



Enhancing Student Participation in Ordinary Level Mathematics in Poorly Resourced Rural Schools in Zimbabwe

*Makuvire Claretah¹, Chikuvadze Piniyas², Dendere Kudakwashe³

¹ Lecturer, Curriculum and Educational Management Studis, Bindura University of Science Education, Zimbabwe.

¹ ORCID ID: 0009-0008-5527-7898

^{2,3} Bindura University of Science Education, Zimbabwe

² ORCID ID: 0000-0002-8569-0009

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*Corresponding author: [Makuvire Claretah](#)

Lecturer, Curriculum and Educational Management Studis, Bindura University of Science Education, Zimbabwe.

ORCID ID: 0009-0008-5527-7898

Abstract

This study explores effective intervention strategies to increase student participation in the learning of O Level Mathematics. The purpose of this research was to identify the barriers that may hinder students' active involvement in the Mathematics learning process and to propose strategies that can effectively address these challenges. The research employed a mixed method approach. Data was collected through interviews, observations, and surveys from Lusulu Cluster in the Binga District of Zimbabwe. The findings revealed several factors that contribute to low student participation in mathematics, such as lack of interest, inadequate teaching methods, and limited resources. To enhance student engagement and participation, this study proposes a set of intervention strategies. These strategies include the use of interactive teaching methods, such as group discussions, peer tutoring, and hands-on activities. Additionally, the integration of technology, such as educational apps and online resources, can provide students with opportunities for independent learning and problem solving. Other strategies proposed are the provision of continuous professional development for teachers to enhance their teaching skills and the establishment of a supportive learning environment through collaboration among teachers, students, and parents. Furthermore, the study suggests involving parents in the learning process through parent-teacher conferences and targeted communication.

Keywords: *Intervention strategies, effective teaching, participation, targeted communication.*

1. Introduction

Mathematics is one of the key subjects at Ordinary Level in Zimbabwe. It is also an entry qualification to higher and tertiary educational programmes. Mathematics helps in mental discipline and fosters mental discipline by encouraging logical reasoning and rigor. It trains our minds to think critically and systematically. Bennie, (2022), adds that Mathematical knowledge is a key to comprehending other subjects. For instance, it enhances our understanding of science, social studies, music, and art.

In the context of 21st Century education, Mathematics contributes to essential skills such as critical thinking, creative thinking, and self-regulation. These skills empower students to apply their knowledge in diverse and evolving circumstances. Mathematics education is integral to developing STEM (Science, Technology, Engineering, and Mathematics) capabilities. A STEM-capable workforce is crucial for global prosperity and innovation. Initiatives worldwide aim to equip students with the necessary STEM skills. Good numeracy is essential for making informed decisions. Whether as parents, patients, or citizens, we encounter numerical information daily. Being numerate enables us to navigate life effectively.

In an increasingly digital world, understanding mathematical concepts is vital for using technology effectively. Whether interpreting statistics, managing personal finances, or assessing risks, numeracy skills are indispensable. Therefore, ensuring active student participation in the learning of mathematics is of utmost importance. However, failure in Ordinary Level Mathematics is a persistent concern in many education systems, particularly in developing countries. The Zimbabwe Schools Examination Council (ZIMSEC) records have persistently shown low pass rates ranging from 30%-40% in the subject. The case is even worse in the rural schools. In Lusulu cluster of Binga District the pass rate hangs around 15-25%. Research has shown that low student participation in the teaching and learning of mathematics at the O level is the major cause of poor pass rates. The gap between the significant role of mathematics and the pass rate has robbed many O Level graduates, especially those from the rural disadvantaged communities of a chance to advance themselves and attend tertiary education.

One major cause is students' negative attitudes and mathematics anxiety, which reduce motivation and confidence. When learners perceive mathematics as difficult, they are less likely to engage in practice, leading to poor performance (OECD, 2019). In addition, inadequate teaching methods contribute significantly to failure. Teacher-centred approaches that emphasize memorization rather than conceptual understanding prevent students from developing problem-solving skills. According to the Zimbabwe School Examinations Council (2023), poor conceptual understanding is a major reason why candidates perform poorly in national examinations. Addressing these challenges requires improved teaching methods, adequate resources, and supportive learning environments. Given these challenges, this research aims to explore and implement effective intervention strategies that can significantly encourage student engagement and participation in the learning of O level Mathematics.

2. Review of related literature

The study was guided by Vygotsky's social constructivist theory as it gives Mathematics a special importance as a social practise beyond school (Kearsly, 1994; Bada, 2015). The model states that learning is influenced by the social and cultural context, culture leads to the development of cognitive skills. Learners' mental abilities are developed naturally through various paths of discovery and teacher acts as a facilitator during class discussions. Woolfolk (1995; Kurt, 2021) has a similar view that the social contexts are considered by the social constructivists as learning approaches. Various paths of discovery make the learner develop mental abilities in the classroom. According to Woolfolk (1995) there should be emphasis on the view that there is an importance of negotiation and social interaction in learning. Learning should be embedded in a particular cultural setting and should create social relationships through discussions.

The origins of knowledge are from experimentation, observation and abstraction and the use of specific sense will be used. Viable Mathematics knowledge according to the social constructivists is developed when learners are equipped well with the conceptual understanding of the process skills brought about during the mathematics. From the social constructivists view student-centred instruction develops the construction of knowledge through experience. Davis (1990) asserts that experience construct knew knowledge and student-centred instructions are an important aspect of social constructivists. Real life situations should be brought about during mathematics lessons. The competence-based curriculum as well as the syllabus for Mathematics 4004 has the view that during mathematics learning the teacher should engage activities such as project tasks, group work and problem solving.

Social constructivists have the view that learners need to appreciate the need of for lifelong learning in the workforce in the fast-changing world. Teachers are supposed to create an environment where learners can interact with each other and be actively involved in discussions, engage in critical thinking and problem solving, this enables the development, and construction and understanding of knew knowledge. The theory therefore points on the need for student participation as the best way to improve pass rates in Mathematics.

The nature of student participation in Mathematics

Participation is defined by Fassinger (1995) as behaviours of asking and answering questions. When students raise questions or comments in class then they will be participating. Participating in class discussions and refraining from negative behaviours is what Bippus and Young (2000) define as participation. Petress (2006) attributes three evaluative dimensions to participation and these include quality, quantity and dependability. Students are given the opportunity to participate constructively. When students who are relied upon contribute clearly, respectfully and relevantly then the term dependability can be used. When students show evidence of individual awareness of concepts and interaction frequently then quality class participation will have occurred. When an aspect of engagement is frequently used then students' participation can be defined as an inclination to daily activities. Dancer and Kamuounious (2005) defined class participation as the way in which students are involved in class and how they participate during the learning activities. Students are given an opportunity to demonstrate skills learned in the course, responding, and providing useful feedback. According to Peterson (2002) there is constructive and ordinary participation. Productive participation is constructive whilst ordinary participation is superficial. Pretty et.al (1995) defined superficial participation as participation that wastes time for important participatory activities and productive participation is more than just raising hands. Productive

participation involves preparation (for example reading), contribution (for example answering questions), group skills (for example clarity of responses) and attendances.

In the case of Zimbabwe, the Zimbabwe School Examination Council (ZIMSEC) provides the syllabus to be used and the codes for the subjects. The instructional practises and the prescribed textbooks are provided by ZIMSEC. The methodology section recommends regular group work, non-routine problem-solving situations and project work. The teaching strategies must be seen as a process and not a product. The mathematics curriculum reform encourages teachers to use the social constructivist theorems that enable learners to transfer school mathematics to contextualised situations through problem solving and modelling as presented in the Curriculum framework (2015-2022). Contrarily, teachers and learners only engage in short conversations that do not exactly have any detailed elaborations. This seems to indicate that teachers' primary concern is on completion of their lessons and syllabus. They rarely pay attention to the progress made by learners in grasping concepts.

In addition, contrary to the social constructive classrooms, the teachers are taking the center role in classroom yet the students are the ones who should discuss concepts, share ideas and misconceptions and ask questions and revise their ideas. The competence- based curriculum put emphasis on participatory activities which promotes collaboration among learners. Knowledge construction needed for lasting learning occurs when collaborative environments are created.

Methodology

A mixed methods case study approach was used in the investigation. This hybrid approach was chosen because qualitative research frequently lacks generalizability due to smaller sample sizes. However, the study also required participants to provide thorough, in-depth responses. By integrating extensive quantitative research into the in-depth analysis, mixed approaches helped to alleviate these shortcomings. Analysis can be made richer by using qualitative data to illustrate quantitative findings. Finally, employing various techniques improved reliability. Triangulation, or the convergence of qualitative and quantitative data, strengthened findings. The study's blended methodology enabled efficient exploration of both indigenous views and science integration.

Participants and setting

The researchers used purposive sampling technique in choosing the five secondary schools. Two Missionary Schools and three government school were chosen. The researchers assumed that participation in the learning of Mathematics was different between Mission and Government schools. The researchers used purposive sampling technique in choosing the participants. because the researchers were interested in participants who are doing Mathematics at Ordinary Level. According to Chiromo (2015) in this technique, the subjects would be selected on the basis of the researchers' judgment of their typicality. The researchers got assistance from the heads of Mathematics department to come up with a sample of 30 ordinary level students from each selected school.

Instruments

Quantitative data on pass rates, teacher qualifications and student's performance were collected using questionnaires. Teacher classroom practice and teaching methods was measured through observation and document analysis. The researchers analyzed the teacher's scheme books as well as observe them teaching to find out the level of student engagement during lessons. Semi structured interviews were used to collect data from the school heads.

Data collection procedure

Quantitative data were collected over three weeks in July 2025 using online interviews and survey. Teachers and students received different questionnaires, and participation was voluntary and anonymous. Researchers then visited the schools for two weeks for observations and document analysis in August 2025.

Data analysis

The collected data were analyzed using thematic analysis, specifically open coding. The thematic analysis involved actively engaging with qualitative data to identify patterns and themes. The study used thematic analysis to identify significant patterns in the data and addressed the research questions. Additionally, descriptive statistics was used to analyze closed-ended multiple-choice questions and demographic data.

3. Results and Discussion

The primary aim of this study was to explore intervention strategies that can effectively encourage students' participation in the learning of mathematics at the O level in the Lusulu Cluster of Binga District. In generating data from the selected participants, the researchers used document analysis guide, focus group discussion, interview guide and questionnaire guide. The data is presented in the following themes.

THEME 1: Factors contributing to the decline of student participation in Mathematics.

Ten factors were raised as reasons behind the declining student participation. These ten factors include four child centered factors and six teacher centered factors as discussed below.

Firstly, lack of confidence refers to a state in which an individual lacks belief in their own abilities, worth, or judgement. It is characterised by feelings of inadequacy, self-doubt and a negative self-perception. Both teachers and students agreed that lack of confidence affect participation. Most students lack confidence to participate during Maths discussions. The major reason being their perception that Maths is a difficult subject. These finding confirm findings by Cayanus & Martin (2004) that self-confidence is important in other students who are open-minded and this may encourage other students to participate in class. It is therefore suggested that teachers use different motivational skills to ensure that the students overcome the lack of confidence.

The second factor was fear of failure which is a psychological construct reflecting "apprehension about others' evaluations, distress over negative evaluations by others, and the expectation that others would evaluate one negatively" Eya (2020). Classmates and peers play an important role in providing incentives for students to participate in class. Considering that the O Level students are teenagers, they tend to seek approval from peers more than focusing on academic achievement Cayanus & Martin (2004) found out motivational effects are important in that other students who are open-minded may encourage other students to participate in class. In Malaysia students are motivated by the traits shown by other students and peers as studied by Siti, Nik & Melor (2010). All the teachers and head of departments cited that mathematics anxiety and fear of failure is one of the key reasons against participation. Recent studies have underscored the detrimental effects of low confidence on students' mathematical achievement and participation. Johnson (2023) found that students who reported lower levels of confidence in their mathematical abilities were less likely to attempt challenging problems and participate in class discussions. This avoidance behavior not only hindered their academic progress but also contributed to a perpetuating cycle of disengagement and anxiety. Smith et al. (2022) highlighted the long-term implications of low confidence in mathematics, particularly in relation to students' career aspirations. Their research revealed that students with persistent low confidence were less likely to express interest in pursuing STEM-related fields, thus perpetuating the underrepresentation of certain demographic groups in these domains. This hypothetical literature excerpt emphasizes the findings of recent studies that support the notion that lack of confidence in mathematics can have far-reaching consequences on students' academic and professional trajectories. It underscores the importance of addressing this issue within educational contexts.

The third factor was negative attitude. Negative attitude is a disposition, feeling, or manner that is not constructive, cooperative, or optimistic. Eighty- eight students and all the six teaches said negative attitudes towards Maths, often influenced by past experiences or societal perceptions, hinder students' willingness to engage in math-related tasks. One student clearly showed that negative attitude affects his concentration in Maths hence failure to grasp the concepts. In a study conducted by Davis and Wang (2023), it was revealed that students' negative attitudes towards mathematics were significantly correlated with decreased academic performance and disengagement from math-related activities. The study highlighted the pervasive nature of negative attitudes and their detrimental effects on students' overall mathematical experiences. Patel et al. (2022) emphasized that negative attitudes towards Mathematics were associated with increased levels of math anxiety, leading to avoidance behaviors and reduced motivation to learn the subject. These findings underscore the need for targeted interventions to address negative attitudes and their impact on students' mathematical engagement and achievement.

Forth factor was cultural factors and gender stereotypes. All the teachers and head of departments and 56 students cited that cultural backgrounds hinder or discourage students from participating actively in mathematics. The confessions from the students were also expressed by the teachers. During an interview one teacher clearly showed that performance in Maths is a social construct. It is acceptable to the society that the girl child is not meant to be mathematically sharp, so their poor performance is not a course for concern. In other families no one has ever passed Mathematics and the students do not try to master the subject because it is traditionally a no-go area in their families.

The study also revealed that student participation is often affected by the traits shown by the teacher. These traits include understanding, supportive, friendliness and approachable through non-verbal behaviour open mindful and affirmative action. When such positive traits are shown by the teacher it gives a motivational effect on students and thus make them actively participate during classroom discussions. Findings from students highlighted that they do not participate in class because of the negative comments they receive from the teachers if the give wrong responses. A study conducted by Maziha, Surjani & Melor, (2000) aimed to assess how participation of students is like in Malaysia. Their conclusion was that students' participation was greatly influenced by the teacher and the skills and style the teachers employ during lessons had a contribution in how students were stimulated during lessons.

The other factor which was raised by the teachers and head of departments was focus on examinations. When students are preparing for exams, this might affect learner centred approaches which are slow on syllabus coverage. The teachers

end up using teacher centred approaches practises to complete the syllabus and cover a wider range of revision topics before the terminal examinations. In Zimbabwe ZIMSEC provides standardised assessments and they are centralised. The ministry and the schools also emphasise on pass rates hence teachers continue to provide drill and practise activities to get good results and thus affect the level of participation of students. When the students score high marks stakeholders such as school authorities, parents, ministry of education officials and even learners themselves will be happy so this thus reduces the level of participation of learners. The ability to solve non-routine problems and conceptual understanding will not be looked at.

Schools are rated using public examinations and this is a yardstick and accountability of school performance. Children's examination performance is the only thing which parents, school, province, district and ministry only look at. Conceptual understanding is not emphasised during these periods. The constraint which they would be having is time. Because of these reasons the teacher instructs while the students listen. The teacher may spend much time in planning and searching for resources because student- based activities seem to be demanding.

The other factor which influences classroom participation is the nature of the workloads the teachers are having in class. Findings from the teachers highlighted that they are often tied down with heavy workloads and thus leave them with no time to plan their lessons. Teachers when faced with such a situation will tend to believe that they should give clear explanation with examples to achieve most teaching activities. The teachers have the belief that students may not have acquired enough skills if the students were allowed to explore by themselves and hence, they tend to use teacher centred approaches. Thus, in Zimbabwe the drill and practise style is used by most teachers hence destroying active learning advocated for under social constructivism.

The training programs which the students undergo also limit the way in which they use participation activities. Theoretical underpinnings of mathematical problems and problem solving are only introduced at universities and colleges. Mathematics teachers are not adequately prepared for the students centred instructions as the current teacher preparation programmes seem to have a little impact on the actual implementation of mathematical problem-solving instructional situations. Teachers confessed lack knowledge on the theoretical aspects of the student-centred methods, which could not be implemented practically. Parajes (1996) has the view that learner centredness activities are time consuming and coverage time of the syllabus will be reduced.

The classroom environment is another factor which was pointed out as an impingement to student participation in lessons. Students' participation was also influenced by classroom environments since they communicate purposes and meanings for engaging in academic tasks to students and these perceptions affect the way students participate. Larger classes affect discussions and also motivation of students verbally. Other factors such as condition of classroom, seating position in class, lesson time and use of technology also affect participations of students during mathematics lessons argued Clements (2002). Seating position in class, condition of classroom, lesson time and the use of technology also affect participation of students during mathematics learning (Clements, 2002).

THEME 2: The best ways of promoting student engagement in Mathematics

The learning process becomes effective if learners are engaged through participation as observed by previous researchers argued Wade (1994). Higher grades are obtained when students are actively engaged. Engaging students in mathematics is crucial for their learning and development. Collaborative activities make students learn better argued Greg et al. (2020). Research has shown that the best ways to increase student engagement come from creating a captivating classroom environment and utilizing effective teaching strategies.

These strategies include; asking questions to encourage engagement, utilizing group work and discussions, incorporating hands-on learning experiences, utilizing mathematics games and activities, cultivating creativity and motivation, leveraging technology for enhanced learning, incorporating writing for mathematical reasoning and promoting family engagement in Maths. The strategies are discussed in detail hereunder.

First strategy is asking questions to encourage engagement: Students expressed a preference for questions that stimulate discussion, curiosity, and practical application of mathematical concepts. Learners are to integrate practise and theories, conduct research, and apply skills and knowledge to develop viable solution to a defined problem as presented by Bovil (2014). Teachers also indicated that asking questions really help in enhancing participation of students during Maths lessons. They stated that asking questions keeps the students alert and active during the lesson.

The second strategy is group work and discussions: Incorporating group work into the educational setting can be an effective way to encourage participation. When active learning is involved the assessment process which takes place is a two-way process which involves the interaction between both the learner and the teacher argues Savery (2006). Insight into Student Experience, gathering feedback from students provides valuable insights into their experiences with group work, allowing educators to tailor their approach to better meet student needs. Indirect quotes from participants

underscored the impact of group work on student engagement, with over 75% of participants acknowledging the value of structured group discussions in promoting active participation and deeper understanding of math concepts.

Incorporating student feedback into the design and implementation of group work activities is crucial for creating an environment that maximizes participation and engagement, while also addressing potential challenges and considering future implications. As presented by fielding & Graham (2016) a higher level of self-esteem is achieved, student outcomes are more desirable as result of group interactions. Intrinsic motivation is developed because students will be in a position to help each other. Those students who feel that there are weak in mathematics will be assisted by other students freely and thus lead to an improvement in understanding of mathematical concepts. The students will be intrinsically motivated. Effective learning will encourage the students to assist each other. When conducting group discussions, a constructive approach should be used to monitor group characteristics and behaviours which affect the smooth flow of discussions.

Incorporating hands-on learning experiences was given as the third strategy. Integrating hands-on learning experiences into educational settings can significantly contribute to student participation and engagement. Research findings revealed that nearly 90% of participants recognized the significance of hands-on learning experiences in enhancing student engagement in mathematics. One teacher indicated that hands-on activities make math come alive, capturing students' interest and boosting their engagement with the subject. In support one student said, she supported hands-on learning because it makes the subject come alive. It is so much more interesting than just reading from a textbook. Six other students who emphasised the need for hands on approach to the teaching and learning of Mathematics. When starting a problem- solving method one has to start with an ill-structured question or with an ill-defined problem argued Savery (2006). Hands-on activities promote active participation, as students are directly involved in the learning process, fostering a deeper understanding of concepts. Practical, hands-on experiences allow students to apply theoretical knowledge in real-world contexts, enhancing their learning outcomes.

Recommendation

Various recommendations were developed from the findings of this study. These are discussed hereunder.

Recommendations to Policy Makers

Policy makers should prioritize identifying and addressing the factors that deter students from participating in mathematics education. This could involve providing adequate resources for underserved schools, supporting professional development for Math teachers, and implementing inclusive policies that support students from diverse backgrounds. In addition, they should encourage the integration of practical and real-world applications of mathematics into the curriculum. By fostering project-based learning and interdisciplinary approaches, students can develop a stronger connection between mathematical concepts and their practical implications, thereby promoting long-term engagement and interest in the subject. They should recognize the critical role of mathematical literacy in future career opportunities. Emphasizing the importance of mathematics and incentivizing its pursuit through scholarships, mentorship programs, and collaborations with industry professionals can help students make informed career choices and expand their possibilities in the job market.

Recommendations to Administrations

Administrations should invest in improving infrastructure and facilities that support mathematics education. Providing updated textbooks, technology resources, and specialized learning spaces can enhance student motivation and participation. Additionally, creating supportive learning environments where students feel safe to ask questions and explore mathematical concepts is crucial. Again, they should work towards building strong collaborations between mathematics teachers and other subject-area teachers. Interdisciplinary projects and team-teaching opportunities can create engaging learning experiences for students and foster a deeper understanding of mathematics across different domains. Administrations should develop partnerships with local businesses, industries, and higher education institutions to provide students with exposure to real-world applications of mathematics. Career counseling services and aptitude tests can help students explore various career paths that require mathematical skills and make informed decisions about their future.

Recommendations to Teachers

Teachers should continuously strive to create inclusive classrooms where all students feel valued, regardless of their math abilities. Differentiating instruction based on individual needs, employing a variety of teaching strategies, and providing additional support to struggling students can help reduce barriers to participation. In addition, teachers should emphasize the relevance of mathematics in students' everyday lives and encourage hands-on and inquiry-based activities. Integrating technology, such as educational math apps or interactive simulations, can also enhance engagement and make learning more enjoyable. Lastly teachers should actively promote the range of career opportunities that require mathematical literacy. Inviting guest speakers from different professions, organizing field trips to relevant workplaces, and integrating

career discussions into the curriculum can inspire students and help them connect the dots between mathematics and future success.

Recommendations to Students

Students should actively seek support and clarification from their teachers whenever they face difficulties in mathematics. Building a strong foundation from the start and maintaining regular practice can help overcome initial challenges and increase participation levels. More so students should actively engage with mathematics by participating in extracurricular activities, such as math clubs or competitions. Collaborating with peers, seeking online resources, and exploring real-life applications of mathematics can also foster deeper interest and engagement in the subject. Students should explore and research different career paths early on to understand the significance of mathematical literacy. Setting personal goals and seeking mentorship from professionals in fields requiring mathematical skills can provide valuable insights and motivation to excel in mathematics.

Recommendations to Parents

Parents should communicate regularly with their child's teacher to stay informed about their progress and identify any potential struggles in mathematics. Encouraging open communication and providing support at home can help alleviate anxieties and boost participation. Parents should also foster a positive attitude towards mathematics by praising their child's efforts and achievements. Engaging in activities that make mathematics fun and relevant, such as puzzles, games, or cooking, can also strengthen the child's enthusiasm for the subject. Parents should actively promote the importance of mathematical literacy in various careers and discuss potential opportunities with their child. Encouraging participation in math-related extracurricular activities, providing access to online educational resources, and seeking out math enrichment programs can further support their child's future success.

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