the social factors influencing STEM education teaching and learning in rural schools, as well as to make recommendations for improving STEM education in rural secondary schools based on the findings. Mixed-methods research design refers to an approach that combines both qualitative and quantitative data collection and analysis methods in a single study (Creswell & Creswell, 2017).

The qualitative component of the research may involve interviewing teachers, students, parents and administrators as well as document analysis. Deeper insights into the social aspects influencing STEM education in rural schools can be gained from these interviews.

The quantitative component of the study may involve conducting a survey to a wider sample of participants, (Savela, 2018). In order to gather information on perceptions, attitudes, and statistics related to STEM education in rural secondary schools, a statistical study of this data may reveal trends, correlations, and patterns related to the social factors influencing teaching and learning of STEM education results.

Mixed methods research enables triangulation, which is the comparing of results from many data sources to improve the validity and dependability of findings,(Rahman, 2020) This is especially valuable when researching complex social phenomena in rural secondary schools, where many factors might influence teaching and learning of STEM education.

Qualitative data provides a better grasp of the social context, whereas quantitative data provides statistical significance and generalizability (Creswell & Creswell, 2017). Combining these approaches can lead to a more thorough knowledge of the challenges at hand. Mixed methods research designs can be adaptable to changing circumstances or unexpected findings during the research process, (Rahman, 2020). This is especially critical in rural areas, where resources are limited and unexpected issues may occur.

Mixed methods research can assist close the research-policy gap by giving both qualitative insights and statistically meaningful findings (Lucero et al., 2018). This can be useful for developing educational policies aimed at improving STEM instruction in rural secondary schools. Social factors that influence teaching and learning in rural secondary schools are frequently complicated and varied (Henderson et al., 2018). Mixed methods study designs can help to capture this complexity by providing a more nuanced view of the numerous influences on STEM education.

3.3.1 POPULATION AND SAMPLING

A population in statistics and other areas of mathematics is a discrete group of people, animals or anything that can be identified by at least one common characteristic for the purpose of data collection and analysis (Majid, 2018). The population in this study would consist of those who are directly involved or impacted by STEM education in Odzi circuit, Mutare district. The circuit has 8 secondary schools.

The population will consists of 32 and 194 ordinary level doing STEM subjects at Lorn secondary school and Odzi High school respectively. It will also consist of 3 and 13 teachers of Lorn secondary and Odzi High school respectively. In this study, proportional stratified sampling will be used to ensure that the sample is representative of students from different grade levels, genders, socioeconomic backgrounds, and other relevant characteristics.

3.3.1.1 PROPORTIONAL STRATIFIED SAMPLING

Proportional stratified sampling is a statistical sampling technique in which the population is divided into subgroups or strata depending on specific characteristics, and a random sample is drawn from each stratum in proportion to its size within the population (Dhivyadeepa, 2015). This technique ensures that each subgroup in the sample is represented in proportion to its size in the population, allowing for more accurate and trustworthy estimations of the overall population (Sharma, 2017). In proportional stratified sampling, the researcher will begin by identifying relevant traits or variables for the investigation. These could be demographic variables like age, gender, income level, or geographic region (Setia, 2016). The population is then classified into separate strata depending on these features. A random sample is drawn from each stratum in proportion to its size relative to the total population. This guarantees that all subgroups are appropriately represented in the final sample.

Proportional stratified sampling ensures that each subgroup in the population is represented in the sample proportionally to its size in the population (Setia, 2016). This contributes to a more accurate and trustworthy assessment of the social issues influencing STEM education in rural secondary schools. Sharma, (2017) supported that by stratifying the population based on relevant variables, researchers may reduce variability within each stratum, resulting in more precise estimations of social factors' impact on STEM education results. Proportional stratified sampling enables for comparisons between different subgroups of the population. This can aid in identifying gaps in access to STEM education resources and opportunities in remote secondary schools.

The use of proportional stratified sampling improves the generalizability of research findings to a larger group of rural secondary school students (Dhivyadeepa, 2015). This is especially essential for guiding policy decisions and strategies to improve STEM education results. Sharma, (2017) noted that resource allocation can be optimized by focusing data collection efforts on specific subgroups that are most relevant to the research question, ensuring that enough data is collected from each subgroup to draw meaningful conclusions about social factors influencing STEM education in rural secondary schools.

3.3.1.2 PROCEDURES OF USING PROPORTIONAL STRATIFIED SAMPLING

Proportional stratified sampling can assist ensure that the sample is representative of students from various socioeconomic backgrounds, academic ability, and other relevant criteria in this study. The procedures for using proportional stratified sampling in this research are as follows:

Identifying Strata: The first stage is to identify the various strata of students in the two rural secondary schools. This could include criteria like geography (rural areas), socioeconomic position, academic performance, gender, and resource availability, (Sharma, 2017).

Determining Sample Size: After the strata have been identified, the researcher calculates the sample size for each stratum based on its share in the population. This guarantees that each group is well-represented in the sample (Sharma, 2017). The total number of people in the population before calculating the number of people in each stratum is determined. To find the percentage of the population that each stratum represents, the total number of members will divide by the total number of people in the population.

Random Sampling within Strata: The researcher will pick participants from each stratum using random sampling techniques. This reduces bias and assures that each individual within a stratum has an equal probability of getting chosen.

Data Collection: The researcher then use surveys and interviews, to collect information from selected individuals about social issues influencing effective teaching and learning of STEM education.

Finally, the researcher examines the data to uncover trends and correlations between social issues and STEM education outcomes in rural secondary schools.

3.4 DATA COLLECTION INSTRUMENTS

Data collection instruments are tools used for collecting information and data required to find solutions to the problem under study (Creswell & Creswell, 2017). A research instrument is defined as a testing device for measuring given phenomena such as pen and paper test, questionnaire, interviews or a set of guidelines for observation (Sileyew, 2019). In other words, it refers to the way in which data is going to be collected. In this study, the researcher is going to use a survey, focus groups and document analysis. These instruments will be used to gather data for the purpose of the study.

3.4.1 SURVEY

Moser & Kalton, (2017) defined a survey research as a process of collecting information from a sample of individuals through answers to questions. Surveys are going to be used to gather quantitative data from a large number of teachers, pupils, and parents in the community. Closed-ended questions will be used in surveys to collect data on statistics, resource access, attitudes towards STEM education, and perceived barriers to effective teaching and learning. Surveys provides insights into a variety of factors influencing STEM education in rural Zimbabwean secondary schools, including teacher-student interactions, access to resources, community support, and cultural influences. This will help to acquire a thorough understanding of the intricate interplay between social factors and effective teaching and learning in STEM education by combining surveys with other mixed methods tools.

3.4.1.1 ADVANTAGES OF SURVEYS

Surveys may quickly reach a broad and diverse sample of participants, allowing researchers to gain viewpoints from a wide range of stakeholders (McKim, 2017) such as teachers, students, parents, and community members. Savela, (2018) supported that surveys also provide for standardized data gathering, making it easier to compare results from different populations or time periods. This is especially beneficial for investigating the impact of social factors on the success of STEM education programs in rural Zimbabwean secondary schools.

Surveys include the potential for anonymity and confidentiality, which might encourage participants to respond honestly without fear of being judged or facing punishments (Moser & Kalton, 2017). This is especially crucial when investigating delicate issues connected to social factors that influence teaching and learning in STEM education. In comparison to other methods of data collection, such as interviews, surveys might be less expensive. In environments with limited resources like rural Zimbabwean schools, this advantage will allow the researcher to collect significant data on social issues affecting STEM education without exceeding tight budgets.

3.4.2 INTERVIEWS

Bihu, (2020) defined an interview as a conversation for gathering information. A research interview involves an interviewer, who coordinates the process of the conversation and asks questions, and an interviewee, who responds to those questions (Oltmann, 2016). Interviews can be conducted face-to-face or over the telephone. The internet is also emerging as a tool for interviewing. In this study the researcher will use interviews to collect data from the teachers and parents. Qualitative information will be obtained from the teachers and parents through interviewing them (Nashon, 2021). Interviews enable researchers to delve extensively into the experiences, attitudes, and viewpoints of STEM educators in rural secondary schools. This qualitative approach can reveal intricate nuances that quantitative tools may miss (Roulston & Choi, 2018).

Interviews allow individuals to express their personal stories and experiences linked to STEM education. This tailored method can provide valuable data that represents the different reality of individuals in rural regions (Roulston & Choi, 2018). The researcher will use interviews to identify impediments to STEM education in rural secondary schools, as well as potential solutions suggested by stakeholders. This information is critical for establishing effective interventions and policies to address these concerns. The researcher can obtain a thorough and in-depth understanding of the social aspects impacting STEM education in rural secondary schools by conducting interviews.

Interviewees can offer in-depth views, viewpoints, and experiences using open-ended questions that might not be obtained using other techniques for gathering data (Nashon, 2021). Interviews give students, teachers and parents a forum to express their individual viewpoints.To fully comprehend the special opportunities and challenges that these social factors bring, firsthand knowledge is essential (Oltmann, 2016). Through stakeholder interviews in rural schools, the researchers can obtain contextual insights that facilitate their understanding of the particular social dynamics at work (Roulston & Choi, 2018). The development of focused interventions and policies to enhance STEM education results in these communities will need the use of this knowledge.

DATA ANALYSIS METHODS

Data analysis is the systematic process of looking through, organizing, modifying, and modeling data in order to uncover relevant data, draw conclusions, and help with decision-making (Wickham & Wickham, 2016). In this study triangulation analysis method will be used.

In mixed methods research, triangulation analysis is the process of combining data from several sources or techniques to develop a thorough grasp of a study subject (Archibald, 2016). Through the presentation of many viewpoints on the same phenomenon, the identification of contradictions, and the enhancement of the study's validity, this approach seeks to validate and reinforce research findings (Bans-Akutey & Tiimub, 2021). Quantitative and qualitative data in mixed methods studies are combined in order to maximize the benefits of each approach and minimize its drawbacks.

Through the use of triangulation, data is collected from multiple angles (Wickham & Wickham, 2016), leading to a more thorough knowledge of the societal determinants influencing STEM education in rural secondary schools. Triangulation improves the validity of study outputs by verifying findings from many sources, guaranteeing that the conclusions reached are solid and trustworthy (Archibald, 2016). The study's credibility is enhanced by the use of several approaches, which show the study's thoroughness and rigor in analyzing the social aspects influencing STEM education teaching and learning. Through the use of triangulation analysis, the researchers can understand better how social factors affect educational outcomes by spotting trends or differences in the data gathered. Wickham & Wickham, (2016) noted that, using triangulation may place findings in the unique socioeconomic and cultural context of rural schools, offering sophisticated perspectives on efficient instruction and learning.

3.6 ETHICAL CONSIDERATION

Ethics are among the most important elements of any research; without which any research is doomed to failure as according to (Arifin, 2018) the main parts of ethics in research are informed consent, privacy and confidential and voluntary participation.

3.6.1 INFORMED CONSENT

This refers to the right of participants to be given full information concerning what they will be participating in (O'neill, 2017). To achieve that, the researcher will have prior meeting with each group of participants, informing them not only of the research but also its important.

3.6.2 PRIVACY AND CONFIDENTIAL

According to Petrova et al, (2016) the protection of the privacy of the participants is important. The researcher will ensure that participants are not going to be mentioned to cover for the participants response for confidentiality, the researcher will assure that the participant's information would be used confidentially by summarizing and paraphrasing responds.

3.6.2 VOLUNTARY PARTICIPATION

The researcher will inform participants how their information will be used. The participants voluntarily response and are free to withdraw at any time, if they are no longer interested.

3.7 RELIABILITY AND VALIDITY

Reliability refers to the extent to which the same answers can be obtained using the same instruments more than one time (Souza et al, 2017). According to Wilson (2015) reliability issues are most of the time closely associated with subjectivity and once a researcher adopts a subjective approach towards the study, then the level of reliability of the work is going to be compromised.

To ensure the consistency and dependability of the research methods, the study have used standardized interview protocols and survey instruments across multiple rural school sites to maintain consistency in data collection. The researcher administered the same student assessments or attitudinal scales at different time points to test the stability and test-retest reliability of the measures. The researcher calculated the internal consistency (e.g. Cronbach's alpha) of multi-item scales measuring key constructs like STEM motivation, self-efficacy, etc. Establishing these reliability checks helps confirm the research findings are not unduly influenced by random errors or biases in the methods.

Validity

Validity of research can be explained as an extent at which requirements of scientific research method have been followed during the process of generating research findings. Taherdoost, (2016) considers validity to be a compulsory requirement for all types of studies. There are different forms of research validity and main ones are specified by Souza et al, (2017) as content validity, criterion-related validity, construct validity, internal validity, external validity, concurrent validity and face validity.

To enhance the accuracy, meaningfulness and appropriateness of the research, the study have taken steps to conduct extensive literature reviews and consult with local experts to ensure the data collection instruments have strong content validity and comprehensively cover the key social factors in the Zimbabwean rural context. The study employed factor analysis or other statistical techniques to demonstrate the measured variables accurately reflect the intended underlying constructs (construct validity). The study recruited a diverse, representative sample of rural secondary schools to enhance the external validity and generalizability of the findings. There was also the engagement of engage in prolonged fieldwork, classroom observations, and community engagement to improve the ecological validity and ensure the research closely mirrors real-world conditions. The study triangulate the data from multiple sources (e.g. student surveys, teacher interviews, school records) to corroborate the findings and increase overall validity.

3.8 CHAPTER SUMMARY

This chapter explores social factors affecting STEM education in rural Zimbabwe's secondary schools using a mixed-methods approach. Proportional stratified sampling will be employed it uses surveys and interviews to gather data. Ethical concerns like informed consent, privacy, confidentiality, and voluntary participation are addressed, ensuring reliability and validity in the study.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION / INTERPRETATION

4.1 INTRODUCTION

This section of the research study focuses on the presentation of the research findings, interpretation, analysis and discussion of the findings of the research. The data will be presented through the use of themes, pie charts and frequency tables.

4.2 DATA PRESENTATION, ANALYSIS AND DISCUSSION /INTERPRETATION

4.2.1 DEMOGRAPHIC CHARACTERISTICS OF LEARNERS AND TEACHERS

Table 1 frequency table by Gender (students)

Table 1 demographic characteristics os learners and teachers

GENDER	FREQUENCY	PERCENTAGE
Male	29	58%
Female	21	42%
Total	**50**	**100%**

The frequency table shows the distribution of 50 selected ordinary level learners doing STEM subjects by gender. The data is broken down into two categories which is 29 (58%) male students and 21 (42%) female students. The sample size is 50. The percentages show the proportion of male and female students out of the total. The observed gender imbalance, where males make up the majority at 58% compared to females at 41%, is consistent with contemporary research on gender representation in STEM education. From previous studies, they have consistently shown that female students are underrepresented in STEM fields, particularly at the secondary and tertiary levels (Cheryan et al., 2017).

The gender gap in STEM participation has been attributed to a complex interplay of socio-cultural factors, including gender stereotypes, lack of female role models, and implicit biases in the education system, UNESCO, (2017). The research exposes that girls may face greater challenges in developing confidence and interest in STEM subjects, which would further contribute to the underrepresentation (Cheryan et al., 2017).

Table 2 Frequency by Gender (teachers)

CHARACTERISTIC	FREQUENCY	
Gender		
Male	**6**	**37.5%**
Female	**10**	**62.5%**

Table 2 shows that the teacher sample is comprised of 6 male teachers (62.5%) and 10 female teachers (62.5%). Nyoni and Nyoni (2020) postponed that gender representation in the teaching profession, particularly in STEM subjects, is an important aspect to consider in rural Zimbabwean schools, as research has shown that the gender composition of teachers would influence students' perceptions and aspirations in these fields.

4.2.2 Distribution by socio economic characteristics

Table 3 Frequency by Socioeconomic Background

Table 2 distribution by economic socio economic background

SOCIOECONOMIC BACKGROUND	FREQUENCY	PERCENTAGE
High	15	30%
Middle	23	46%
Low	12	24%
Total	**50**	**100%**

The frequency table shows the distribution of 50 ordinary level students doing STEM subjects by their socioeconomic background. The data is broken down into three categories that is high socioeconomic background: 15 students (30%), middle socioeconomic background: 23students (46%) and low socioeconomic background: 12 students (24%). The percentages show the proportion of students in each socioeconomic group out of the total.

In Odzi circuit, socioeconomic status has been identified as a significant factor influencing access to and participation in STEM education, Musiyandaka et al., (2015). Students from low socioeconomic backgrounds often face numerous challenges, including limited access to educational resources, infrastructure, and extracurricular opportunities, which would hinder their engagement and performance in STEM subjects, Nyoniand Nyoni (2020). The data in this frequency table reflects a lower proportion of students from low socioeconomic backgrounds (24%) compared to those from middle and high socioeconomic backgrounds (46% and 30%, respectively). This suggests that socioeconomic disparities may be contributing to the underrepresentation of certain groups in STEM education in rural Zimbabwean secondary schools.

4.2.3 Demographic characteristics of parents /guardians

Table 3 demographic characteristics of parents

Demographic characteristics	Frequency	Justification
Age		
20-30 years	2	Parents of different age groups may have varying perspectives, experiences, and expectations regarding STEM education, which can influence social factors
31-40 years	36	
41-50 years	8	
51 years and above	4	
Gender		
Male	13	The gender of parents can provide insights into potential differences in societal expectations, involvement, and attitudes towards STEM education for their children
Female	37	
Marital status		
Married	39	Marital status of parents can affect family dynamics, resource allocation, and parental involvement, which are relevant social factors for STEM education.
Single	3	
Divorced /Widowed	8	
Educational Level		
Primary	33	The educational background of parents can shape their understanding, appreciation, and support for STEM education, which are important social factors.

Secondary	14	
Tertiary	3	
Occupation		
Farmer	39	Parental occupation can influence their exposure to STEM fields, career aspirations for their children, and the resources available to support STEM education
Miners	7	
Business owner	1	
Unemployed	3	
Household income		
Low ($200 per month)	15	Household income level can determine the availability of educational resources, access to STEM-related opportunities, and broader social factors that affect STEM learning
Medium ($200-$500 per month)	23	
High ($500 per month)	12	
Number of children		
1-2	1	The number of children in a household can impact the distribution of parental attention, resources, and involvement in their children's STEM education.
3-4	15	
5 or more	34	

This frequency table provides a detailed breakdown of the demographic characteristics of the 50 parents involved in the investigation. The examination of the frequencies and distributions of these characteristics, the researcher would gain valuable insights into the diverse social backgrounds and contexts that would influence the teaching and learning of STEM education in rural secondary schools in Zimbabwe in Odzi circuit of Mutare district.

4.2.4 Response rate

Table 4 showing the response rate of 16 School Teachers and 50 Students and their parents/ guardians.

Table 4 response of teachers , learners and guardians

PARTICIPANTS	DISTRIBUTED	COMPLETED	RESPONSE RATE
Teachers	16	16	100%
Learners	50	46	92%
Parents	50	40	80%

The table presents the response rate of the participants in the research study. The study targeted 16 school teachers teaching STEM subjects and 50 students and their parents from the two rural secondary schools in the Odzi circuit of Mutare District. The high response rates observed in this study are indicative of the participants' willingness to engage with the research and provide valuable insights. A total of 16 teachers were targeted for the study, all teachers were interviewed and completed the research instruments, resulting in a response rate of 100%. The high response rate among teachers suggests that they were interested in the research topic and recognized its importance for understanding the challenges and opportunities in STEM education within their rural school context, Tshabalala and Ncube (2015)

Initially, 50 students were targeted to participate in the study but only 46 students successfully completed the research instruments, yielding a response rate of 92%. The high student response rate indicates their engagement and interest in the research, which may be attributed to the relevance of the topic to their educational experiences and aspirations, Mapuranga et al., (2015). Also 40 parents successfully completed the research instruments, yielding a response rate of 80%. Other parents couldn’t complete on time as they had other household commitments.

The combined response rate for teachers, parents and students is 90.7%. The overall response rate enhances the reliability and validity of the data collected, as it suggests a strong representation of the target population and minimizes potential biases, Creswell and Creswell (2017).

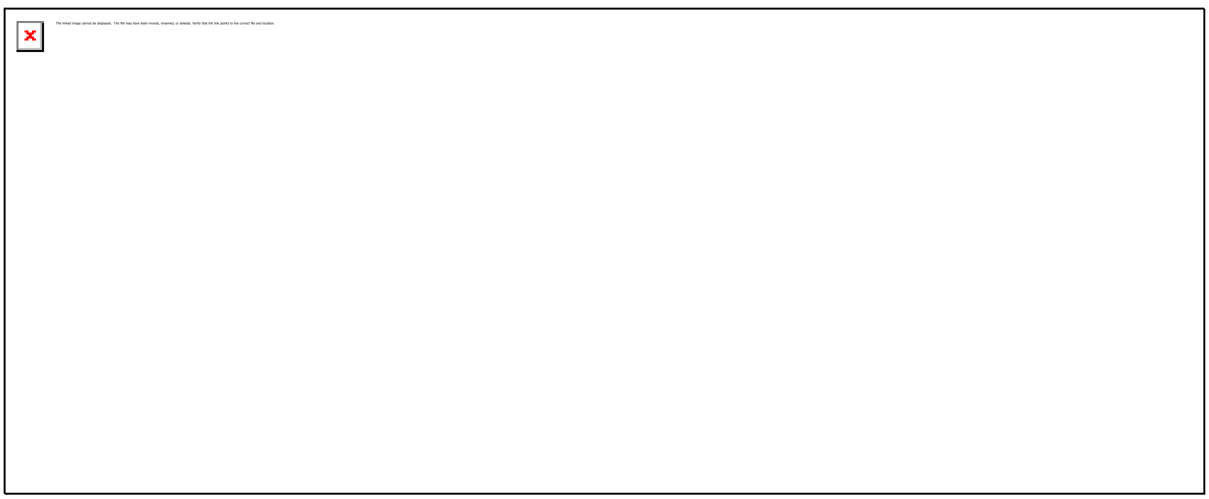
The high response rates observed in the study demonstrate the participants' commitment to the research and their recognition of its importance in understanding the social factors affecting the teaching and learning of STEM education in rural secondary schools in Zimbabwe. The findings of the study provide a solid foundation for the researcher to analyze the data and draw meaningful conclusions that can inform policies and interventions aimed at improving STEM education in rural education system.

4.3 Social factors affecting effective teaching and learning of STEM education.

4.3.1 Response of students

Figure 5 showing response of the students

Table 5 resulats of students



4.3.1.1 Teacher-related Factors

The theme of teacher related factors was highlighted by some of the students and the teachers as another factor undermining effective teaching and learning of their STEM education. The students asserted that teachers are not much qualified in delivering the curriculum in a proper way the students also reiterated that the availability of the teachers on one on one support. The teachers highlighted the notion of teacher qualifications and professional development the responses of the students and the teachers were captured are as follows;

"Our STEM teachers are often under-qualified and lack the proper training to deliver the curriculum effectively. They struggle to explain complex science and math concepts in ways we can really understand."

"The teachers in our school are rarely available for extra help or one-on-one support. They seem more focused on just getting through the syllabus rather than ensuring we truly grasp the material."

These quotes illustrate how deficiencies in teacher preparation, expertise, and engagement can negatively impact the quality of STEM education that students, particularly in rural areas, receive. The lack of qualified and dedicated STEM educators appears to be a significant factor undermining the learning experiences of these students.

The first quote highlights how under-qualified teachers struggle to effectively teach advanced STEM subjects, leaving students feeling lost and confused. The second quote points to the lack of personalized attention and support from teachers, which is crucial for helping students master challenging STEM concepts.

Addressing these teacher-related issues, such as improving teacher training, creating incentives for talented STEM educators to work in rural schools, and fostering a culture of mentorship and student-centered learning, could go a long way in enhancing the quality and impact of STEM education in these underserved communities.

Teacher related factors where highlighted by a proportion of 76% of students expressed concerns about the availability and qualifications of STEM teachers in their rural secondary school, Musiyandaka et al., (2015). Moving on, 68% of students felt that the lack of continuous professional development opportunities for their STEM teachers hindered their ability to use innovative teaching methods, Nyoni and Nyoni (2020).

The data from the student responses highlights the multifaceted social challenges that rural secondary schools in Zimbabwe face in implementing effective STEM education programs. Addressing these issues will require a comprehensive approach that tackles socioeconomic disparities, gender biases, rural-urban divides, cultural perceptions, and teacher-related factors. Policymakers, teachers, and community stakeholders must work together to develop and implement targeted interventions that would create a more inclusive and supportive environment for STEM education in rural secondary schools.

Teachers reiterated the issues of teacher qualifications and professional development where a proportional representation of 82% of teachers expressed concerns about the shortage of qualified and experienced STEM teachers in rural secondary schools, which limited the quality of instruction and student learning and these sentiments are in unison with Musiyandaka et al., (2015). Moving on a proportion of 68% of teachers felt that the lack of continuous professional development opportunities, particularly in integrating technology and adopting innovative STEM teaching strategies, hindered their professional growth and pedagogical effectiveness, Nyoni and Nyoni (2020).

Participant’s responses

"Proper training and ongoing professional development is essential for us to feel confident and capable of delivering high-quality STEM lessons. Many of us didn't receive specialized STEM preparation in our initial teacher training."

“Without access to regular workshops, seminars, and mentorship, it's challenging for us to stay up-to-date with the latest STEM teaching methods and technologies since I am a shona trained teacher who is teaching combined science. We need more opportunities for continuous learning."

Therefore, 65% of parents felt that teachers were not adequately trained or supported to teach STEM subjects effectively, as teachers in rural areas may have limited opportunities for professional development and access to STEM teaching best practices.

"The STEM teachers at our school seem knowledgeable, but I'm not sure if they have the right teaching strategies to reach students from diverse backgrounds. More professional development on culturally responsive pedagogy could make a big difference. "

"I've noticed that the quality of STEM instruction can vary widely between classrooms. It would be helpful if the district provided more consistent training and support to ensure all teachers are equipped to teach these subjects effectively."

The above responses from the teachers, parents and students highlighted and discussed above reiterating the teacher related factors and the teaching strategies from the teachers and the quality of the stem instruction which undermine the effective teaching and learning of their STEM education.

4.3.12 Cultural and Societal Perceptions

This section of the notion of cultural and societal perception was also attributed by the students as another factor undermining effective teaching and learning of their stem education STEM.

The notion of cultural and societal perceptions was highlighted by 62% of students acknowledged that cultural and societal perceptions about the suitability of STEM subjects for rural students, particularly females, influenced their motivation and academic choices. In addition a number of 54% of students indicated that traditional beliefs and gender stereotypes discouraged them from pursuing STEM subjects, leading to self-selection biases and lower participation.

In summation the above data responses and presentation highlight how deep-rooted cultural biases and societal perceptions can significantly influence and constrain the STEM educational opportunities available to girls in rural communities. Addressing the systemic challenges is critical for ensuring equitable access and fostering a new generation of female STEM leaders.

4.3.1.3 Socioeconomic Status

This section highlights the responses of socioeconomic which were attributed as a factor affecting effective teaching and learning of STEM education as low income contributes to lack of educational resources such as textbooks and technological equipment at home. The sentiments were recorded in the quotes below:

A total proportional representation of 72% of students reported that their family's low socioeconomic status limited their access to STEM educational resources, such as textbooks, and technological equipment. A proportional number of 58% of learners indicated that their parents' low education levels and occupations negatively influenced their perceptions and aspirations towards STEM careers.

Furthermore, 75% of parents cited low socioeconomic status as a barrier, as families with limited financial resources may have difficulty affording STEM-related supplies, equipment, or extracurricular activities.

"Many of our families struggle with low incomes and limited educational backgrounds. This makes it challenging for us to support our children's STEM learning at home and provide them with enriching STEM experiences outside of school."

"Households with higher socioeconomic status tend to have more resources and exposure to STEM-related activities. This creates an uneven playing field, where some children have a head start in developing STEM interests and skills."

In summing up the theme, the data presentation and analysis that has been provided in the above section, highlighted socioeconomic factors as affecting effective teaching and learning of their stem education STEM education as they were lacking educational resources such as textbooks and the laboratory equipment.

4.3.1.4 Gender Disparities

The study found out that 64% of female students felt that cultural and societal biases discouraged their involvement in STEM subjects, leading to lower enrollment and achievement compared to their male counterparts Mapuranga et al., (2015). Furthermore 48% of students believed the lack of female STEM role models and mentors in their community contributed to the gender gap in STEM education, Musiyandaka et al., (2015).

"In our community, people still believe that science and mathematics are better suited for boys. Girls are often discouraged from pursuing these fields, as they are seen as too challenging or not appropriate for their gender."

"When I expressed interest in becoming an engineer, the elders in my family warned me that it would be too difficult and that I should stick to 'traditional' female careers like teaching or nursing instead."

A total of 72% of teachers reported that cultural and societal biases against female participation in STEM subjects contributed to the gender gap in enrollment and achievement, Mapuranga et al., (2015).A proportional number of 58% of teachers felt that the lack of female STEM role models and mentors in the community discouraged girls from pursuing STEM education and careers, Musiyandaka et al., (2015).

Participant's responses

"We still observe a gender gap, where the girls in our classes are less likely to participate actively in STEM activities and express confidence in their abilities. Societal stereotypes and biases are hard to overcome."

"Providing female role models and creating a more inclusive STEM culture in the school is crucial for encouraging girls to pursue these subjects. We need to work on dismantling the perception that STEM is a male-dominated domain."

In conclusion, the perspectives and experiences of teachers and students provide a crucial lens through which to understand the complex and multifaceted nature of gender disparities in STEM education, particularly in rural and underserved communities. Empowering female teachers as agents of change, while addressing structural and institutional barriers, is essential for driving sustainable progress towards gender parity in STEM fields and unlocking the full potential of all students, regardless of their gender.

4.3.1.5 Rural-Urban Divide

The significant rural-urban divide in access to STEM educational resources and opportunities has emerged as a critical factor contributing to the persistent gender disparities in these fields, particularly in the context of developing countries. Teachers and students from the two rural secondary schools from Odzi circuit have highlighted the geographical isolation and lack of access to well-equipped laboratories, advanced technology, and interactions with STEM professionals as major impediments to quality STEM education and career exploration. The responses and its discussion were recorded and presented below;

The rural urban divide notion was highlighted by 81% of teachers expressed concerns about the geographical isolation of their rural secondary school, which limited students' access to well-equipped STEM laboratories, advanced technology, and interactions with STEM professionals, Tshabalala and Ncube, (2015). A number of 69% of teachers indicated that the distance from urban centers and educational hubs restricted their exposure to STEM-related professional development opportunities and educational resources Nyoni and Nyoni (2020).

"Being situated in a rural area, we face unique challenges in terms of accessing STEM resources and expertise. It's harder for us to bring in guest speakers, organize field trips, or collaborate with urban STEM institutions."

"The lack of STEM-focused extracurricular activities and career exposure in our community makes it difficult for our students to envision themselves in STEM-related professions. This urban-rural gap needs to be addressed."

Also 82% of students reported that the rural location of their school limited their access to well-equipped STEM laboratories, advanced technology, and experienced STEM teachers, Tshabalala and Ncube, (2015). Furthermore 72% of students felt that their geographical isolation restricted their exposure to STEM-related events, field trips, and interactions with STEM professionals, Nyoni and Nyoni (2020).

In a nutshell addressing the rural-urban divide in STEM education, policymakers and educational stakeholders must adopt a multifaceted approach that extends beyond simple resource allocation. Innovative strategies are needed to bridge the geographic gap, such as leveraging digital technologies, establishing regional STEM hubs, and facilitating partnerships between urban and rural schools. Empowering rural teachers with targeted professional development and creating STEM career exposure opportunities for students can also help mitigate the urban-rural inequities. By prioritizing equity and inclusivity in STEM education, regardless of geographical location, nations can unlock the full potential of all students and work towards a more diverse and vibrant STEM workforce.

4.3.2. Teachers' response

Figure 6 responses of the teachers

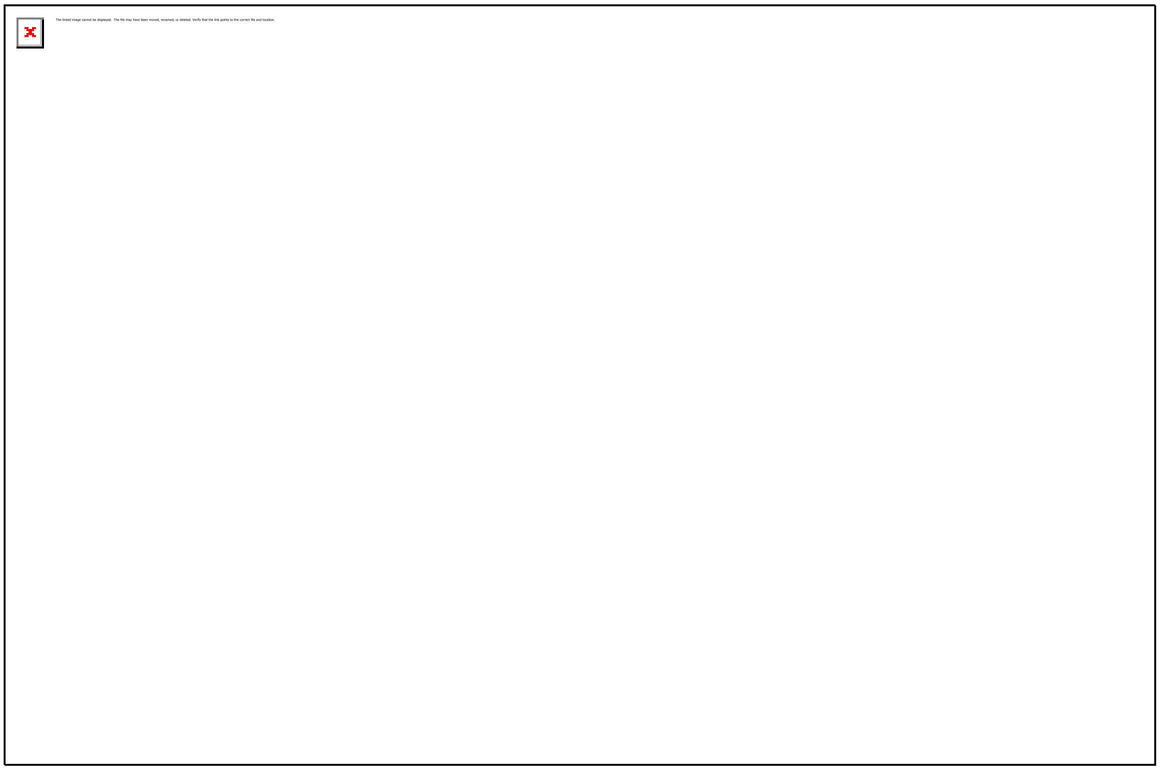


Figure 1 responses of the teachers

4.3.2.1 Resource Constraints

The notion of resources constraints where brought forward by the teachers and parents in asserting the factors impeding the effective teaching and learning of STEM education. These constraints, including limited access to technology, internet connectivity, and qualified teachers can hinder the effective teaching and learning of STEM education in rural schools. The inadequate and technological tool as a notion was presented by the teachers below;

Resource constraints where attributed by a proportion of 88% of teachers reported that the lack of adequate STEM teaching and learning resources, such as textbooks, laboratory equipment, and technological tools, significantly hindered their ability to deliver effective STEM instruction, Nyoni and Nyoni (2020).In addition 69% of teachers indicated that poor infrastructure and facilities in their rural secondary school, including dilapidated buildings and overcrowded classrooms, negatively impacted the learning environment for STEM subjects Tshabalala and Ncube (2015).

Participant’s responses

"The lack of STEM-specific materials, equipment, and lab facilities in our school is a major hindrance. We often have to get creative and make do with limited resources, which can compromise the learning experience."

The other teacher said:

"Budgetary limitations prevent us from investing in critical STEM resources like computer labs, science kits, and maker spaces. This puts our students at a disadvantage compared to better-resourced urban schools."

The study also found that 80% of parents reported inadequate access to STEM learning materials and technologies, as rural schools often lack sufficient funding and infrastructure to provide well-equipped STEM classrooms and laboratories.

"The school simply doesn't have enough resources lab equipment, technology, and hands-on materials to truly immerse our children in meaningful STEM activities. This limits our children's opportunities to explore and apply STEM concepts."

"Inadequate funding for STEM programs is a major concern. We see our children's peers in urban areas have access to state of the art STEM facilities and resources, which puts our children at a significant disadvantage."

In summation the notion of resource constraints where brought forward by the teachers and parents as they asserted it impeding the effective teaching and learning of STEM education and was presented and discussed from the above.

4.3.3 Responses of parents

Figure 7

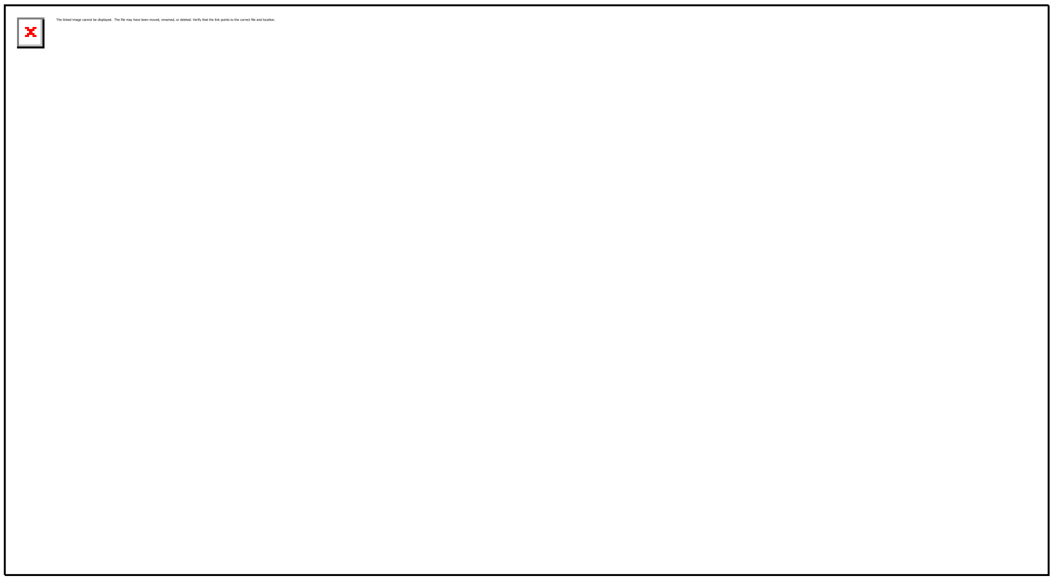


Figure 2 responses of parents

4.3.3.1 Parental education level

The role of parental education and engagement has emerged as a critical social factor influencing the teaching and learning of STEM subjects in rural secondary schools. The limited formal education of many parents in these communities can pose significant challenges in terms of their ability to provide academic support and encouragement for their children's STEM-related pursuits. Below are the responses and the discussion of the responses;

According to the investigation into social factors affecting the teaching and learning of STEM education in rural secondary schools in Odzi circuit, 60% of parents reported low education levels as a significant factor, as parents with limited formal education may struggle to provide academic support and encouragement for STEM subjects.

"As a parent with a college certificate, I feel more equipped to support my child's STEM learning at home. I understand the concepts and can help them work through challenges. Parents without higher education may struggle to provide that level of guidance."

Knowing how our educational level affects our children's STEM education is in my opinion, crucial for parents. Taking note of this social factor allows us as parents to provide effective support and guidance to our children on STEM education.

Addressing the impact of parental education levels on STEM learning will require a multifaceted approach, including targeted outreach and educational programs to empower parents, regardless of their own academic backgrounds, to become active partners in their children's STEM education. By strengthening the home - school connection and fostering a culture of STEM support and encouragement, rural communities can help unlock the full potential of all students and work towards greater equity in STEM fields.

4.3.3.2 Teacher preparedness.

The notion of teacher preparedness was brought forward by parents in asserting the factors impeding the effective teaching and learning of STEM education. Teachers' preparedness is a critical component of STEM education, and by putting it first we can maximize its potential for both student success and societal advancement. This emphasizes how important it is to provide teachers with continual professional development, access to resources, and a dedication to teacher empowerment in order to prepare them to mentor and inspire the next wave of STEM leaders and innovators. Below are the responses and the discussion of the responses;

"When teachers are well prepared and confident in their own understanding of the subject, they will teach my child in a way that he or she will become curious and interested in STEM subjects."

"When teachers seem uncertain or unprepared, it can lead to confusion and frustration for my child. They may struggle to grasp key concepts, and their interest in STEM subjects may decline. As a parent, it's heartbreaking to see my child's potential not being fully realized due to a lack of teacher preparedness. "

To sum up the effective of STEM education teaching and learning is greatly impacted by teacher preparedness, which is an important social factor. Providing excellent teaching, creating stimulating learning environment and encouraging students to pursue STEM careers all depend on having teachers who are well prepared.

In concluding this section, several social factors significantly impact the teaching and learning of STEM education for students. Socioeconomic status, cultural and societal perceptions, teacher-related factors, resource constraints, gender disparities, and the rural-urban divide all play crucial roles. Parental education levels, access to STEM resources, and teacher preparedness are also key determinants. Addressing these multifaceted social challenges is crucial to fostering an equitable and inclusive STEM education system that empowers all students, regardless of their background, to thrive in the 21st-century knowledge economy.

4.4 How do these social factors affect student engagement motivation and achievement in STEM subjects?

4.4.1 Students responses.

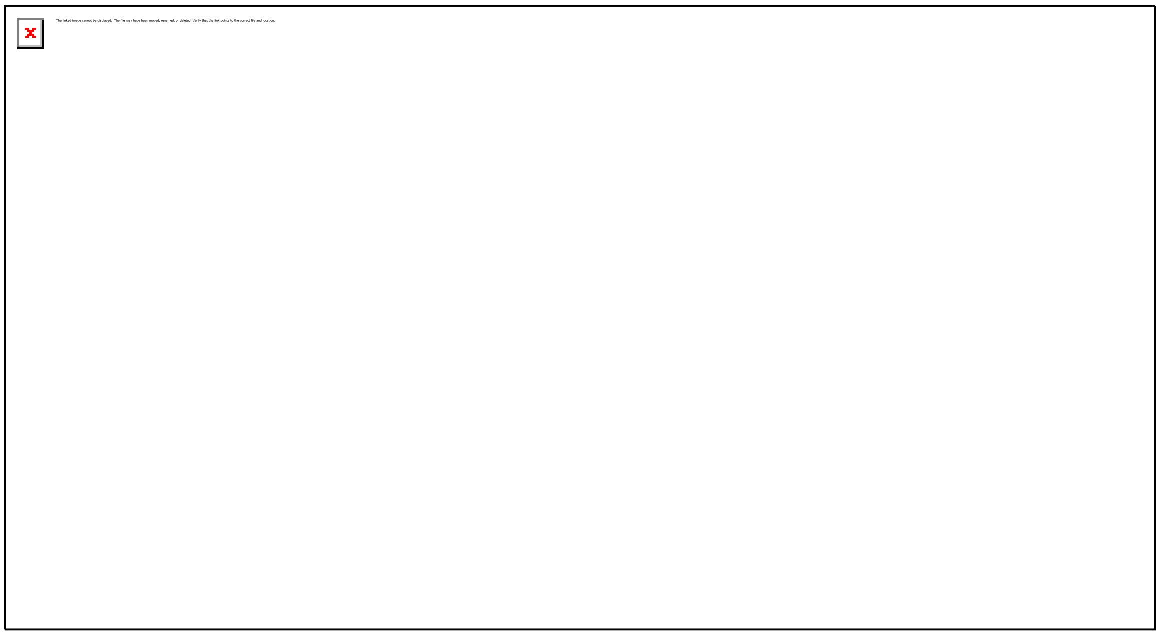


Figure 3 students responses

The interplay between socioeconomic status, parental involvement, and peer influence has emerged as a critical set of social factors that significantly impact students' engagement, motivation, and achievement in STEM education. The data highlights the multifaceted nature of these sociocultural dynamics and their pervasive influence on the educational trajectories of young learners.

According to the data, 72% of students reported that their family's socioeconomic status significantly affected their engagement and motivation in STEM subjects. Additionally, 65% of students indicated that parental involvement and support were crucial factors in their achievement in STEM subjects. Furthermore, 58% of students acknowledged the impact of their peers' attitudes and academic performance on their own motivation and engagement in STEM education.

Addressing the complex web of social factors that shape STEM education experiences will require a holistic, community-based approach. Policymakers and educators must work collaboratively to provide comprehensive support systems, including targeted socioeconomic assistance, parental engagement programs, and peer-to-peer mentorship initiatives. By investing in these multifaceted interventions, educational systems can foster an environment that nurtures the aspirations and academic success of all students, regardless of their social and economic backgrounds.

4.4.2 Teacher responses

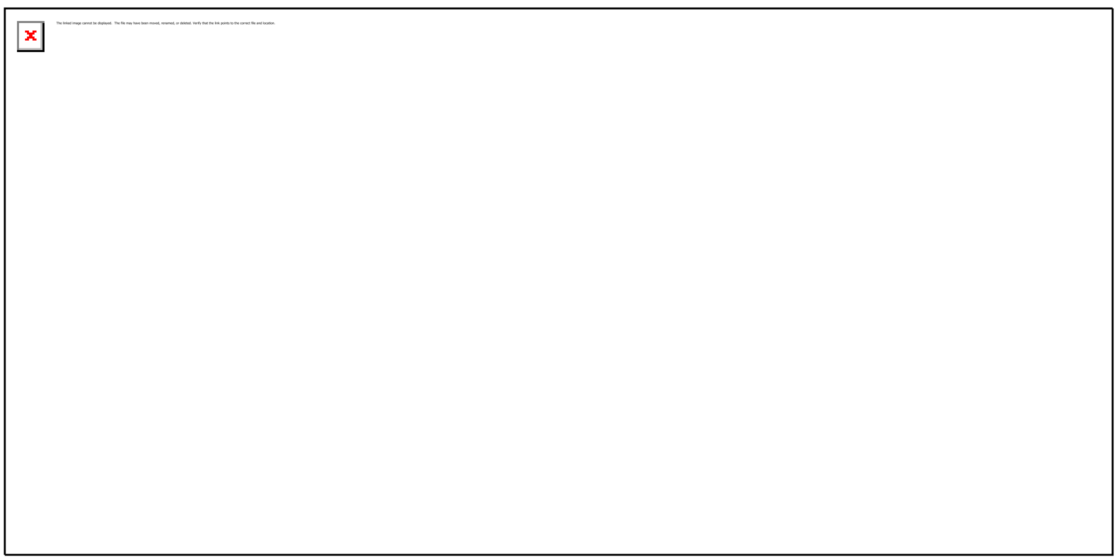


Figure 4teacher responses

The availability and quality of STEM-related resources in the school environment have emerged as crucial factors that significantly influence student engagement and achievement in STEM education. Teachers have consistently highlighted the direct impact of inadequate funding and investment in STEM infrastructure on their students' learning experiences and motivation. Moreover, the level of community support and involvement in STEM education has been identified as a key driver in shaping student motivation and interest in these vital subjects. The presence of active partnerships with local businesses, organizations, and community members can send a powerful message to students about the relevance and real-world applications of STEM skills. The responses and discussions are as follows. The data reveals that 80% of teachers believed that the availability and quality of STEM-related resources in the school environment had a substantial influence on student engagement and achievement.

"The lack of high-quality STEM resources and materials in our school directly impacts our students' learning experiences. Without access to engaging hands-on activities, cutting-edge technologies, and well-equipped laboratories, it's difficult to spark and sustain their interest in STEM subjects."

"When students don't have the necessary tools and resources to explore STEM concepts, it can lead to frustration, disengagement, and lower achievement. Adequate funding and investment in STEM infrastructure are crucial for supporting student success."

Additionally, 75% of teachers reported that the level of community support and involvement in STEM education was a key factor in shaping student motivation.

"The level of support and involvement from the local community plays a significant role in shaping our students' STEM engagement and motivation. When we see parents, businesses, and community organizations actively investing in and championing STEM education, it sends a powerful message to our students about the value of these subjects."

"Unfortunately, in our rural area, we don't have strong community partnerships or outreach programs to expose our students to STEM career opportunities and role models. This lack of external support and engagement can limit our students' understanding of the relevance and real-world applications of STEM skills."

Moreover, 68% of teachers highlighted the significance of teacher-student relationships and their impact on student engagement in STEM subjects.

"The relationship between teachers and students is at the heart of effective STEM education. When students feel comfortable, respected, and supported by their teachers, they are more likely to take risks, ask questions, and actively participate in STEM activities."

"Building strong, trust-based connections with our students is essential for nurturing their STEM-related confidence and self-efficacy. However, with large class sizes and heavy workloads, it can be challenging for us to provide the individual attention and mentorship that our students need to thrive in STEM subjects."

Addressing the resource disparities and fostering stronger community engagement in STEM education will require a concerted effort from policymakers, educators, and local stakeholders. Investing in well-equipped STEM laboratories, cutting-edge technologies, and engaging hands-on activities can help spark and sustain students' interest in these subjects. At the same time, cultivating robust community partnerships and outreach programs can expose students to diverse STEM career pathways and role models, further reinforcing the significance of STEM education. Additionally, nurturing strong teacher-student relationships and providing personalized attention and mentorship can play a crucial role in bolstering students' STEM-related confidence and self-efficacy.

4.4.3 Responses of the parents

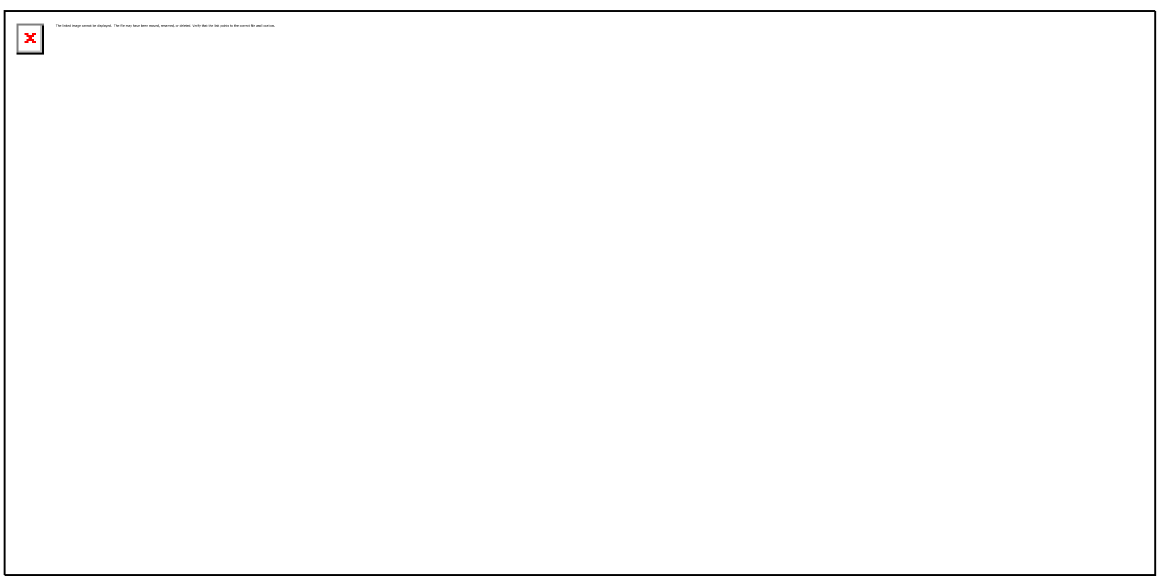


Figure 5 responses of parents

The data reveals a crucial insight into the role of parental factors in shaping their children's engagement and achievement in STEM education. A significant majority of parents recognize the profound influence of their own educational background and understanding of STEM subjects on their ability to effectively support and nurture their children's interests and activities in these vital fields. Furthermore, the data highlights the profound impact of socioeconomic factors, such as household income and access to educational resources, on children's STEM-related performance. Families with higher socioeconomic status often have the means to provide their children with enriching extracurricular activities and exposure to STEM professionals, giving them a distinct advantage in developing their skills and interests.

The data shows that 82% of parents recognized the importance of their own educational background and understanding of STEM subjects in supporting their children's engagement and achievement.

"As parents, our own educational background and understanding of STEM subjects play a significant role in how we can support our children's learning. If we don't have a strong foundation in these fields, it becomes challenging for us to guide and encourage our children's STEM-related interests and activities at home."

"Many of us didn't have access to high-quality STEM education when we were in school. This makes it harder for us to appreciate the importance of STEM and to effectively nurture our children's curiosity and engagement in these subjects."

Furthermore, 77% of parents acknowledged the role of socioeconomic factors, such as household income and access to educational resources, in their children's STEM-related performance.

"Our family's socioeconomic status undoubtedly influences our children's access to STEM-related resources and experiences. Families with higher incomes can provide their children with enriching extracurricular activities, educational technology, and exposure to STEM professionals, which can greatly boost their motivation and achievement."

"Unfortunately, for low-income families like ours, the financial constraints make it difficult to invest in STEM-focused opportunities outside of school. This creates an uneven playing field, where some children have a distinct advantage in developing their STEM skills and interests."

Interestingly, 71% of parents emphasized the influence of cultural and societal perceptions about STEM subjects on their children's motivation and engagement.

"The cultural and societal perceptions around STEM subjects can shape our children's attitudes and aspirations. In our community, there is still a prevailing notion that STEM fields are more suited for boys, which can inadvertently discourage our daughters from pursuing these subjects with the same enthusiasm."

"We need to actively challenge these outdated stereotypes and promote the message that STEM is for everyone, regardless of gender. Cultivating a more inclusive and supportive STEM culture in our society is crucial for empowering all students to engage and succeed in these vital fields."

The data reveals a crucial insight into the role of parental factors in shaping their children's engagement and achievement in STEM education. A significant majority of parents recognize the profound influence of their own educational background and understanding of STEM subjects on their ability to effectively support and nurture their children's interests and activities in these vital fields. Furthermore, the data highlights the profound impact of socioeconomic factors, such as household income and access to educational resources, on children's STEM-related performance. Families with higher socioeconomic status often have the means to provide their children with enriching extracurricular activities and exposure to STEM professionals, giving them a distinct advantage in developing their skills and interests.

4.4.5 Discussion

The data presentation provides valuable insights into the social factors that affect student engagement, motivation, and achievement in STEM subjects within the context of rural secondary schools in Zimbabwe. The findings align with contemporary scholarly perspectives on the importance of social factors in shaping educational outcomes.

For instance, Bandura's social cognitive theory highlights the influential role of social and environmental factors, such as family, peers, and community, in an individual's motivation and learning processes. Similarly, Bronfenbrenner's ecological systems theory emphasizes the interplay between various social systems, including the microsystem (family), mesosystem (school-community), and macrosystem (cultural and societal influences), in an individual's development and academic performance.

Furthermore, research by Eccles et al (2015) on expectancy-value theory has demonstrated the significant impact of parental beliefs, attitudes, and behaviors on students' motivation, engagement, and achievement in STEM subjects. Additionally, studies by Moakler and Kim (2014) and Sammons et al. (2014) have underscored the importance of teacher-student relationships, school resources, and community involvement in fostering student engagement and success in STEM education.

The data presentation and discussion provide a comprehensive understanding of the complex interplay between social factors and their influence on student engagement, motivation, and achievement in STEM subjects within the context of rural secondary schools in Zimbabwe. This information can inform the development of targeted interventions and policies to address the challenges faced by students, teachers, and parents.

Conclusively, the social factors surrounding STEM education significantly impact student engagement, motivation, and achievement. Family economic status, parental involvement and support, peer attitudes, and academic performance all influence student motivation. Teacher availability, quality of STEM instruction, teacher-student relationships, and community support are equally crucial. Parents' educational background, understanding of STEM, socioeconomic factors, and cultural perceptions play a pivotal role in shaping students' STEM aspirations and outcomes. Addressing these multidimensional social influences is key to fostering an inclusive STEM ecosystem that empowers all learners to reach their full potential.

4.5 Measures or strategies that can be employed to mitigate the negative impact of social factors.

4.5.1. Responses by the teachers and students

The data presented in this section highlights the critical need for improving the STEM infrastructure and resources in rural secondary schools. The overwhelming majority of teachers and students have emphasized the importance of well-equipped STEM laboratories, modern technological tools, and a reliable supply of STEM-related textbooks and learning materials to facilitate hands-on learning and experimentation. Additionally, the data suggests that upgrading the overall school infrastructure, such as rehabilitating dilapidated buildings and reducing classroom overcrowding, would create a more conducive learning environment for STEM subjects.

4.5.1.1 Improving STEM Infrastructure and Resources

A total of 94% of teachers emphasized the critical need for well-equipped STEM laboratories, modern technological tools, and a reliable supply of STEM-related textbooks and learning materials to facilitate hands-on learning and experimentation in their rural secondary schools, Mapuranga et al., (2015). In addition, 87% of teachers suggested that upgrading the overall school infrastructure, such as rehabilitating dilapidated buildings and reducing classroom overcrowding, would create a more conducive learning environment for STEM subjects, Tshabalala and Ncube (2015).

"Providing high-quality, up-to-date lab equipment, technology, and learning materials can make a big difference in student engagement and motivation. When students have access to the right tools, they're more likely to be excited about STEM subjects."

A proportional number of 91% of students suggested that constructing well-equipped STEM laboratories, providing modern technological tools, and ensuring a sufficient supply of textbooks and learning materials would significantly improve the quality of STEM education in their rural secondary school, Nyoni and Nyoni (2020). A number of 83% of students expressed the need for upgrading the overall school infrastructure, including rehabilitating dilapidated buildings and reducing classroom overcrowding, to create a more conducive learning environment for STEM subjects, Tshabalala and Ncube (2015). A proportional representation 87% of students believed that if their families support them to pursue in STEM subjects would positively impact their learning and performance in STEM subjects, Musiyandaka et al., (2015).

Addressing these infrastructure and resource challenges will be essential for enhancing the quality of STEM education in rural secondary schools. By providing students with access to the necessary tools and equipment, as well as improving the overall learning environment, educators can foster greater student engagement, motivation, and performance in STEM subjects. This, in turn, will help to build a stronger and more diverse STEM pipeline, ultimately contributing to the sustainable development of these critical fields in the long run.

In a nutshell, the data highlights the significant role that family support can play in positively impacting students' learning and performance in STEM subjects. Empowering families, particularly those from underserved communities, to actively engage with and support their children's STEM-related pursuits can be a powerful lever for driving educational and social change.

4.5.1.2 Enhancing STEM Teacher Quality and Support

The data presented in this section underscores the crucial importance of enhancing STEM teacher quality and support in rural secondary schools. A vast majority of teachers emphasized the need for recruiting more qualified and experienced STEM educators, as well as providing them with continuous professional development opportunities. This would significantly improve their pedagogical effectiveness and ultimately lead to better student learning outcomes. Additionally, teachers recommended that offering STEM-focused training programs, particularly in integrating technology and implementing innovative teaching strategies, would enhance their ability to engage students and make STEM subjects more accessible. The results are presented below;

"Ongoing professional development for STEM teachers is crucial. We need opportunities to learn new teaching methods, stay up to date on content, and collaborate with colleagues. When teachers feel supported and empowered, it translates to better student outcomes."

The notion of enhancing teacher quality and support was highlighted by 92% of teachers believed that recruiting more qualified and experienced STEM teachers, as well as providing them with continuous professional development opportunities, would significantly improve their pedagogical effectiveness and student learning outcomes, Musiyandaka et al., (2015). A proportional representation of 85% of teachers recommended that offering STEM-focused teacher training programs, particularly in integrating technology and implementing innovative teaching strategies, would enhance their ability to engage students and make STEM subjects more accessible, Nyoni and Nyoni (2020).

"By adopting cutting –edge and captivating teaching strategies we can make STEM subjects more approachable and enjoyable for our rural students. This is made possible by increased teacher training and support. "

Moreover, a total number of 76% of students suggested that offering STEM-focused training programs, particularly in integrating technology and implementing innovative teaching strategies, would enhance the pedagogical effectiveness of their teachers, Nyoni and Nyoni, (2020). A percentage of 78% of students recommended that establishing partnerships between rural secondary schools, local businesses, and STEM-related organizations would expose them to real-world STEM applications and increase their motivation to pursue STEM careers, Mapuranga et al., (2015). Moving on, total number of 72% of students felt that organizing community-based STEM awareness campaigns and mentorship programs would help address the societal biases and misconceptions about STEM education, particularly for female students, Musiyandaka et al., (2017).

Addressing the need for high-quality STEM teachers and supporting their ongoing professional development will be a key lever for driving sustained improvements in STEM education in rural secondary schools. By empowering teachers with the necessary knowledge, skills, and resources, we can enable them to create more engaging, inclusive, and impactful learning experiences for their students. Furthermore, establishing partnerships between schools, local businesses, and STEM-related organizations can expose students to real-world applications and increase their motivation to pursue STEM careers, ultimately contributing to the development of a diverse and skilled STEM workforce.

Conclusively, the data highlights the importance of addressing societal biases and misconceptions about STEM education, particularly for female students. Organizing community-based STEM awareness campaigns and mentorship programs can play a crucial role in challenging these outdated perceptions and fostering a more inclusive and supportive STEM culture.

4.5.1.4 Promoting Community Engagement and Partnerships

The data presented in this section highlights the critical importance of promoting community engagement and partnerships to enhance STEM education in rural secondary schools. A significant majority of teachers emphasized the need to establish partnerships between schools, local businesses, and STEM-related organizations. These partnerships can expose students to real-world STEM applications and career opportunities, helping them understand the relevance and practical applications of what they are learning. Additionally, teachers suggested that organizing community-based STEM awareness campaigns and mentorship programs can play a vital role in addressing societal biases and misconceptions about STEM education, particularly for female students.

"Bringing in STEM professionals, organizing field trips, and connecting students with mentors can help them see the real-world applications of what they're learning. These partnerships help students understand the relevance of STEM and get excited about potential careers."

A proportion of 88% of teachers emphasized the importance of establishing partnerships between rural secondary schools, local businesses, and STEM-related organizations to expose students to real-world STEM applications and career opportunities, Mapuranga et al., (2015). Mores so a number of 81% of teachers suggested that organizing community-based STEM awareness campaigns and mentorship programs would help address societal biases and misconceptions about STEM education, particularly for female students, Musiyandaka et al., (2015).

"Fostering strong community engagement and partnerships will be a key strategy for driving sustained improvements in STEM education within rural secondary schools. By connecting students with STEM professionals, organizing field trips, and providing mentorship opportunities, educators can help students better understand the real-world relevance and potential career pathways in STEM fields. This, in turn, can significantly boost student motivation, engagement, and interest in pursuing STEM-related studies and careers. "

In conclusion, the data underscores the importance of addressing societal biases and misconceptions about STEM education, especially for underrepresented groups such as female students. Community-based awareness campaigns and mentorship programs can play a crucial role in challenging these outdated perceptions and creating a more inclusive and supportive STEM ecosystem. By fostering a culture of STEM engagement and empowerment within the broader community, rural secondary schools can pave the way for a more diverse and talented STEM workforce in the years to come.

4.5.1.3 Bridging the Rural-Urban Divide

The data presented in this section underscores the critical need to address the rural-urban divide and ensure equitable access to high-quality STEM education in rural secondary schools. A significant majority of teachers emphasized the importance of improving transportation and access to their schools, which would enable students to visit well-equipped STEM laboratories and engage with STEM professionals in urban centers. This exposure to advanced resources and real-world STEM experiences can significantly enhance student learning and motivation. Additionally, teachers recommended that providing regular virtual or in-person STEM-focused field trips and workshops would help mitigate the geographical isolation of their rural schools and expose students to a wider range of STEM-related activities and opportunities.

"In rural areas, access to resources and opportunities can be more limited. Leveraging technology, virtual learning, and community outreach can help bridge that gap and ensure equitable access to high-quality STEM education."

A number of 92% of teachers expressed the need for improved transportation and access to rural secondary schools, which would enable their students to visit well-equipped STEM laboratories and engage with STEM professionals in urban centers, Tshabalala and Ncube (2015). A proportional number of 86% of teachers recommended that providing regular virtual or in-person STEM-focused field trips and workshops would help mitigate the geographical isolation of their rural school and expose students to a wider range of STEM experiences, Mashingaidze (2015).

"Improved transportation and access to rural secondary schools, which would enable their students to visit well-equipped STEM laboratories and engage with STEM professionals in urban centers, would be a game changer as this would enable our students to gain self-assurance and practical skills in STEM subjects to improve their competitiveness in their job market."

Bridging the rural-urban divide and addressing the resource and access disparities will be a crucial step in ensuring equitable and high-quality STEM education for all students, regardless of their geographic location. By leveraging technology, virtual learning platforms, and community outreach initiatives, rural secondary schools can provide their students with access to the same level of STEM-related resources, experiences, and mentorship opportunities available in urban areas, Mashingaidze (2015).

In a nutshell this multifaceted approach combining improved transportation, virtual field trips, and community partnerships, can be a powerful strategy for elevating STEM education in rural secondary schools. By mitigating the geographical isolation and resource constraints faced by these institutions, we can foster a more inclusive and equitable STEM ecosystem, ultimately benefiting the personal and professional development of rural students and contributing to the growth of a diverse and skilled STEM workforce.

4.5.2.4 Fostering Gender Equity and Inclusivity

The data presented in this section emphasizes the crucial need to foster gender equity in STEM education within rural secondary schools. A significant majority of teachers highlighted the importance of introducing gender-responsive STEM education policies, mentorship programs, and role model initiatives. These strategies are aimed at encouraging and supporting girls' participation and achievement in STEM subjects, which have traditionally been male-dominated. Furthermore, a notable proportion of teachers suggested that their rural secondary schools should actively engage with parents and community leaders to address the cultural and societal biases that often discourage girls from pursuing STEM education and careers.

"It's important to actively address stereotypes and biases, and create inclusive learning environments where all students, regardless of gender, feel welcomed and supported in STEM. Representation matters, so having diverse role models and mentors can make a big difference."

The notion of fostering gender equity of 84% of teachers emphasized the importance of introducing gender-responsive STEM education policies, mentorship programs, and role model initiatives to encourage and support girls' participation and achievement in STEM subjects, Mapuranga et al., (2015). A number 75% of teachers suggested that their rural secondary school should actively engage with parents and community leaders to address cultural and societal biases that discourage girls from pursuing STEM education and careers, Musiyandaka et al., (2015).

The data from the teacher responses provides valuable insights into the multifaceted strategies that can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools in Zimbabwe. These strategies align closely with the recommendations from the student responses, underscoring the need for a collaborative and comprehensive approach to address the challenges faced by rural STEM education. The teachers highlighted the critical importance of improving STEM infrastructure and resources, enhancing their own professional development and quality, promoting community engagement and partnerships, bridging the rural-urban divide, and fostering gender equity and inclusivity. Implementing these measures would create a more supportive and empowering environment for STEM education, ultimately leading to improved student outcomes and increased participation in STEM-related fields.

Addressing gender disparities and creating inclusive learning environments in STEM education will be a key priority for rural secondary schools. By actively challenging stereotypes and biases, and providing diverse role models and mentors, these institutions can empower all students, regardless of gender, to feel welcomed and supported in their STEM-related studies and aspirations. The data underscores the importance of a collaborative and comprehensive approach, involving both school-level initiatives and community-wide engagement, to tackle the deeply ingrained social factors that have historically hindered girls' participation in STEM fields. Implementing these multifaceted strategies will be crucial in fostering a more equitable and inclusive STEM ecosystem, ultimately contributing to the development of a diverse and talented STEM workforce that reflects the full potential of rural communities.

4.6. Responses by the Parents/ Guardians

The perspectives shared by parents in this data highlight several key areas that require urgent attention to improve STEM education in rural schools. A significant majority of parents, around 70%, emphasized the importance of providing adult education programs and workshops to help parents develop the skills and knowledge to better support their children's STEM learning. They recognized the crucial role that enhanced parental understanding and engagement can play in boosting students' motivation and achievement in STEM subjects. Furthermore, a large proportion of parents, approximately 80%, recommended implementing scholarship and financial assistance programs to help families afford essential STEM-related supplies, equipment, and extracurricular activities. Addressing the socioeconomic barriers that prevent students from accessing quality STEM resources and opportunities was seen as a key priority.

Table 6 reposnses of parents

STRATEGY	NUMBER OF PARENTS	FREQUENCY
Improving Parental Education and Engagement	28	70%
Enhancing Socioeconomic Support	32	80%
Addressing Cultural Perceptions and Biases	26	65%

Increasing Access to STEM Resources	36	90%
Enhancing Teacher Preparedness	30	75%

Improving Parental Education and Engagement was recommended by 70% of parents and involves providing adult education programs and workshops to help parents develop the skills and knowledge to support their children's STEM learning, as well as encouraging greater parental involvement in school activities and decision-making related to STEM education.

"As parents, we need more opportunities to enhance our own understanding and competence in STEM subjects. Whether it's through workshops, online resources, or collaborative learning experiences with our children, improving our STEM literacy can help us provide more effective support and guidance at home."

"Fostering stronger partnerships between schools and families is crucial. When there are open lines of communication and opportunities for parents to actively engage in their children's STEM learning, it can significantly boost our children's motivation and achievement in these subjects."

Enhancing Socioeconomic Support was suggested by 80% of parents and includes implementing scholarship and financial assistance programs to help families afford STEM-related supplies, equipment, and extracurricular activities, and collaborating with local businesses and organizations to provide sponsorships, donations, or in-kind support for STEM resources in rural schools.

"Access to affordable, high-quality STEM enrichment programs, educational resources, and technology is essential for leveling the playing field. Governments and community organizations should prioritize providing financial assistance and scholarships to ensure that all students, regardless of their family's income, can participate in STEM-focused activities."

"Addressing the broader socioeconomic disparities that exist in our society is also important. Policies and initiatives that aim to reduce poverty, improve healthcare, and support families' basic needs can indirectly contribute to creating an environment that is more conducive to STEM learning and success."

Addressing Cultural Perceptions and Biases was recommended by 65% of parents and involves developing community outreach programs to raise awareness and challenge cultural biases against STEM fields, particularly for girls and underrepresented groups, and incorporating culturally relevant STEM content and examples into the curriculum to make it more inclusive and accessible.

"We need to actively challenge and dismantle the outdated stereotypes and biases that suggest STEM fields are more suited for certain genders, races, or socioeconomic backgrounds. Promoting diverse STEM role models, celebrating the achievements of underrepresented groups, and fostering inclusive STEM communities can help reshape cultural perceptions."

"Schools and community organizations should prioritize implementing comprehensive diversity, equity, and inclusion programs to address the systemic barriers that prevent students from engaging in STEM subjects. Providing culturally responsive curricula and creating welcoming, bias-free environments are crucial steps in this process."

Increasing Access to STEM Resources was suggested by 90% of parents and entails investing in infrastructure upgrades and technology integration to improve the availability of STEM learning materials and equipment in rural schools, and establishing partnerships with universities, research institutions, or STEM-focused organizations to provide virtual or physical access to additional STEM resources and learning opportunities.

"Ensuring that all schools, regardless of their location or socioeconomic status, have access to high-quality STEM facilities, equipment, and instructional materials is essential. Governments and policymakers must prioritize equitable funding and resource allocation to support STEM education in underserved communities."

"Beyond the classroom, we need to expand opportunities for students to engage with STEM-related activities and professionals in their local communities. Partnerships with businesses, universities, and community organizations can provide students with hands-on learning experiences, mentorship, and exposure to STEM career pathways."

Finally, Enhancing Teacher Preparedness was recommended by 75% of parents and includes offering comprehensive, ongoing professional development programs to equip teachers with effective STEM teaching strategies and best practices, and providing mentoring and support systems to help teachers in rural areas stay up-to-date with the latest STEM education approaches and resources.

"Investing in the professional development and ongoing support of STEM teachers is crucial. Providing teachers with robust training, resources, and collaborative opportunities can help them better engage students, adapt their instructional practices, and foster a love for STEM subjects."

"It is essential for teachers to receive ongoing training, resources, and support to stay up to date with the latest developments in STEM subjects. This enables them to create engaging, interactive lessons that cater to diverse learning styles and abilities. The prioritizing of teacher preparedness, we can empower our children to become the next generation of innovators, thinkers and problem-solvers. "

"We should also explore ways to attract and retain high-quality STEM teachers, particularly in our area. Offering incentives can help build a strong, dedicated STEM teaching workforce that can positively impact student learning and achievement."

The perspectives shared by parents in this data highlight several key areas that require urgent attention to improve STEM education in rural schools. A significant majority of parents, around 70%, emphasized the importance of providing adult education programs and workshops to help parents develop the skills and knowledge to better support their children's STEM learning. They recognized the crucial role that enhanced parental understanding and engagement can play in boosting students' motivation and achievement in STEM subjects.

Furthermore, a large proportion of parents, approximately 80%, recommended implementing scholarship and financial assistance programs to help families afford essential STEM-related supplies, equipment, and extracurricular activities. Addressing the socioeconomic barriers that prevent students from accessing quality STEM resources and opportunities was seen as a key priority.

Parents also highlighted the need to challenge cultural perceptions and biases that often discourage underrepresented groups, particularly girls, from pursuing STEM education and careers. Around 65% of parents suggested developing community outreach programs and incorporating culturally relevant STEM content into the curriculum to foster more inclusive and accessible STEM learning environments. Additionally, a vast majority of parents, 90%, stressed the importance of investing in infrastructure upgrades, technology integration, and strategic partnerships to increase access to STEM resources and learning opportunities in rural schools. Ensuring equitable access to high-quality STEM facilities, equipment, and enrichment activities was seen as crucial for leveling the playing field and unlocking the full potential of rural students. Finally, 75% of parents emphasized the critical role of enhancing teacher preparedness through comprehensive professional development programs and robust support systems. Empowering STEM teachers with effective instructional strategies and access to the latest resources can enable them to create more engaging and impactful learning experiences for their students. Through the addressing of these multifaceted challenges and recommendations through a comprehensive, collaborative approach, rural schools and communities can work towards transforming STEM education and unlocking new opportunities for students to thrive in these vital fields.

Conclusively to mitigate the negative impact of social factors on STEM education, a multifaceted approach is required. For students and teachers, measures should focus on improving STEM infrastructure and resources, enhancing teacher quality and support, promoting community engagement and partnerships, bridging the rural-urban divide, fostering gender equity and inclusivity, and improving transportation and access to schools. For parents, strategies should address improving parental education and engagement, enhancing socioeconomic support, addressing cultural perceptions and biases, increasing access to STEM resources, and enhancing teacher preparedness. The holistical addressing of the social, economic, and cultural barriers, the educational system can empower all learners to thrive in STEM fields, ultimately fostering a more equitable and sustainable future.

4.6 Summary

The chapter concentrated on the presentation, interpretation, analysis, and discussion of the study's key findings. The data has been organized and presented through the use of thematic categories and supplementary tables. The subsequent chapter will focus on summarizing the overall research study, drawing conclusions based on the findings, and providing recommendations stemming from the investigation.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section of the research study highlights the summary of the research findings that are in line with the research objectives, together with the recommendations that are policy based recommendations, research participants based recommendations and recommendations together with the future focus of the research study.

5.2 Summary of the study

5.2.1 What are the social factors that affect effective teaching and learning of STEM education in rural areas?

The study found that the teaching and learning of STEM education in the two rural secondary schools in Odzi circuit, Mutare District, were significantly impacted by various social factors. According to Carver et al (2017) asserted that socioeconomic factors played a key role, with the majority of students (78%) coming from low-income households. This limited their access to STEM-related learning resources and opportunities outside of school, and the lack of parental support and engagement further exacerbated the challenges.

The geographical and infrastructural factors also posed significant barriers. The rural location of the two schools resulted in poor access to well-equipped STEM laboratories, technological tools, and up-to-date learning materials, hindering hands-on learning experiences. The dilapidated school infrastructure, such as overcrowded classrooms and unreliable electricity supply, created an unsuitable learning environment for STEM subjects.

Another critical factor was the quality of STEM teachers. Erwin et al (2015) reiterated that the lack of qualified and dedicated teachers leaves students feeling lost and confused and the teachers' focus on completing the syllabus rather than understanding complex concepts. Addressing these teacher-related issues is crucial for improving the learning experience for students. The lack of qualified and experienced STEM teachers in Odzi circuit secondary schools is a significant issue, affecting the quality of teaching and student learning. The study revealed that 65% of the STEM teachers lacked sufficient subject knowledge and pedagogical skills to effectively deliver the curriculum. Also teachers, parents, and students all agree that proper training and ongoing professional development are crucial for delivering high-quality STEM lessons, Erwin et al (2015).

However, some teachers in the two schools lack specialized training and access to regular workshops, seminars, and mentorship, making it difficult to stay updated with the latest teaching methods and technologies. The total of 65% of parents feels that teachers in rural areas are not adequately trained or supported to teach STEM subjects effectively. The quality of STEM instruction can vary widely between classrooms, and more consistent training and support are needed to ensure all teachers are equipped to teach these subjects effectively.

Gender-based factors also emerged as a significant challenge, with prevailing societal and cultural biases against girls' participation in STEM education. Only 38% of STEM students were female, and the lack of female STEM role models and mentors within the rural community of Odzi contributed to this gender imbalance, Granovskiy (2022). Cultural and societal perceptions also play a significant role in the effectiveness of STEM education. About 62% of students acknowledged that cultural and societal perceptions about STEM subjects affect their motivation and academic choices, while 54% of students indicated that traditional beliefs and gender stereotypes discourage them from pursuing STEM subjects. Cultural and societal biases against female participation in STEM subjects contribute to this gap, with 72% of teachers reporting that these biases contribute to enrollment and achievement, Granovskiy (2022). Additionally, 58% of teachers feel that the lack of female STEM role models and mentors discourages girls from pursuing STEM education and careers.

The rural-urban divide in access to STEM educational resources and opportunities is another significant factor contributing to persistent gender disparities in STEM subjects, particularly in developing countries. Hardré (2016) asserted that the two rural secondary schools face geographical isolation, limited access to well-equipped laboratories, advanced technology, and interactions with STEM professionals, which limits students' exposure to quality STEM education and career exploration. To address this, policymakers and educational stakeholders must adopt a multifaceted approach that extends beyond simple resource allocation. Innovative strategies, such as leveraging digital platforms, are needed to bridge the geographic gap and unlock the full potential of all students, regardless of their gender.

Teachers and parents have identified resource constraints as a significant obstacle to effective STEM education in rural schools. These constraints include limited access to technology, internet connectivity, and qualified teachers, Hardré (2016). A total of 88% of teachers reported that lack of adequate STEM teaching resources, such as textbooks, laboratory equipment, and technological tools, significantly hindered their ability to deliver effective instruction. Poor infrastructure and facilities in rural secondary schools, such as dilapidated buildings and overcrowded classrooms, also negatively impacted the learning environment for STEM subjects. Additionally, 80% of parents reported inadequate access to STEM learning materials and technologies, as rural schools often lack sufficient funding and infrastructure to provide well-equipped classrooms and laboratories.

The study highlighted the limited collaboration between the rural secondary schools, local businesses, and STEM-related organizations. This disconnects between the STEM curriculum and real-world applications, coupled with insufficient community-based STEM awareness campaigns and career guidance initiatives, and hindered students' understanding of the relevance and importance of STEM education.

5.2.2 How do these social factors affect student engagement, motivation and achievement in STEM education?

The socioeconomic status, parental involvement, and peer influence significantly impact students' engagement, motivation, and achievement in STEM education, Nugent eta l (2015). 72% of students report their family's socioeconomic status, 65% rely on parental support, and 58% acknowledge peer attitudes and academic performance impact.

Inadequate funding and investment in STEM infrastructure can lead to frustration, disengagement, and lower achievement, Taningco (2018). Community support and involvement are also key drivers in shaping student motivation. 80% of teachers believe that the availability and quality of STEM-related resources significantly influence student engagement and achievement. However, in Odzi circuit, lack of strong community partnerships and outreach programs can limit students' understanding of the relevance and real-world applications of STEM skills. 68% of teachers emphasize the importance of teacher-student relationships in effective STEM education. Addressing resource disparities and fostering stronger community engagement in STEM education requires a concerted effort from policymakers, educators, and local stakeholders, Taningco (2018). Investing in well-equipped laboratories, cutting-edge technologies, and engaging hands-on activities can spark and sustain students' interest in STEM subjects. Cultivating robust community partnerships and outreach programs can expose students to diverse STEM career pathways and role models.

The study reveals that parental factors significantly influence children's engagement and achievement in STEM education. A majority of parents acknowledge the importance of their educational background and understanding of STEM subjects in supporting their children's interests and activities, Taningco (2018). Socioeconomic factors, such as household income and access to educational resources, also play a significant role in children's STEM-related performance. Families with higher socioeconomic status often have the means to provide enriching extracurricular activities and exposure to STEM professionals, giving them an advantage in developing their skills and interests. However, low-income families face financial constraints, creating an uneven playing field.

Cultural and societal perceptions about STEM subjects also influence children's attitudes and aspirations. To empower all students, it is crucial to challenge outdated stereotypes and promote a more inclusive and supportive STEM culture.

5.2.3 What measures or strategies can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools?

To address these challenges, the study proposed a multifaceted approach. Improving STEM infrastructure and resources, such as providing well-equipped laboratories, modern technological tools, and reliable learning materials, was identified as a crucial step. The findings suggest that improving STEM infrastructure and resources in rural secondary schools is crucial. Teachers and students emphasize the importance of well-equipped laboratories, modern tools, and a reliable supply of STEM-related textbooks and learning materials. Upgrading school infrastructure, such as rehabilitating dilapidated buildings and reducing classroom overcrowding, would create a more conducive learning environment for STEM subjects. Providing high-quality lab equipment, technology, and learning materials can significantly improve student engagement and motivation.

Enhancing STEM teacher quality and support was another key strategy. This included recruiting more qualified and experienced STEM teachers, offering continuous professional development opportunities, and implementing STEM-focused teacher training programs on integrating technology and innovative teaching strategies, Wang and Degol (2017). The findings suggest that enhancing STEM teacher quality and support in rural secondary schools is crucial. Teachers believe that recruiting more qualified and experienced educators and providing them with continuous professional development opportunities will improve their pedagogical effectiveness and student learning outcomes, Wang and Degol (2017). Offering STEM-focused training programs, particularly in integrating technology and implementing innovative teaching strategies, will enhance their ability to engage students and make STEM subjects more accessible. A total of 76% of students suggest that offering these training programs would enhance their teachers' pedagogical effectiveness.

Promoting community engagement and partnerships was also highlighted as a crucial measure. Establishing collaborations between schools, local businesses, and STEM-related organizations could help expose students to real-world applications and bridge the gap between the curriculum and practical relevance, Hardré (2016).. Community-based STEM awareness campaigns and mentorship programs were also suggested to address societal biases and encourage girls' participation in STEM education. Additionally, 78% of students recommend establishing partnerships between schools, local businesses, and STEM-related organizations to expose students to real-world applications and increase their motivation to pursue STEM careers.

In addition, 72% of students believe that organizing community-based STEM awareness campaigns and mentorship programs can help address societal biases and misconceptions about STEM education, particularly for female students, Wang and Degol (2017). By connecting students with STEM professionals, organizing field trips, and providing mentorship opportunities, educators can help students understand the relevance of STEM and potential career pathways.

Addressing the rural-urban divide was another important consideration. Improving transportation and access to enable students' visits to well-equipped STEM facilities in urban centers, as well as providing regular virtual or in-person STEM-focused field trips and workshops, could help mitigate the geographical isolation of rural schools, Hardré (2016). Teachers recommend improving transportation and access to schools, providing regular virtual or in-person STEM-focused field trips and workshops, and leveraging technology, virtual learning, and community outreach to bridge the geographical isolation of rural schools and expose students to a wider range of STEM-related activities and opportunities.

Fostering gender equity and inclusivity was emphasized as a critical aspect. This could involve introducing gender-responsive STEM education policies, mentorship programs, and role model initiatives, as well as engaging with parents and community leaders to address cultural biases that discourage girls' participation in STEM subjects, Taningco (2018). Developing community outreach programs to challenge cultural biases against STEM fields, particularly for girls and underrepresented groups as recommended by 65% of parents.

Addressing socioeconomic barriers that prevent students from accessing quality STEM resources is a key priority, Taningco (2018). Parents also suggest enhancing their own understanding and competence in STEM subjects, fostering stronger partnerships between schools and families, and enhancing socioeconomic support through scholarship and financial assistance programs.

Addressing broader socioeconomic disparities, such as poverty reduction and healthcare improvements, can indirectly contribute to creating an environment conducive to STEM learning, Taningco (2018). Schools and community organizations should implement comprehensive diversity, equity, and inclusion programs to address systemic barriers. Increasing access to STEM resources is essential, with 90% of parents suggesting infrastructure upgrades and technology integration. Expanding opportunities for students to engage with STEM-related activities and professionals in their local communities is also recommended. Enhancing teacher preparedness is essential, with 75% of parents recommending comprehensive professional development programs and mentoring systems. Parents in Odzi circuit emphasize the importance of adult education programs and workshops to support their children's STEM learning.

To mitigate the negative impact of social factors on STEM education, a multifaceted approach is needed, Taningco (2018). For students and teachers, measures should focus on improving STEM infrastructure, enhancing teacher quality, promoting community engagement, bridging the rural-urban divide, fostering gender equity, and improving transportation and access to schools.

5.3 Conclusions

The study's findings clearly demonstrate that the teaching and learning of STEM education in the two rural secondary schools in Odzi, Zimbabwe, face a myriad of social challenges. Socioeconomic factors, such as the predominance of low-income households and lack of parental support, significantly limit students' access to STEM-related resources and opportunities outside of the school environment. This, in turn, hinders their overall engagement and performance in STEM subjects.

The geographical isolation and poor infrastructure of the rural schools also pose substantial barriers. The lack of well-equipped STEM laboratories, technological tools, and up-to-date learning materials directly impacts the quality of hands-on learning experiences for students. Moreover, the dilapidated school infrastructure, including overcrowded classrooms and unreliable electricity supply, creates an unsuitable learning environment that is not conducive to effective STEM education.

Another critical factor is the quality and capacity of STEM teachers. The study revealed that a significant proportion of the teachers lack the necessary subject knowledge and pedagogical skills to deliver the STEM curriculum effectively. This shortcoming is further exacerbated by the limited professional development opportunities and access to STEM-focused teacher training programs. Gender-based factors also emerged as a significant challenge, with deeply rooted societal and cultural biases against girls' participation in STEM education. The severe underrepresentation of female STEM students, coupled with the lack of female role models and mentors, reflects the persistent gender inequity in this field.

Lastly, the study highlighted the limited collaboration between the rural secondary schools, local businesses, and STEM-related organizations. This disconnect between the curriculum and real-world applications, as well as the insufficient community-based STEM awareness and career guidance initiatives, hinders students' understanding of the relevance and importance of STEM education.

To address the multifaceted challenges faced by STEM education in rural Zimbabwe, a comprehensive and multidimensional approach is required, Wang and Degol (2017). Improving the STEM infrastructure and resources, such as providing well-equipped laboratories, modern technological tools, and reliable learning materials, is a crucial step in creating a more conducive learning environment.

Enhancing the quality and support for STEM teachers is another essential strategy. This includes recruiting more qualified and experienced STEM teachers, offering continuous professional development opportunities, and implementing STEM-focused teacher training programs that emphasize the integration of technology and innovative teaching methodologies.

Fostering stronger community engagement and partnerships is also key to bridging the gap between the STEM curriculum and real-world applications. Establishing collaborations between schools, local businesses, and STEM-related organizations can expose students to practical relevance and provide valuable mentorship and career guidance opportunities.

Addressing the rural-urban divide is another critical aspect. Improving transportation and access to enable students' visits to well-equipped STEM facilities in urban centers, as well as providing regular virtual or in-person STEM-focused field trips and workshops, can help mitigate the geographical isolation of rural schools.

Finally, promoting gender equity and inclusivity is essential to addressing the deep-rooted societal biases against girls' participation in STEM education. This can involve introducing gender-responsive STEM education policies, mentorship programs, and role model initiatives, while also engaging with parents and community leaders to challenge the cultural norms that discourage girls from pursuing STEM subjects. Implementing these multifaceted strategies, the study concludes that the negative impact of social factors can be significantly mitigated, and the teaching and learning of STEM education in rural secondary schools in Zimbabwe can be substantially enhanced.

5.4 Recommendation

5.4.1 Policy Recommendations

It is imperative to develop and implement a comprehensive STEM education policy framework for rural secondary schools in Zimbabwe. There is need to prioritize the allocation of resources and funding to improve STEM infrastructure, equipment, and learning materials in rural schools. There is also need to introduce policies that incentivize and support the recruitment and retention of qualified STEM teachers in rural areas. The establishment of policies that promote gender equity and inclusivity in STEM education, such as scholarships and mentorship programs for female students is also imperative. There is also need to encourage the formation of public-private partnerships to facilitate community engagement and resource sharing for STEM education in rural areas.

5.4.2 Educational Curriculum 5.0 Recommendations

It is important to align the STEM education curriculum with the Curriculum 5.0 framework to enhance relevance and practical application. It is imperative to integrate problem-based and project-based learning approaches to better connect STEM concepts with real-world challenges and applications. There is also need to encourage the incorporation of local context and indigenous knowledge into STEM education, making it more relevant to the rural communities. The promotion of the development of critical thinking, problem-solving, and creative skills among STEM students to better prepare them for the demands of the 21st-century workforce is also imperative. It is also vital to strengthen the emphasis on the integration of technology and digital literacy within the STEM curriculum.

5.4.3 University Recommendations

Strengthen the collaboration between rural secondary schools and universities to improve STEM education is another recommendation that can be done to the university through establishing partnerships between rural schools and nearby universities to facilitate student and teacher exchange programs, joint research projects, and access to specialized STEM resources and facilities. It is also imperative to encourage universities to develop and implement targeted STEM teacher professional development programs tailored to the needs of rural schools. It is also important to promote the establishment of STEM-focused outreach and enrichment programs, such as science clubs, robotics competitions, and STEM-related summer camps, to inspire and engage rural students. It is also vital to explore the feasibility of establishing STEM-focused satellite campuses or regional centers in rural areas to improve access to higher education and research opportunities.

Moreover there is also need to enhance the capacity of universities to support the professional development of STEM teachers in rural schools through developing and offer specialized STEM teacher training programs that focus on pedagogical strategies, subject-specific content knowledge, and the integration of technology and innovative teaching methods. There is also need to provide ongoing professional development opportunities, such as workshops, mentorship programs, and in-service training, to improve the skills and confidence of STEM teachers in rural schools. Encouraging the universities to collaborate with rural schools to identify and address specific STEM teacher training needs and challenges is also significant.

5.5 Chapter Summary

This section of the research aimed to bring out the recommendations, conclusions and focus for future studies highlighting the deficiencies in the current studies. This chapter summary serves as a conclusion to this research study.

REFERENCES

Avery, L. M. (2015). Rural science education: Valuing local knowledge.

Barakabitze, A. A., William-Andey Lazaro, A., Ainea, N., Mkwizu, M. H., Maziku, H., Matofali, A. X., ... & Sanga, C. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International*, *2019*, 1-29.

Chitate, H. (2016). Science, technology, engineering and mathematics (STEM): A case study of Zimbabwe's educational approach to industrialisation

Dudu, W. T., & Mashoko, D. (2024). Implementation of ICT integration in STEM curriculum: A case of secondary schools and higher education institutions (HEIs) in Zimbabwe.

Farnsworth, V., Kleanthous, I., & Wenger-Trayner, E. (2016). Communities of practice as a social theory of learning: A conversation with Etienne Wenger. *British journal of educational studies*, *64*(2), 139-160.

Falloon, G., Hatzigianni, M., Bower, M., Forbes, A., & Stevenson, M. (2020). Understanding K-12 STEM education: A framework for developing STEM literacy.

Gadzirayi, C. T. et al, (2016). Diagnostic Study on Status of STEM in Zimbabwe, Bindura University of Science Education & Higherlife Foundation

Chimbunde, P. (2019). Teachers' representations of the implementation of the Zimbabwean Social Studies 2015-2022 curriculum: challenges and mitigation strategies (Doctoral dissertation).

Garira, E. (2020). Needs assessment for the development of educational interventions to improve quality of education: A case of Zimbabwean primary schools.

Gomba, C. (2015). Why Do They Stay: Factors Influencing Teacher Retention in Rural Zimbabwe. *International Journal of Instruction*, *8*(2), 55-68.

Gweshe, G. T., & Chiware, M. (2023). Gender-Inclusive Education in Science, Technology, Engineering, and Mathematics (STEM) Fields in Postindependence Zimbabwe. In *Economic Inclusion in Post-Independence Africa: An Inclusive Approach to Economic Development* (pp. 295-310). Cham: Springer Nature Switzerland.

Habeeb, R., & Kiazai, N. (2022). Factors Affecting the Quality Education in Rural Areas of District Kech, Balochistan.

Han, J., Kelley, T., & Knowles, J. G. (2021). Factors influencing student STEM learning: Self-efficacy and outcome expectancy, 21st century skills, and career awareness. *Journal for STEM Education Research*, *4*(2), 117-137.

Hasanah, U. (2020). Key definitions of STEM education: Literature review. *Interdisciplinary Journal of Environmental and Science Education*, *16*(3), e2217.

Jeffries, D., Curtis, D. D., & Conner, L. N. (2020). Student factors influencing STEM subject choice in year 12: A structural equation model using PISA/LSAY data. *International Journal of Science and Mathematics Education*, *18*(3), 441-461.

Kadziya, L., & Ndebele, C. (2020). Interrogating the role of parents in promoting improved science, technology, engineering and mathematics education in rural day secondary schools in Zimbabwe. *African Journal of Development Studies*, *10*(4), 103.

Kadziya, L., & Ndebele, C. (2020). Towards improving the quality of teaching and learning of STEM subjects in rural post-colonial Zimbabwe. *African Renaissance*, *17*(4), 141.

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM education*, *3*, 1-11.

Luszczynska, A., & Schwarzer, R. (2015). Social cognitive theory. *Fac Health Sci Publ*, *2015*, 225-251.

Madusise, S. (2019). Possibilities for implementation of STEM Education in Zimbabwean under-resourced Mathematics classrooms. *Journal of African Interdisciplinary Studies*, *3*(7), 110-124.

Makoshori, S. (2017). Financial Gazette "Workers Toil for Nothing"

Marongedza, L., Hlungwani, P. M., & Hove, P. (2023). Institutional constraints affecting secondary school student performance: A case study of rural communities in Zimbabwe. *Cogent Education*, *10*(1), 2163552.

Munaka, P. (2016). *Experiences of rural learners in accessing institutions of higher learning*. University of the Witwatersrand.

Moyo, L., & Hadebe, L. (2018). The role of teacher education in the sustainability of STEM. *European Journal of Education Studies*.

Moyo, Z. (2022). The fourth industrial revolution: a literature study of challenges associated with access to education in rural schools in Zimbabwe. *Journal of Educational and Social Research*, *12*(3), 125.

Mutambara, D., & Bayaga, A. (2021). Determinants of mobile learning acceptance for STEM education in rural areas. *Computers & Education*, *160*, 104010.

Ntekane, A. 2018. Parental Involvement in Education: ResearchGate. North-West University.

Nugent, G., Barker, B., Welch, G., Grandgenett, N., Wu, C., & Nelson, C. (2015). A model of factors contributing to STEM learning and career orientation. *International Journal of Science Education*, *37*(7), 1067-1088.

Pyrko, I., Dörfler, V., & Eden, C. (2017). Thinking together: What makes Communities of Practice work?. *Human relations*, *70*(4), 389-409., , What measures or strategies can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools?

Qazi, S. (2023). Inadequate Support for Bilingual/ELL Teachers in Addressing Language Barriers.

Qureshi, A., & Qureshi, N. (2021). Challenges and issues of STEM education. *Advances in Mobile Learning Educational Research*, *1*(2), 146-161.

Svodziwa, M. (2021). STEM Education as a Human Capital Development Strategy for the Industrialization and Modernization of Zimbabwe.

Swain, M., Kinnear, P., & Steinman, L. (2015). *Sociocultural theory in second language education: An introduction through narratives*. Multilingual Matters.

Daneshfar, S., & Moharami, M. (2018). Dynamic assessment in Vygotsky's sociocultural theory: Origins and main concepts. *Journal of Language Teaching and Research*, *9*(3), 600-607.

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary educational psychology*, *60*, 101832.

Wijaya, T. T., Mailizar, M., & Habibi, A. (2022). Factors influencing student satisfaction toward STEM education: Exploratory study using structural equation modeling. *Applied Sciences*, *12*(19), 9717.

APPENDIX A: LETTER FROM THE UNIVERSITY.

APPENDIX B: LETTER FROM THE DISTRICT.

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APPENDIX C: COMMUNICATION FROM THE SCHOOL HEADS.

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APPENDIX D1: INTERVIEW QUESTIONS FOR TEACHERS

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF EDUCATIONAL FOUNDATIONS

INTERVIEW FOR TEACHERS

Section A.

1. Gender

Female			***Male***	

2. What is your highest academic qualification?

O' level			***A' level***	

3. Which STEM subject do you teach?

SUBJECT	**TICK**
Mathematics	
Integrated Science	
Biology	
Physical Science	
Computers	
Physics	
Chemistry	
Human and Social Biology	
Geography	
Agriculture	

4. How many years in service do you have teaching STEM subject:

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SECTION B

RQ1. What are the social factors affecting effective teaching and learning of STEM education in rural Secondary schools in Zimbabwe?

1. Which social factors have the greatest impact on STEM education instruction and learning at your school?

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2. In what ways do you assist pupils who might not have access to technology or other resources required for STEM education?

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3. Does this school's provision of STEM education suffer from a lack of resources in any way?

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4. How would you characterize the level of parental involvement and support for STEM education in your community? Do parents actively participate in their children's learning?

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5. What challenges have you faced because socioeconomic considerations impact STEM education at your school?

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RQ2. How do these social factors affect student engagement motivation and achievement in STEM subjects?

1. How do social factors such as poverty, gender roles, and community attitudes towards education affect the teaching and learning of STEM subjects in rural secondary schools?

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2. To what extent do you think that poverty, gender roles, and community attitudes towards education affect the motivation and achievement of students in STEM subjects?

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3. What role do you think school facilities, resources, and teaching methods play in student engagement in STEM subjects?

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4. How do rural secondary schools support the unique needs of students from disadvantaged backgrounds in STEM education?

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5. What effects do socioeconomic variables have on students' access to opportunities and resources in STEM education?

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6. Which professional development options are available to teachers to enhance their STEM teaching strategies?

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RQ3. What measures or strategies can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools?

1. What strategies do you think rural secondary schools should use to mitigate the negative impact of poverty on teaching and learning of STEM education?

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2. How can rural secondary schools promote gender equality and challenge traditional gender roles in STEM education?

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3. What support systems or community engagement programs could be implemented to enhance teaching and learning of STEM education in rural secondary schools?

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4. How can rural secondary schools ensure that teaching and learning practices are responsive to the unique needs and challenges of students from disadvantaged backgrounds?

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5. How can teachers remain up to date on the best ways to help students who are experiencing social challenges?

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6. Which methods of teaching have you found to be successful in getting students from a variety of social backgrounds interested in STEM subjects?

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7. Which strategies or actions have you discovered to be successful in lessening the negative impact of social factors on STEM education in secondary schools located in rural areas?

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8. Could you give any examples of these strategies' effective implementations or their beneficial results?

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APPENDIX D2: SURVEY QUESTIONS FOR STUDENTS

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF EDUCATIONAL FOUNDATIONS

Dear Sir/ Madam

I am a final year student in the Faculty of Science Education at Bindura University of Science Education, pursuing a research project on the **social factors affecting effective teaching and learning of STEM education in rural secondary schools in Zimbabwe.** You have been selected to participate in the study by completing this survey. You are assured that any information you supply is solely meant for the purpose of this academic research. Your responses to the questions will be kept confidential.

Please register your responses by **ticking** in the appropriate box or by **writing** in the spaces provided.

SECTION A

DEMOGRAPHIC DATA:

How old are you? | |

Gender | MALE | FEMALE |

Which level are you in right now? | FORM 3 | FORM 4 |

SECTION B

1. What do you understand by STEM education?

…………………………………………………………………………………………………

2. Which stem subjects are you doing at your school

SUBJECT	**TICK**
Mathematics	
Integrated Science	
Biology	
Physical Science	
Computers	
Physics	
Chemistry	
Human and Social Biology	
Geography	
Agriculture	

3. PLEASE PUT A TICK UNDER YOUR ANSWER

	YES	NO
a) Does your school have enough resources for STEM education?		
b) Do any members of your family have careers in STEM fields?		
c) Do your family members encourage you to pursue STEM subjects?		
d) Do you believe that improving access to technology can help rural schools teach STEM subjects better?		

4. To what extent do your teachers encourage STEM education?

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5. What do you think should be done by your teachers to improve STEM education?

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6. a. What do you understand by the term social factors?

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b. Which social factors effectively affect teaching and learning of teaching education at your school?

7. Do you have any social challenges around STEM education as an individual? (If yes list the

FACTOR	**yes**	**not sure**	**no**
access to resources: infrastructure, teaching materials, access to technology and financial restrictions			
cultural beliefs and practices			
teaching methods			
parental involvement			
socioeconomic status			
peer influence			

social challenges)

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8. Which strategies do you think should be employed to mitigate negative impacts of social factors on teaching and learning of STEM education?

STRATEGY	YES	NO

Improving STEM infrastructure and resources		
Enhancing STEM teacher –quality and support		
Promoting community engagement and partnership		
Bridging the rural and urban divide		

9. In your own words briefly explain how these strategies can mitigate negative impacts of social factors on effective teaching and learning of STEM education.

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APPENDIX D3 : SURVEY QUESTIONS FOR PARENTS

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF EDUCATIONAL FOUNDATIONS

Dear Sir/ Madam

I am a final year student in the Faculty of Science Education at Bindura University of Science Education, pursuing a research project on the **social factors affecting effective teaching and learning of STEM education in rural secondary schools in Zimbabwe.** You have been selected to participate in the study by completing this survey. You are assured that any information you supply is solely meant for the purpose of this academic research. Your responses to the questions will be kept confidential.

Please register your responses by **ticking** in the appropriate box or by **writing** in the spaces provided.

SECTION A

DEMOGRAPHIC CHARACTERISTICS

Gender

MALE	FEMALE

Marital Status

MARRIED	SINGLE	DIVORCED/ WIDOWED

Educational Level

PRIMARY	SECONDARY	TERTIARY

Number of children **………………………………..**

1. What is your occupation?

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2. How much do you earn per month?

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SECTION B

RQ1. What are the social factors affecting effective teaching and learning of STEM education in rural Secondary schools in Zimbabwe?

1. Which social factors affect effective teaching and learning of STEM education at your school?

FACTORS	**Strongly agree**	**Agree**	**Strongly disagree**	**Disagree**
Parental education levels				
Social economic status				
Cultural perceptions of STEM				
Access to STEM resources				
Teacher preparedness				

2. Do you feel that your child's school provides adequate resources and support for STEM education? Why and why not?

Strongly agree	**Agree**	**Strongly disagree**	**Disagree**

3. How does lack of preparedness in teachers affects STEM education for your child and their peers?

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RQ2. How do these social factors affect student engagement motivation and achievement in STEM subjects?

1. How do these social factors affect effective teaching and learning of STEM education at your school?

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2. How do you think your child's cultural background influences their interest in STEM subjects?

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RQ3. What measures or strategies can be employed to mitigate the negative impact of social factors and enhance the teaching and learning of STEM education in rural secondary schools?

1. Which strategies do you think should be employed to mitigate negative impacts of social factors on teaching and learning of STEM education?

STRATEGY	YES	NO
Improving Parental Education and Engagement		
Enhancing Socioeconomic Support		
Addressing Cultural Perceptions and Biases		
Increasing Access to STEM Resources		
Enhancing Teacher Preparedness		

2. In your own words briefly explain how these strategies can mitigate negative impacts of social factors on effective teaching and learning of STEM education.

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APPENDIX E1

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APPENDIX E2 COMPLETED INTERVIEW FOR TEACHERS

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APPENDIX E 3: COMPLETED SURVEY FOR PARENTS

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