**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF SCIENCE EDUCATION**

# EXPLORING THE USE OF MIXED ABILITY GROUPING AS A TEACHING APPROACH TO IMPROVE MATHEMATICS PASS RATE AT ORDINARY LEVEL.


BY

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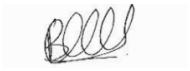
Signed  Date 30/06/2024

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**DEDICATION**

This research project is dedicated to my loving family, whose unwavering support and encouragement have been the driving force behind my academic pursuits. To my partner, Loveness Rutendo, your patience and understanding have allowed me to pursue my dreams. And to my child, Brayden Tatenda, your curiosity and enthusiasm inspire me to make a positive impact on the world.

I also dedicate this work to my colleagues who have shared their expertise and knowledge to help me grow as a researcher. Your contributions have enriched my understanding and have been invaluable to the completion of this study.

**ABREVIATIONS AND ACCRONYMS:**

ZPD----- Zone of Proximal Development

**ABSTRACT**

This study explores the effectiveness of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level. A quasi-experimental design was employed, with a non-equivalent control group sampling technique used to select 58 pupils. Questionnaires, observations, and pre-test and post-test assessments were used to collect data. The results show a significant improvement in mathematics achievement among pupils in the mixed ability grouping experimental group, compared to the control group. The study highlights the potential of mixed ability grouping to promote inclusive learning, enhance student motivation, and improve mathematics outcomes. The findings have implications for teaching practices and educational policy, suggesting that mixed ability grouping may be a valuable strategy to support student success in mathematics.

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# CHAPTER ONE: INTRODUCTION

## 1.1 INTRODUCTION

This chapter acts as the beginning to the study carried out on the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at Ordinary level. This chapter will focus on a number of issues which include the background to the study, statement of the problem and research questions which will provide the guide to the study. It also aims at providing the assumptions of the study, significance of the study stating the delimitations as well as the limitations of the study. More so, the chapter will consider definition of terms and finally summary of the whole chapter.

## 1.2 BACKGROUND TO THE STUDY

There is a "vicious circle" (Taylor et al., 2016) that prevents secondary schools from teaching mathematics in mixed-attainment groups, despite evidence that setting or streaming according to some notion of "ability" does not appear to be an effective strategy for raising attainment, particularly for the most disadvantaged pupils. Mixed ability grouping in New Zealand goes beyond mere abilities of pupils as ethnically diverse domestic pupils and predominantly Asian international pupils learn in mixed ability settings to erase the social differences created by their differences in backgrounds and ethnicity (Baker & Clark 2017). Pohtola (2015) reported that teachers in Sweden assign pupils to different groups rather than letting pupils decide where they want to sit in their classrooms. This is done to minimise playfulness amongst pupils who are friends if they sit in the same group as well as to ensure that every pupil is accommodated in mixed group settings. Through adopting these citations, the study aimed to find out if the use of mixed ability grouping as a teaching approach addresses social differences created by differences backgrounds and ethnicity.

South Africa adopted the policy on inclusive education in 2001 that aimed at offering quality and equity in education to all pupils, as well as addressing their diverse needs in the classrooms despite their differences (Hove, 2022). It was also noted that mixed ability grouping is one of the commonly used classroom practices in the schools, but little is known on how it reflects on principles of inclusivity. This motivated the researcher to find out how mixed ability grouping reflects on inclusivity as one of the commonly used classroom practices.

According to Tieso (2003) in Blackmer (2022), grouping by ability has received criticism for its outdated, discriminatory beginnings and has been the centre of debate over contemporary application and merit in facilitating the most appropriate teaching and learning environments. Therefore, this might also result in low pass rate in subjects like mathematics at Ordinary level where pupils must have confidence for them to pass. Many schools in Zimbabwe including the researcher current station still use or practice ability grouping, this prompted the researcher to carry out this study.

According to Wilkinson and Penny (2022), seminal reports commissioned by the United Kingdom government called for schools and secondary schools particularly to abolish all form of ability grouping in favour of mixed ability grouping to ensure that all pupils received equal access to teachers, curriculum materials and resources. The researcher concurred with this finding since he also noted that at his current station, teachers usually pay less or no attention to the lower attaining pupils, since pupils are streamed according to ability. Research has also shown that mixed ability grouping can foster greater self-confidence and attitudes towards learning particularly among lower attaining pupils (Francis, Taylor & Tereshechenko, 2020). Thus, by employing mixed ability grouping, pass rate of mathematics will improve since confidence is one of the factors that may lead to enjoyment of mathematics. With this in mind, the researcher noted that there were no pupils who could be amongst those few passing mathematics at O' level Zimsec examination in the class with lower attaining pupils. In support Croston and Hills (2017) postulated that ability grouping or streaming has consistently been shown to have a positive effect on the self-confidence of higher-attaining pupils, often at the expense of lower-attaining pupils. Thus, leaving behind the lower attaining pupils, hence lower pass rate in ordinary level mathematics.

Most schools in Zimbabwe practice ability grouping which seems to favour high attaining pupils over low attaining pupils as will be discussed below. The study was concerned about why pupils are not performing well in mathematics, although it is a pillar in people's socio-economic growth because it is a major prerequisite in the employment market (Shumbayawonda (2010) in Ndhlela, 2022).

Ordinary level mathematics has the lowest pass rate of all the subjects in the school curriculum and even at national level. This problem is causing concern among education inspectors, school personnel and the researcher as well. In 2022, the Ministry of Primary and Secondary Education

in collaboration with UNICEF conducted workshops country wide on how schools and teachers in particular could do to improve pass rate of mathematics at Ordinary level. The researcher and other colleagues pointed out mixed ability grouping as teaching approach to improve mathematics pass rate as it promotes inclusivity.

In October 2020, the researcher started working at a Secondary school in Zvimba District in Mashonaland West province and was given all Ordinary levels classes. The community was worried about the poor mathematics results at the school. At every Annual General Meeting, there has been ongoing debate about the low pass rate in mathematics, with some parents advocating for a complete overhaul of the mathematics department staff. After the headmaster disclosed this, the researcher had a strong interest in ways to enhance the department, mathematics pass rate. An increase in subject dropouts, lesson absconding, below average term pass rates, and a reduction in the pass rate for Ordinary level pupils all support this view point.

This study will offer the best way for removing within-class group classification, labelling and stratification by encouraging good and ideal learning interactions among the pupils as an intervention strategy. These concerns were brought up by the researcher which led to the initiation of this study.

## 1.3 STATEMENT OF THE PROBLEM

This research study focuses on the issue of the relatively low pass rate in ordinary level mathematics and the necessity to explore innovative teaching approaches to address it. Despite various efforts aimed at improving pupils' performance in mathematics, the pass rate remains a significant challenge. Traditional methods of grouping pupils based on similar abilities may not adequately meet the diverse learning needs present in mathematics classrooms (KHDA, 2022). Consequently, there is a requirement to investigate the viability of mixed ability grouping as an alternative teaching approach to enhance the pass rate. The study aims to examine the impact of mixed ability grouping on pupils' academic performance and their comprehension of mathematical concepts. By doing so, it seeks to determine whether mixed ability grouping can serve as an effective strategy for improving mathematics pass rate at Ordinary level.

## 1.4 RESEARCH QUESTIONS

1. Does the implementation of mixed ability grouping in mathematics classrooms affect the academic performance of pupils at the ordinary level?

2. What are the perceptions of pupils regarding the use of mixed ability grouping as a teaching approach in ordinary level mathematics classrooms?

3. What are the attitudes and beliefs of teachers towards the use of mixed ability grouping as a strategy to enhance the ordinary level mathematics pass rate?

4. How does the use of mixed ability grouping impact student engagement and motivation in ordinary level mathematics classrooms?

5. What are the challenges and benefits associated with implementing mixed ability grouping in mathematics education to improve the ordinary level mathematics pass rate?

## 1.5 RESEARCH HYPOTHESIS

The research used a statistical analysis to examine whether there is a relationship between academic performance and mixed ability grouping as a teaching approach.

This was achieved by comparing post-test scores between control group and experimental group.

Null hypothesis ($H_0$): There is no significant difference in the ordinary mathematics pass rate between pupils taught using mixed ability grouping and those taught using traditional ability grouping.

Alternative hypothesis ($H_1$): There is significant difference in the ordinary mathematics pass rate between pupils taught using mixed ability grouping and those taught using traditional ability grouping.

## 1.6 RESEARCH OBJECTIVES

The study seeks to:

1. To determine the effectiveness of mixed ability grouping, compared to traditional homogeneous grouping, in improving mathematics pass rate at ordinary level.

2. To examine the impact of mixed ability grouping on pupils' conceptual understanding and mastery of mathematical concepts, and its relationship to the pass rate in ordinary level mathematics.
3. To investigate the role of mixed ability grouping in addressing the diverse learning needs of pupils in ordinary level mathematics, and its influence on the pass rate.
4. To explore the motivational factors associated with mixed ability grouping and their impact on pupils' engagement and perseverance in mathematics, and their subsequent effect on the pass rate.
5. To identify the key instructional strategies and practices within mixed ability grouping that contribute to improved pass rates in ordinary level mathematics.

## 1.7 ASSUMPTIONS

The study assumptions are as follows:-

- ❖ Teachers and pupils would respond to all questions without reservations.
- ❖ The school authorities can adopt the mixed ability grouping as a teaching approach and do away with streaming or tracking to improve mathematics pass rate.
- ❖ When teaching mathematics, most teachers did not adopt a mixed ability grouping strategy.
- ❖ The use of a mixed ability grouping strategy inside a class had a favorable influence on ordinary level mathematics performance, and the pass rate could be objectively measured.
- ❖ Secondary School pupils and staff would be agreeable in supporting the researcher with the research, and the research would be devoid of bias.

## 1.8 SIGNIFICANCE OF THE STUDY

The study has the potential to contribute to enhancing pupils' academic performance in ordinary level mathematics. The findings can provide insights into a teaching approach that may lead to improved understanding, higher achievement, and increased success rates in mathematics. Furthermore, the study acknowledges the diverse learning needs of pupils in ordinary level mathematics classrooms. Thus, helping to address the varying levels of mathematical proficiency among pupils, ensuring that all pupils have the necessary support to succeed. Implementing mixed ability grouping also promotes inclusive education practices, hence by bringing together pupils with different abilities, this approach fosters collaboration, peer learning, and mutual support. Mixed ability grouping acknowledges and values the unique strengths and contributions of each

pupil thereby creating an inclusive learning environment where all pupils can be successful. The study's findings will also inform educational policies and decision-making processes. Policymakers can use the research outcomes to develop guidelines and recommendations for implementing mixed ability grouping as a teaching approach in mathematics education aimed at improving pass rates and promoting effective teaching strategies in ordinary level mathematics.

## 1.9 LIMITATIONS OF THE STUDY

Limitations are constraints that are largely beyond your control (Wiersman 2002 in Takaedza 2023). The researcher faced time constraints because of work and teaching responsibilities. To overcome this obstacle the researcher sought permission to work with pupils after school hours and on extra days to collect data. Additionally, the researcher struggled with financial limitations, particularly in buying necessary supplies like stationery and printing work cards, as well as covering expenses related to visiting the tutor regularly. The researcher raised funds by selling kapenta on weekends to ensure the project's success. It was also the researchers first time of doing a study of this scope, so gathering data and presenting it in the desired manner was complex and challenging. However, in order to generate a good project, the researcher sought advice from his supervisor.

## 1.10 DELIMITATIONS OF THE STUDY

The study focused on form three pupils of a Secondary school in Zvimba District in Mashonaland West province of Zimbabwe. The study examines the impact of mixed ability grouping within a class on pupils' performance in ordinary mathematics. It focuses solely on a methodology of mixed ability grouping and ignores any other factors affecting pupils' performance at ordinary level. The researcher based his findings on theories of grouping methodologies, namely within-class mixed ability grouping and other similar ideas of within class ability grouping. Other variables such as school politics, economic and cultural issues, the effect of Covid-19 pandemic, as well as other characteristics such as class numbers and materials, to name a few, were held constant in this study.

## 1.11 DEFINITION OF TERMS

**1. Mixed Ability Grouping**: refers to an instructional strategy where pupils of varying abilities are grouped together to work on a common task or project (Akçay & Yılmaz, 2018).

**2. Teaching Approach:** refers to a method or strategy used by teachers to facilitate learning and instruction (Hill & Hannafin, 2017).

**3. Ordinary Level Mathematics**: refers to the standard level of mathematics education provided to pupils in secondary schools (Çakıroğlu & Özsoy, 2017).

**4. Pass Rate**: refers to the percentage of pupils who achieve a passing grade in a particular subject or course (Gökçe & Özgelen, 2017).

## 1.12 SUMMARY

This chapter was a provision or an insight on structure of the research which is inclusive of the background of the study on the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level and statement of the problem. The researcher discussed research questions that he assumed will help him in his research. The significance of the study, assumptions, limitations and delimitations were also discussed in this chapter. The chapter ends by providing definition of key terms which will be widely used in the study. The following chapter will have a look on literature review where the researcher looked at the views of other authors on the problem.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 INTRODUCTION

This chapter provides a comprehensive review of the existing literature on the use of mixed ability grouping as a teaching approach to enhance ordinary level mathematics pass rate. The review aims to examine the theoretical foundations, empirical studies, and key findings related to this instructional strategy. By analysing the available research, this chapter will also identify gaps in the literature and highlights the need for further investigation in future.

## 2.2 THEORETICAL FOUNDATIONS OF MIXED ABILITY GROUPING

This chapter begins by exploring the theoretical foundations that support the use of mixed ability grouping in mathematics education. The following theories are commonly cited in the literature:

### 2.2.1 SOCIAL CONSTRUCTIVISM

Social constructivism is a theoretical framework that emphasizes the role of social interactions and collaborations in shaping pupils' understanding and knowledge of mathematics (Vygotsky, 1978). In the context of mixed ability grouping, social constructivism suggests that pupils learn mathematics by engaging in peer-to-peer discussions, sharing ideas, and building on each other's strengths and weaknesses (Webb, 2015). This approach fosters a collaborative learning environment where pupils can learn from one another, promoting a deeper understanding of mathematical concepts and improving pass rates at ordinary level (Hattie, 2015).

According to social constructivist theory, the teacher's role is to facilitate student learning by creating an inclusive and supportive classroom environment that encourages active participation and collaboration (Gillies, 2016). In mixed ability groups, teachers can use strategies such as open-ended questions, problem-solving activities, and group discussions to promote critical thinking and problem-solving skills (Kumar, 2016). By doing so, teachers can help pupils develop a growth mindset, seeing mathematics as a learning process rather than a fixed ability (Dweck, 2015).

Research has shown that mixed ability grouping, informed by social constructivist theory, can lead to improved mathematics pass rates at ordinary level (Kyndt et al., 2017). When pupils work together, they develop a sense of community and belonging, which enhances their motivation and engagement in learning mathematics (Gillies, 2016). Moreover, mixed ability grouping allows

teachers to differentiate instruction and cater to diverse learning needs, ensuring that all pupils have the opportunity to succeed (Tomlinson, 2014).

Social constructivism also highlights the importance of language and communication in the learning process (Vygotsky, 1978). In mixed ability groups, pupils can engage in mathematical discussions, share their thinking, and learn from one another's perspectives, promoting a deeper understanding of mathematical concepts (Webb, 2015). By encouraging pupils to articulate their thinking and listen to others, teachers can help pupils develop a shared understanding of mathematics and improve their pass rates at ordinary level (Hattie, 2015).

In a nutshell, social constructivism provides a robust theoretical framework for understanding the benefits of mixed ability grouping in improving mathematics pass rates at ordinary level. By creating a collaborative and inclusive learning environment, teachers can harness the power of social constructivism to promote deeper understanding and improved student outcomes in mathematics.

### 2.2.2 ZONE OF PROXIMAL DEVELOPMENT (ZPD)

The Zone of Proximal Development (ZPD) is a theoretical framework developed by Vygotsky (1978) that suggests that pupils learn best when they are engaged in activities that are slightly beyond their current level of understanding. In the context of mixed ability grouping, the ZPD is particularly relevant as it provides a framework for teachers to create learning opportunities that cater to diverse learning needs. By grouping pupils of varying abilities together, teachers can create a learning environment that challenges each student to work within their ZPD, promoting deeper understanding and improved mathematics pass rates (Webb, 2015).

According to Vygotsky (1978), the ZPD represents the difference between what a learner can do without help and what they can achieve with guidance and encouragement from a skilled partner. In mixed ability groups, pupils can work together to complete tasks that are beyond their individual abilities, but attainable with the help and support of their peers (Gillies, 2016). This collaborative approach enables pupils to learn from one another, receive scaffolding and feedback, and develop a growth mindset, essential for success in mathematics (Dweck, 2015).

Research has shown that mixed ability grouping, informed by the ZPD, can lead to improved mathematics pass rates at ordinary level (Kyndt et al., 2017). By creating learning opportunities

that cater to diverse learning needs, teachers can ensure that all pupils are working within their ZPD, promoting engagement, motivation, and deeper understanding (Hattie, 2015). Moreover, mixed ability grouping allows teachers to differentiate instruction and provide targeted support, ensuring that all pupils have the opportunity to succeed in mathematics (Tomlinson, 2014).

In conclusion, the ZPD provides a robust theoretical framework for understanding the benefits of mixed ability grouping in improving mathematics pass rates at ordinary level. By creating learning opportunities that challenge pupils to work within their ZPD, teachers can promote deeper understanding, critical thinking, and problem-solving skills, essential for success in mathematics.

## 2.3 BENEFITS OF MIXED ABILITY GROUPING

Mixed ability grouping is a teaching approach that involves grouping pupils of varying abilities together to learn mathematics. This approach has several benefits that can improve mathematics pass rates at ordinary level.

### 2.3.1 Differentiation and scaffolding

Mixed ability grouping also allows teachers to differentiate instruction and provide targeted support to pupils who need it. Tomlinson (2016) found that teachers who use mixed ability grouping are better able to differentiate instruction and provide scaffolding to pupils, which leads to improved student outcomes. Similarly, Hattie (2016) found that mixed ability grouping enables teachers to provide targeted support to pupils, which reduces the achievement gap between high and low achievers.

### 2.3.2 Critical thinking and problem-solving

Mixed ability grouping also promotes critical thinking and problem-solving skills, essential for success in mathematics. Kumar (2016) found that mixed ability grouping encourages pupils to think critically and solve problems collaboratively, which leads to deeper understanding and improved student outcomes. Similarly, Kyndt et al. (2017) found that mixed ability grouping promotes critical thinking and problem-solving skills, which are essential for success in mathematics.

### 2.3.3 Reducing the achievement gap

Mixed ability grouping has also been shown to reduce the achievement gap between high and low achievers. Hattie (2016) found that mixed ability grouping reduces the achievement gap by providing targeted support to pupils who need it. Similarly, Gillies (2016) found that mixed ability grouping fosters a sense of community and belonging, which reduces the achievement gap by promoting a sense of inclusivity and support.

### 2.3.4 Improved peer-to-peer learning

Mixed ability grouping allows pupils to learn from one another and share ideas and perspectives, promoting peer-to-peer teaching (Webb, 2016). This approach encourages pupils to work together, share their strengths, and support each other's weaknesses, fostering a sense of community and teamwork (Gillies, 2016). By learning from one another, pupils can gain a deeper understanding of mathematical concepts and develop problem-solving skills (Kumar, 2016).

There is evidence from the literature that mixed ability grouping is a powerful teaching approach that can improve ordinary level mathematics pass rates. By promoting peer-to-peer learning, differentiating instruction, fostering critical thinking and problem-solving skills, and reducing the achievement gap, mixed ability grouping provides a supportive and inclusive learning environment that enables all pupils to succeed in mathematics.

## 2.4 CHALLENGES OF MIXED ABILITY GROUPING

Mixed ability grouping faces several challenges in implementation, including difficulties in classroom management, lesson planning, and assessment (Kumar, 2018). Teachers may struggle to manage classrooms with pupils of varying abilities, leading to disruptions and decreased productivity (Gillies, 2017). Moreover, lesson planning becomes more complex, as teachers need to cater to diverse learning needs and abilities (Hattie, 2016). Assessment also becomes challenging, as teachers need to evaluate student progress and understanding in a heterogeneous group (Webb, 2017).

Sustaining mixed ability grouping over time is another significant challenge. Teachers may experience burnout and frustration due to the added demands of differentiating instruction and managing diverse classrooms (Kumar, 2018). Moreover, the approach may not be sustainable in schools with limited resources, large class sizes, and inadequate support structures (Gillies, 2017).

Additionally, the approach may not be compatible with traditional teaching methods and assessment practices, leading to resistance from teachers and administrators (Hattie, 2016). However, by addressing these challenges and considerations, teachers can effectively harness the benefits of mixed ability grouping to improve the pass rate in ordinary level mathematics while promoting inclusive and supportive learning environments.

## 2.5 RESEARCH GAP

Despite the growing interest in the use of mixed ability grouping as a teaching approach to improve mathematics pass rates at the ordinary level, there remains a research gap in understanding the long-term effects of this instructional strategy on pupils' academic achievement and retention. Existing studies have primarily focused on short-term outcomes, such as immediate improvements in student engagement and collaborative skills (Smith & Johnson, 2018; Brown et al., 2020). However, limited research has explored the sustained impact of mixed ability grouping on pupils' mathematics performance over an extended period, including subsequent grade levels and standardized assessments.

## 2.6 SUMMARY

Following a review of the linked literature, which indicated what previous academics have to say about mixed ability grouping, the literature identified some weaknesses that need to be filled, as well as areas that need to be extended and evaluated under various settings and places. The flaws of mixed ability grouping have also been disclosed, providing the researcher with a better understanding of what he is researching and how to reduce the method's weaknesses. The next chapter will look at research methodology, data collection and data presentation plan.

# CHAPTER THREE: RESEARCH METHODOLOGY

## 3.0 INTRODUCTION

This chapter outlines the research methodology employed to investigate the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level. The chapter provides an overview of the research design, as well as evaluating the strengths and weaknesses of the research instruments employed for gathering data, namely questionnaires, observations and pre-test and post-test. The target population, the sample and the sampling techniques are also analysed in this chapter. Additionally, the chapter covers the process of collecting data, data presentation and analysis techniques, ethical considerations and concludes with a summary.

## 3.1 RESEARCH DESIGN

According to Creswell and Creswell (2018), research design is a critical component of any research study as it provides the blueprint for conducting the research and ensures that the study is conducted in a systematic and rigorous manner. In this study, a quasi-experimental research design was employed to examine the impact of mixed ability grouping as a teaching approach to improve mathematics pass rate at the ordinary level. According to Smith and Johnson (2018), quasi-experimental research refers to a type of research design that shares similarities with experimental research, but lacks random assignment of participants to different groups or conditions. In, quasi-experimental studies rely on naturally occurring groups or pre-existing conditions to form the comparison groups. The design involved the formation of an experimental group, which received mathematics instruction using the mixed ability grouping approach, and a control group, which received instruction through traditional homogeneous grouping. Pre-test and post-test measurements were conducted to assess the mathematics proficiency of pupils in both groups.

Quasi-experimental research was used in this study because of ethical considerations. According to Gopalan, Rosinger and Ahn (2020), quasi-experimental research designs allow researchers to study the effects of mixed ability grouping while respecting ethical considerations by using naturally occurring groups or pre-existing conditions. Thus, it does not disadvantage certain pupils or perpetuate stereotypes. On other hand quasi-experimental research faces the issue of not having random assignment, leading to the potential for selection bias and confounding factors (Gopalan, Rosinger & Ahn, 2020). In other words, the groups being studied mat have underlying differences that are not related to the intervention, which can make it difficult to determine if the intervention

is causing any observed differences. Moreover statistical methods can help account for these extraneous variables, allowing researcher to more accurately determine the impact of the intervention.

## 3.2 DATA COLLECTION INSTRUMENTS

Data collection instruments refer to the tools or methods used to gather data in a systematic and standardized manner (Borg & Gall, 2021).Three instruments to be used in study are questionnaires, pre-test and post-test and observations. Questionnaires were given to both the control group and the experimental group when conducting research. According to Scribbr (2021), by administering questionnaires to both groups, researchers can assess various factors such as attitudes, beliefs, behaviors, or perceptions. Therefore, this data can then be analysed to determine if there are significant differences between the control group and the experimental group. The questionnaire shall be administered to two form three classes control group with 28 pupils and experimental group with 30, as well as four mathematics teachers. The pre-test was administered to both the experimental group and the control group before mixed ability grouping teaching approach was implemented. Whilst post-test was administered after mixed ability grouping teaching approach was implemented. Above all mathematics lessons were also observed during the teaching and learning of mathematics at the selected school, capturing valuable data for subsequent analysis.

### 3.2.1 QUESTIONNAIRES

A questionnaire according to Gray (2011) in Sunzuma (2018) is a research instrument used to collect data from a sample of respondents through a set of standardized questions. The questionnaire was chosen as the most important study tool. The questionnaire was created using the Likert scale as a guideline. According to Likert (1932), the Likert scale, named after its creator Rennis Likert, was one of the most extensively used itemized scales. Strongly disagree and strongly agree are usually at the opposite ends of the Likert scale. The responders are asked to check one of five response categories to indicate their level of agreement. The Likert scale offers various advantages, including the ease with which the researcher could build and administer it, as well as the ease with which the respondents could grasp it.

Questionnaires were created by the researcher and filled out by the pupils and teachers. The questionnaires had questions about the efficiency of mixed ability grouping within a class, as well as a few questions about other techniques of teaching and learning mathematics, such as within-

class ability grouping. The researcher clarified a few points about the efficiency of lecture and group work in teaching and learning observation sketching.

The use of a questionnaire as a primary data gathering technique, which highlights the following advantages: Excluding the names of respondents in questionnaires provides participants with the freedom to express themselves without reservations (Best & Khan, 2019). This approach helps reduce response bias, as participants may feel more comfortable sharing personal data or opinions without the fear of being identified. The questionnaire permitted wide coverage of questions other than interviewing all the 58 pupils since time was limited. Since the questionnaire provides written information, there was less danger of misrepresentation of facts or information. Through questionnaires, there was assurance of getting correct responses since the researcher was there to clarify some of the issues raised. The completed responses were collected within a short space of time. The researcher also had the opportunity to introduce the issue and encourage respondents to provide truthful responses. Another important strength of using questionnaires is that they can provide a standardized and structured way of collecting data, allowing for easy comparisons and analysis. They were used because they collect both quantitative and qualitative data, making them versatile and adaptable to different research questions and design.

Although questionnaires were used to gather data, they have limitations. They may not fully capture the complexity of the research topic, especially when exploring sensitive emotions, personal beliefs, or individual experiences. Additionally, questionnaires often rely on pre-defined questions and response options, which can lead to respondents making assumptions or misinterpreting questions, resulting in incomplete or inaccurate answers. This can compromise the quality and validity of the data. To address these weaknesses, this study also employed qualitative methods and cognitive testing to gain a more comprehensive understanding and ensure accurate responses.

Questionnaires were made up of closed questions. Closed questions limit the number of people who can respond and reduce the number of superfluous responses. Closed questions have an advantage that they can be pre-coded and this makes data analysis easy, and they also require less time to complete (Sarandakos, 2013). However, closed questions only compel participants to select between the answers provided. More so, response choices in closed questions reduce ambiguity,

and participants are more likely to answer questions that the researcher really wants them to answer.

### 3.2.2 OBSERVATIONS

In addition to the questionnaire the study also utilised the observations to gather rich qualitative data. According to Best and Kahn (2020), an observation can be defined as a systematic method of collecting data, whereby researchers utilize their senses to carefully examine individuals within their natural environments. This implies that during the use of observations as data collection instruments, researchers have the ability to employ at least one sense at a given moment.

According to Duke University Library Guides (2024), the primary advantage of observations is that data is collected during or shortly after the activity. Observational research allows researchers to study behaviors and phenomena in naturalistic settings, providing a more authentic representation of real life situations. This indicates that the data is likely to be accurate. According to Duke University Library Guides (2024), observation goes beyond the surface areas that quantitative research often focuses on, it yields rich qualitative data by capturing detailed descriptions of behaviors, interactions and contextual factors that may not be easily captured through other data collection methods. It was also noted that a researcher using observation probes beyond and behind given statements, which is a significant advantage in a mixed-class grouping method. Thus, it allows follow-up questions, hence provide critical insights that may not be obtained from other methods since it offers a detailed understanding of behaviors and processes and enabling the identification of specific issues or areas for improvement. According to Leedy (2019), observations can be non-invasive, especially when conducted in a non-participatory manner, minimising the potential for participant's bias or reactivity.

However, according to Leedy (2019), direct observation can be a length process and is prone to bias from the observer, potentially leading to the recording of non-occurring events and compromising the validity and reliability of the observed data. Additionally, the observer effect can be drawback of observations, as the presence of the observer may affect the behavior of the participants being observed (Popper, 2020). Therefore, it is crucial to exercise caution to ensure that participant's true behaviors are observed during the observation process

More so, observation has a subjective element to it. Many things influence one's perception of something as awful or excellent, one of which is one's background. According to Creswell (2015), the participants' behavior differed during the study lessons because the pupils want to prove a point to the teacher (the researcher) because they are aware that they are being monitored. According to Miles, Huberman and Saldana (2014), the presence and subjectivity of the observer can introduce bias. Thus, observers may unintentionally influence the behavior of participants or interpret behaviors based on their own preconceptions or expectations. Creswell (2015), posited that observational research often focuses on specific settings or contexts, which can limit the generalizability of findings to other populations or environment. Lastly it can be time consuming and require trained observers, making it a resource-intensive data collection method. Triangulation was used in this study to mitigate challenges associated with observation alone, observation was combined with questionnaires and pre-test and post-test to provide a more comprehensive understanding of the research topic.

### 3.2.3 PRETEST AND POST-TEST ASSESSMENTS

Pre-test and post-test assessments are also research instruments that were also employed in this study. These assessments provide valuable data that allows researchers to measure the impact of the intervention and draw conclusions about its effectiveness. They were chosen because of the following reasons; pre-test assessments are administered before the implementation of the intervention (mixed ability grouping) to establish a baseline measurement of pupils' mathematics proficiency. They provide an initial snapshot of pupils' knowledge, skills, and abilities before any potential effects of the teaching approach come into play (Matzen & Edmunds, 2017). Whilst Post-test assessments are administered after the intervention to measure any changes in pupils' mathematics performance. According to Kirk (2019), by comparing the post-test scores with the pre-test scores, researchers can determine whether the use of mixed ability grouping has led to improvements in the ordinary level mathematics performance.

Kirk (2019), postulated that pre-test and post-test assessments provide quantitative data that can be analyzed statistically. Thus, in this research statistical tests were used, t-tests were used to compare the mean scores before and after the intervention and determine whether the observed differences were statistically significant. These statistical analyses provided objective evidence of the impact of mixed ability grouping on the ordinary level mathematics pass rate.

The use of pre-test and post-test have numerical advantages, they allow researchers to measure changes in participants behavior, attitudes, or outcomes over time. Kirk (2019), posited that by collecting data before and after an intervention or treatment, researchers can assess the effectiveness or impact of the intervention. They also address individual differences, according to Matzen and Edmunds (2017). Pre-test and post-test account for individual differences by comparing each participant's baseline performance or characteristics with their subsequent performance. This assists to deal with the influence of individual variations when evaluating the interventions effects.

However, like any other instruments pre-test and post-test have its flaws, according to Kirk (2019), post-test may be affected by attrition, whereby there might be loss of participants over the course of a study which can lead to bias and affect the validity of the results. The act of taking the pre-test may prime participants and influence their performance on the post-test, leading to inflated or deflated scores. This can complicate the interpretation of the intervention's effects. To mitigate the flaws, by including a control group that does not receive the intervention, it was easy to compare the changes observed in the intervention group with those in the control group. More so strategies to promote participant retention such as maintaining regular communication, providing incentives and scheduling convenient follow-up sessions was also employed to mitigate attrition and improve the completeness of the data.

The tests were given and written in a controlled environment. The tests were created and conducted according to established guidelines, and the results were recorded. Tests are useful since the researcher can simply evaluate the results because each learner is given a grade (Kirk, 2019). However, if tests are not closely supervised, pupils may cheat, resulting in an inaccurate portrayal of their performance. As a result, rigorous supervision and invigilation was applied. Following the written tests, the benefits to be gained were noted. Due to the severe invigilation, the test revealed the genuine performance of the pupils. The researcher took the time to mark the papers, revealing a valid test score to be used for research analysis, as well as observing the deficiencies displayed by each child, which aids in their correction. Because the exam was administered after the pupils had covered a large number of ideas, it revealed that they had improved their retention of previously learned topics, indicating a shift in behavior. The test makes it simple to compare prior and present results, as well as to perform a t-test, which clearly shows where there is a quantitative

relationship. However, the study noticed some flaws, such as some pupils taking the tests when they were sick, resulting in lowered test scores, and participants who were overly eager to prove a point to the teacher because they were aware that they were participating in a study that might not be continued in the future.

### 3.3 POPULATION

According to Creswell (2014), population refers to the entire group of individuals, objects or events that share a common characteristic and are of interest to the researcher. It is very crucial to avoid ambiguity when defining the target population to ensure accurate data collection and analysis. The objective of the research is to explore the effectiveness of using mixed ability grouping as a teaching approach to enhance the pass rate in ordinary level mathematics at a secondary school located in Zvimba district, Mashonaland West Province. The target population for this study comprises 58 pupils and 4 teachers from the ordinary level classes at the selected school.

### 3.4 SAMPLE

A sample is a subset of a larger population that is used to represent the larger population in a study. Thus, the selection of a sample is an important step in research design since it can impact the validity and generalizability of the study's findings. Four ordinary level Mathematics teachers and 58 pupils were employed in the study.

#### 3.4.1 SAMPLING PROCEDURE

This study used non-equivalent control group sampling, according to Manion and Morrison (2018), is a quasi-experimental research design that involves the use of two groups, an experimental group and a control group, that are not equivalent at the beginning of the study. The experimental group receives the treatment or intervention, while the control group does not. Another school of thought Hattie (2016), defined non-equivalent control group design as a design in which participants are assigned to control and experimental groups, but the assignment is not random, leading to groups that are not initially equivalent. This is often used in situations where random assignment is not feasible or ethical as the case with this study. Two groups of pupils were identified, one to serve as the control group (class A) and the other as the experimental group (class

B), 28 pupils in the control group and 30 in the experimental group. All mathematics teachers at the school were selected to take part in the study.

### 3.5 DATA COLLECTION PROCEDURE

Questionnaires, observations and pre-test and post-test was used as means of data collection. Fifty eight pupils and four teachers were given questionnaires by the researcher. They were asked to check the boxes next to the answers on the questionnaires where they were applicable. The questionnaires were provided to the pupils for a week to complete. Anonymity was guaranteed, it was also promised that no names would be written on their questionnaires or answer sheets. In addition to the previously indicated instrument, pre-test and post-test was administered to the participants. Before implementing any intervention or treatment, the participants were given a pre-test assessment. The pre-test helped establish a starting point for comparison with the post-test results. After the intervention or treatment period, the participants were given a post-test assessment. The purpose was to evaluate any changes or improvements that have occurred as a result of the intervention.

### 3.6 DATA REPRESENTATION AND ANALYSIS

After collecting data through questionnaires, classroom observations and pre-tests and post-tests for the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level, the next step involves data analysis and data representation.

Questionnaire data was analyzed by calculating descriptive statistics, such as frequencies and percentages, for each item or response category. This analysis provided an overview of participants' perceptions, attitudes, or preferences related to mixed ability grouping. This process involved identifying recurring themes, categorizing responses, and interpreting participants' written responses. This analysis helped to explore participants' experiences, opinions, or suggestions regarding mixed ability grouping.

Measures of central tendency (e.g., mean, median) and measures of variability (e.g., standard deviation) for pre-test and post-test scores were calculated separately. This analysis helped to understand the initial level of mathematics proficiency and the improvement achieved after the intervention. Inferential statistics (paired t-tests) was also conducted to determine whether there is

a significant difference between post-test scores. This analysis helped to assess the effectiveness of mixed ability grouping as a teaching approach. The hypothesis:

$H_0$ (Null Hypothesis): There is no significant difference in the mean post-test scores between the control group and experimental group.

$H_1$ (Alternative Hypothesis): There is a significant difference in the mean post-test scores between the control group and experimental group.

The data observed was recorded manually in a diary, data recorded involved specific behaviors, instructional strategies, or classroom dynamics related to mixed ability grouping. Data was analysed by calculating frequencies, proportions, or durations of specific behaviors or instructional strategies. This analysis provided quantitative insights into the implementation and effectiveness of mixed ability grouping. Qualitative observational data was analysed by identifying patterns, themes, or emergent categories. This analysis involved interpreting qualitative descriptions of classroom interactions, teacher-student dynamics, or student engagement within the context of mixed ability grouping.

Data Representation: Quantitative data, such as pre-test and post-test scores, questionnaire responses, or frequency of observed behaviors were presented in tables. Appropriate headings, labels, and footnotes to ensure clarity and provide a concise summary of the findings was also shown. The use visual representations, such as bar graphs, line graphs, or pie charts was employed to illustrate quantitative data. For example, a bar graph could display the mean pre-test and post-test scores for each group to demonstrate the improvement achieved. Written narratives or summaries to describe qualitative findings from questionnaires and observations was also employed.

### 3.7 ETHICAL CONSIDERATION

Prior to conducting the study, appropriate permission was obtained from relevant authorities. The researcher obtained permission from Bindura University of Science Education, the Ministry of Primary and Secondary Education, and the heads of the selected schools. Ethical considerations were given priority in this study, including ensuring anonymity confidentiality, voluntary participation, as well as and informed consent.

To ensure confidentiality and anonymity, the researcher followed guidelines suggested by Bell (2019). Participants were not required to provide their names, credentials, or any identifying information on the questionnaires provided to pupils and teachers. The researcher emphasized maintaining high levels of confidentiality by assuring respondents that their responses would only be used for research and educational purposes. This encouraged participants to freely express their thoughts and feelings.

Furthermore, participants were informed that their participation in the study was entirely voluntary, and there would be no consequences for those who chose not to continue participating. This ensured that participation was not coerced, allowing individuals to participate based on their own free will. This approach provided participants with a greater opportunity to express their genuine experiences and perspectives.

Lastly, informed consent involves the researcher disclosing the purpose, goals, and objectives of the study to the participants (Phillips & Pugh, 2019). In this study, participants were provided with a consent form that outlined all the relevant information about the study and its significance to various stakeholders. This process ensured that participants felt respected and valued, creating an environment where they could provide genuine and trustworthy information.

## 3.8 SUMMARY

This chapter focused on research methodology, which aimed to produce findings through the execution of a study. It gave a quick overview of the research design and provided information on the research instruments used. The study also examined the advantages and disadvantages of the research instruments, as well as the strategies to mitigate the disadvantages. The population, sampling technique, data collection, presentation, and analysis procedures were also highlighted. The display and analysis of data is the focus of the following chapter.

# CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

## 4.1 INTRODUCTION

This chapter presents the analysis and results of the data collected from both teachers and pupils on the effectiveness of mixed ability grouping as a teaching approach to improve mathematics pass rate at Ordinary level. Data was gathered through questionnaires, classroom observations and pre-test and post-test. Standardized questionnaires with closed ended questions were given to both pupils and teachers. The questions in the two questionnaires were largely identical as they sought to find the views of the pupils and teachers on the same issues. The only significant difference was in the wording, as the pupil's questionnaires used simpler language to ensure they could comprehend the questions easily. The return rate of questionnaires administered to pupils was 100% and that of those administered to teachers was 100%. Pupils were given pre-test for the researcher to measure the existing knowledge of both groups before the intervention. This was followed by a post-test to ascertain if there was any difference between the control group and the experimental group after the treatment.

## 4.2 DATA PRESENTATION

This section of the chapter covers the presentation and analysis of data collected by the researcher for the purpose of the study. To begin with questionnaire results are presented, analysed and interpreted first. The responses obtained from the pupils on questionnaires given are presented in the next section.

### 4.2.1 QUESTIONNAIRE RESULTS FOR PUPILS

Likert scale designed questionnaires were administered to both the pupils and the teachers. The responds from pupils' questionnaire are presented, analysed and interpreted below.

#### 4.2.1.1 Demographic data for pupils

The section shows the demographic information of the pupils that responded to the questionnaires provided during the study.

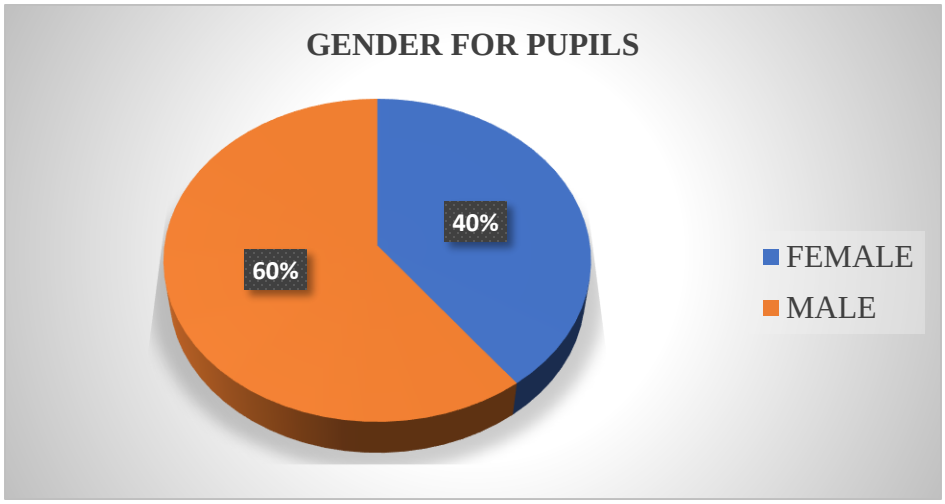


***Figure 4.1: Pie chart of gender of pupils***

Data displayed on the pie chart in Figure 4.1 indicates that the researcher worked with 60% (35) male pupils, as well as 40% (23) female pupils in this study. The same data also shows that the researcher worked with a population of twenty (58). This data indicates that, in the school where this study was done, the population of form three female pupils is less than that of their male counterparts, and most importantly the researcher got views of both boys and girls, regarding the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level.

#### 4.2.1.2 Age of pupils

The chart below shows the information of the pupils' age groups who were the recipients of the questionnaires for the study:

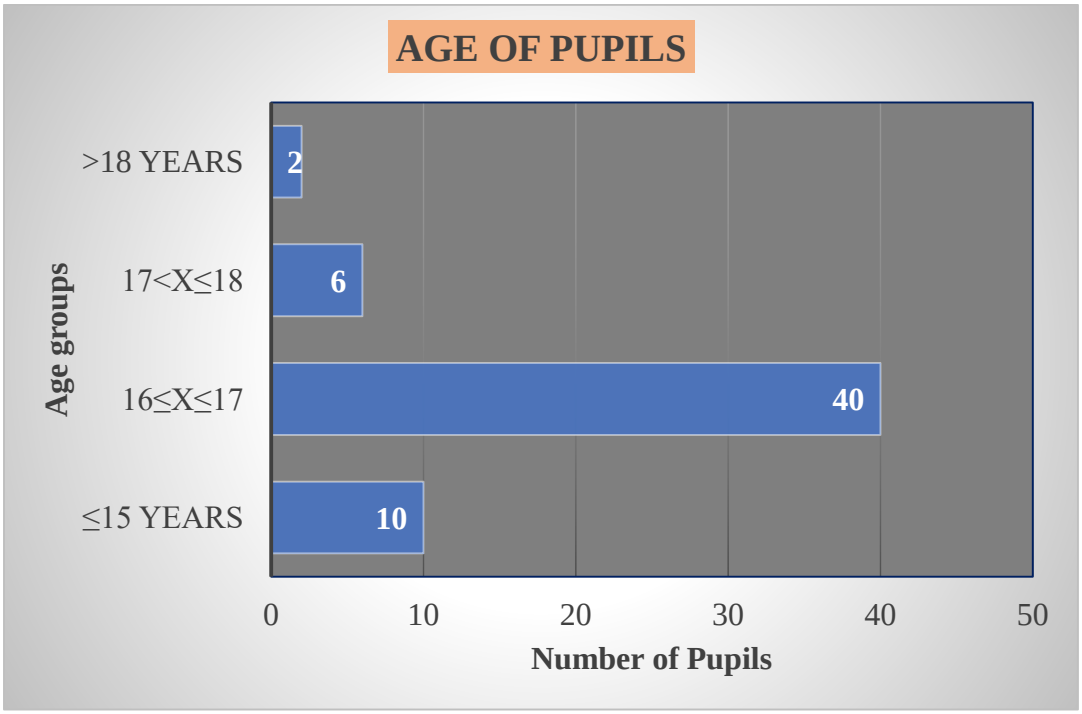


***Figure 4.2 Bar Chart of age of pupils***

The Bar Chart in Figure 4.2 depicts that of the 58 pupils, 10 (17%) were below or 15 years old, 40 (69%) which is majority were between 16 and 17 years inclusive, 6 (10%) were between 17 and 18 years inclusive and 2 pupils (3%) were above 18 years. The data was collected from pupils across different age groups, which enhanced the credibility and trustworthiness of the findings. Thus, providing a more comprehensive and representative understanding of the research topic.

#### 4.2.1.3 Pupils response to the questionnaire

The questionnaires that were administered to pupils were collected and the findings tabulated below:

***Table 4.1: Frequency of choice of answer on each question***

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1. I feel comfortable working in a mixed grouping environment in mathematics. | 40 | 0 | 3 | 0 | 15 |
| 2. I believe that mixed ability grouping allows for a more inclusive learning environment in mathematics. | 48 | 4 | 0 | 0 | 6 |
| 3. I feel that mixed ability grouping allows for more opportunities for peer-to-peer learning in mathematics. | 53 | 1 | 0 | 0 | 4 |
| 4. I believe that mixed ability grouping can be beneficial in terms of building confidence in weaker mathematics pupils. | 54 | 2 | 0 | 0 | 2 |
| 5. I believe that mixed ability grouping allows for a more diverse range of ideas and perspectives in mathematics. | 56 | 1 | 1 | 0 | 0 |
| 6. I believe that mixed ability grouping can be challenging in terms of managing different levels of understanding mathematics. | 42 | 6 | 6 | 1 | 3 |
| 7. I feel that mixed ability grouping can be challenging in terms of keeping all pupils engage in mathematics. | 51 | 2 | 0 | 0 | 5 |
| 8. I believe that mixed ability grouping can be beneficial in terms of developing problem-solving skills in mathematics. | 44 | 4 | 0 | 0 | 10 |
| 9. I believe that mixed ability grouping can be beneficial in terms of promoting growth mind set in mathematics. | 50 | 0 | 0 | 0 | 8 |
| 10. I feel that mixed ability grouping can be challenging in terms of ensuring that all pupils are challenged at an appropriate level in mathematics. | 20 | 0 | 8 | 0 | 30 |

The response rate for the pupils' questionnaire was perfect, with every questionnaire being returned. Forty out of fifty eight pupils strongly agreed that they feel comfortable working in a mixed grouping environment in mathematics with three neither agreeing nor disagreeing and

fifteen strongly disagreed. As such pupil feel that mixed grouping promotes a sense of belonging and inclusivity, where everyone is valued and respected (Hill, 2017).

Of the fifty eight participants, forty eight strongly agree that they believe that mixed ability grouping allows for a more inclusive learning environment in mathematics, four agree and six strongly disagree. This result shows that fifty-two out of fifty eight have positive perception towards mixed ability grouping as a teaching approach.

Asked if mixed ability grouping allows for more opportunities for peer-to-peer learning in mathematics fifty three strongly agree, one out of eighty agree and just four strongly disagree. A larger proportion of pupils agree that mixed ability grouping promotes a supportive learning environment where pupils can learn from peers with different strength and weaknesses as noted by Chambers and Timms (2016).

Fifty four out of fifty eighty participants strongly agreed that they believe that mixed ability grouping can be beneficial in terms of building confidence in weaker mathematics pupils, two agree to this proposition whilst also two strongly disagree. This implies that many pupils feel more confident in their ability to learn and understand mathematics when working in supportive mixed grouping environment.

Fifty six strongly agreed that mixed ability grouping allows for a more diverse range of ideas and perspectives in mathematics, one agreed and one was neutral. In general majority of pupils as noted by Rubel, Lim and Fan (2017), believed that mixed ability grouping ensure that pupils are exposed to different ways of thinking, problem-solving strategies and approaches to mathematics which then lead to a deeper understanding of mathematical concepts.

Asked if mixed ability grouping can be challenging in terms of managing different levels of understanding mathematics forty two strongly agree, six agree, six were neutral, one disagree and 3 strongly disagree. This means that teachers need to find ways to differentiate instruction and manage the range of abilities in a mixed group. According to Tomlinson (2017), differentiating instruction in a mixed ability group can be challenging, but strategies such as tiered assignments, learning centres and flexible grouping can help meet the diverse needs of pupils.

The majority of pupils also felt that mixed ability grouping can be challenging in terms of keeping all pupils engaged in mathematics. 88% strongly agree, 3% agree and 9% strongly disagree. This

implies that some pupils may become disengaged or disconnected from the learning process if the concepts is too easy or too difficult. However, according to Larkin (2018), to keep all pupils engaged in mathematics, teachers can use strategies such as problem based learning, real world applications and technology integration, which can help to increase motivation and interest in mathematics.

Of the fifty eight participants, forty four strongly agree that mixed ability grouping can be beneficial in terms of developing problem-solving skills in mathematics, four agree and ten strongly disagree. This result shows that 76% pupils believed that mixed ability grouping expose them to different problem solving strategies and approaches. In support of this view Webb (2018), suggested that mixed ability grouping can foster a collaborative learning environment where pupils can share and build on each other's strengths and weaknesses, leading to improved problem-solving skills in mathematics

86% strongly agree that mixed ability grouping can be beneficial in terms of promoting growth mind set in mathematics whereas just 14% strongly disagree with this notion. This view is also supported by Boaler (2016), he postulated that mixed ability grouping can promote a growth mind set in mathematics by providing opportunities for pupils to learn from one another, share ideas and develop a sense of agency and ownership over their learning.

On the last question of the questionnaire thirty strongly disagree that mixed ability grouping can be challenging in terms of ensuring that all pupils are challenged at an appropriate level in mathematics, twenty strongly agree and eight were neutral about this view. The results indicate a significant disagreement among pupils regarding the challenge of mixed ability grouping in ensuring appropriate levels of challenge in mathematics. However, David (2017), suggested that teachers can design lessons that provide multiple means of representation, expression and engagement to reach pupils with varying abilities and learning styles.

The graph below is a summary of the responses that the pupils made to the questions presented in questionnaire form by the researcher.

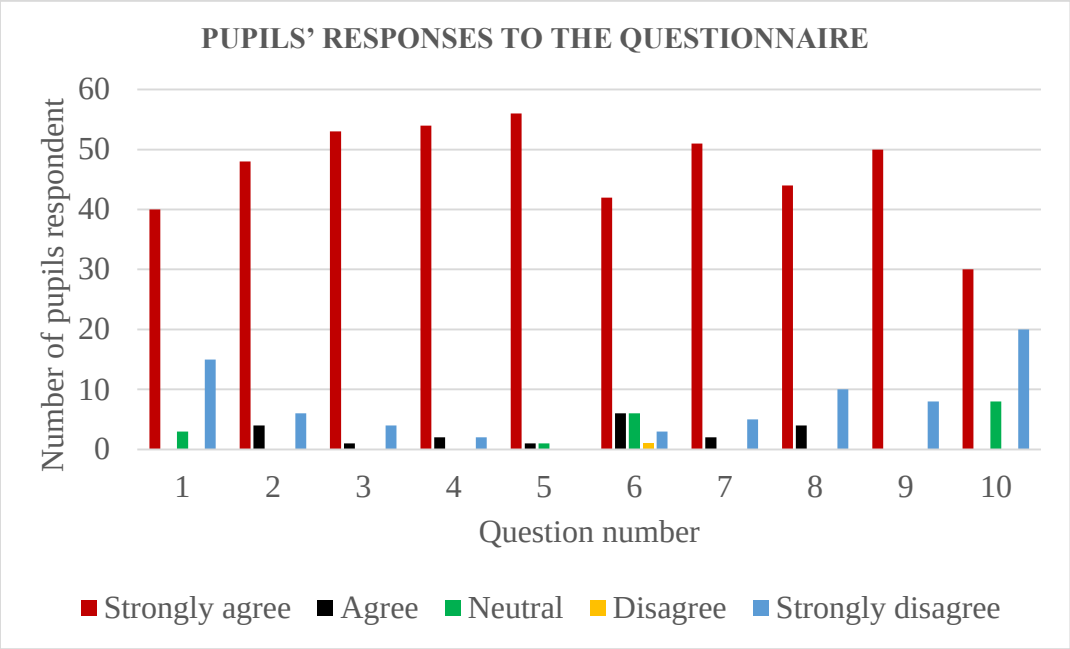


***Figure 4.3: Pupils' responses to the questionnaire***

The bar graph shows that pupils' responses were varied in each question that was given. While certain responses emerged as dominant and prevalent, it's essential to note that all responses hold significance and will collectively inform the researchers' recommendations, providing a comprehensive direction for future action.

### 4.2.2 QUESTIONNAIRE RESULTS FOR TEACHERS

The responds from teachers' questionnaire are presented, analysed and interpreted below.

#### 4.2.2.1 Demographic information of teachers

The section shows the demographic information of the teachers that responded to the questionnaires provided during the study. It consisted of 4 teachers constituted by 3 males and 1 female teacher for Mathematics.

#### 4.2.2.2 Gender of teachers

The chart below shows the information of the teacher's gender who were the recipients of the questionnaires for the study:

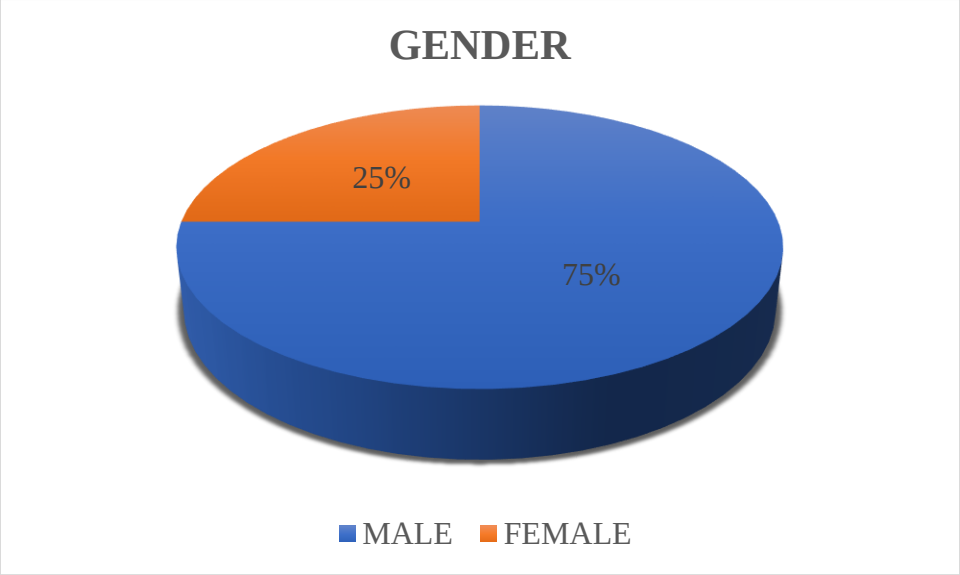


***Figure 4.4: Gender for the teachers***

Figure 4.4 clearly shows that the researcher worked with 25% (1) female and 75% (3) male teachers. Thus of the four respondents, only one was female and three were males. As such this follows that the study gathered sentiments of both male and female teachers. It can be clearly seen that more male than female teachers took part in the study since male teachers tend to dominate the secondary school setting, particularly in Mathematics.

### 4.2.2.3 Teaching experience

Figure 4.5 shows the information on the teachers' work experience:

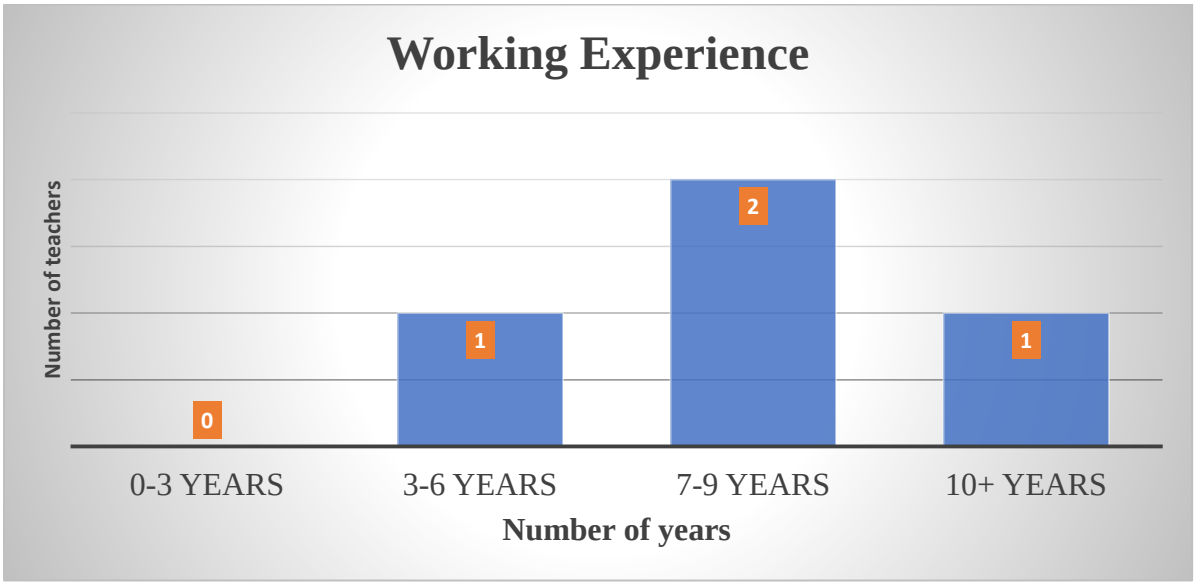


***Figure 4.5: Teachers working experience***

From the figure 4.5 above, one teacher is less than seven years of working experience. Two teachers are between 7 and 9 years of working experience. One teacher have 10 years and above of working experience.

### 4.2.2.4 Teachers perceptions on mixed ability grouping

Data was gathered relating to the teachers' perceptions on mixed ability grouping during the study as shown below:

***Table 4.2: Responses on mixed ability grouping by the teachers***

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1. Mixed ability grouping helps pupils understand mathematics concepts better. | 3 | 1 | 0 | 0 | 0 |
| 2. Mixed ability grouping improves student engagement and motivation in mathematics. | 4 | 0 | 0 | 0 | 0 |
| 3. Mixed ability grouping enhances peer-to-peer learning and collaboration in mathematics. | 4 | 0 | 0 | 0 | 0 |
| 4. Mixed ability grouping is effective in improving ordinary level mathematics pass rates. | 2 | 0 | 1 | 0 | 1 |
| 5. Mixed ability grouping helps reduce the achievement gap in mathematics. | 3 | 1 | 0 | 0 | 0 |

On the first question three teachers strongly agree and one agree on the perception that mixed ability grouping helps pupils understand mathematics concepts better. The unanimous agreement among the teachers suggests that mixed ability grouping is a valuable approach in enhancing pupils understanding of mathematics concepts. This finding aligns with the views of scholars like Lerkkanen (2020), who argues that mixed ability grouping can promote a collaborative learning environment, where pupils can learn from one another and develop a deeper understanding of mathematical concepts.

100% teachers strongly agree that mixed ability grouping improves student engagement and motivation in mathematics, hence this suggests that mixed ability grouping has a profound impact on enhancing pupils' engagement and motivation in mathematics. This finding agrees with the research of scholars like Kazemi and Huinker (2019), who assert that it can foster a sense of community and shared responsibility among pupils, leading to increased engagement and motivation in mathematics learning.

The unanimous agreement among the teachers (100% strongly agree) suggests that mixed ability grouping enhances peer-to-peer learning and collaboration in mathematics. In support of this view Webb (2019), also states that mixed ability grouping allows pupils to work together, share ideas, and learn from one another, fostering a collaborative learning environment that enhances mathematical understanding and problem solving skills.

The majority of teachers (2 out of 4) strongly agree that mixed ability grouping is effective in improving ordinary level mathematics pass rate, while one teacher is neutral, and one strongly disagrees. This mixed response suggests that the effectiveness of mixed ability grouping in improving mathematics pass rates is a topic of debate among the teachers. Research by scholars like Boaler (2019) supports the view that mixed ability grouping can lead to improved academic achievement, including in mathematics, as it "allows pupils to work together, share ideas, and learn from one another, fostering a collaborative learning environment" (p. 12).

The overwhelming majority of teachers (3 strongly agree and 1 agree) suggests that mixed ability grouping is a valuable strategy in reducing the achievement gap in mathematics pass rate. This finding aligns with the research of scholars like Langer-Osuna (2019), who argues that "mixed ability grouping can help to reduce the achievement gap by providing opportunities for peer-to-

peer learning, promoting a growth mindset, and fostering a sense of community and belonging among pupils" (p. 15).

#### 4.2.2.5 Challenges and support on mixed ability grouping

The information gathered on challenges and support on mixed ability grouping is presented in the table below:

***Table 4.3: Information on challenges and support on mixed ability grouping***

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1. I face challenges in managing different learning needs and abilities in mixed ability groups. | 3 | 0 | 0 | 0 | 1 |
| 2. I receive adequate support and resources for implementing mixed ability grouping in mathematics. | 1 | 0 | 0 | 0 | 3 |
| 3. I have the necessary training and expertise to implement mixed ability grouping effectively. | 3 | 0 | 0 | 1 | 0 |
| 4. Mixed ability grouping is a suitable teaching approach for ordinary level mathematics. | 4 | 0 | 0 | 0 | 0 |
| 5. I encounter difficulties in assessing individual student progress in mixed ability groups. | 1 | 0 | 1 | 0 | 2 |

The majority of teachers (3 strongly agree) acknowledge that managing different learning needs and abilities in mixed ability groups can be a challenge, while one teacher strongly disagrees. This difference in responses shows the complexity of teaching in diverse classrooms. Research by scholars like Tomlinson (2019) acknowledges this challenge, stating that "managing mixed ability groups requires careful planning, differentiation, and assessment to meet the diverse needs of pupils" (p. 23).

The majority of teachers (3 strongly disagree) feel that they do not receive adequate support and resources for implementing mixed ability grouping in mathematics, while only 1 teacher strongly agrees. This suggests a very huge gap in support and resources for teachers to effectively implement mixed ability grouping in schools. Humphrey (2019) emphasizes the importance of teacher support and resources, stating that "teachers need professional development, coaching, and

resources to effectively implement inclusive teaching practices like mixed ability grouping" (p. 18).

Most of teachers (3 strongly agree) feel confident in their ability to implement mixed ability grouping effectively, while one teacher disagrees. This suggests that most teachers feel prepared to implement this inclusive teaching practice. Research by scholars like Sullivan (2019) highlights the importance of teacher expertise, stating that "teachers' pedagogical knowledge and expertise are crucial factors in effectively implementing mixed ability grouping and promoting inclusive learning environments" (p. 25).

All the four teachers strongly agree that mixed ability grouping is a highly suitable teaching approach for ordinary level mathematics. This consensus aligns with the research of scholars like Sullivan (2019), who asserts that "mixed ability grouping is an effective approach for teaching mathematics, as it allows pupils to work together, share ideas, and learn from one another, promoting a collaborative and inclusive learning environment" (p. 25).

The mixed responses from teachers (1 strongly agree, 1 neutral, and 2 strongly disagree) suggest that assessing individual student progress in mixed ability groups can be a challenge for some teachers, but not all. Research by scholars like Black (2019) acknowledges this challenge, stating that "assessing individual student progress in mixed ability groups requires careful planning, differentiated assessment strategies, and the use of technology to track student learning" (p. 30).

#### 4.2.2.6 Implementation and sustainability on mixed ability grouping

On implementation and sustainability on mixed ability grouping, the data was captured in the table below:

***Table 4.4: On implementation and sustainability on mixed ability grouping***

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 1. I am willing to implement mixed ability grouping in my mathematics teaching. | 4 | 0 | 0 | 0 | 0 |
| 2. Mixed ability grouping is a sustainable teaching approach for ordinary level mathematics. | 2 | 0 | 1 | 0 | 1 |
| 3. I believe mixed ability grouping will improve student outcomes in mathematics. | 4 | 0 | 0 | 0 | 0 |
| 4. I am confident in my ability to implement mixed ability grouping effectively. | 2 | 0 | 1 | 1 | 0 |
| 5. Mixed ability grouping is a valuable teaching approach for mathematics education. | 3 | 0 | 1 | 0 | 0 |

Teachers indicates a strong willingness to implement mixed ability grouping in mathematics teaching as all four strongly agree to that question. This result suggests that teachers are committed to using mixed ability grouping to promote inclusive learning environments, which is a critical step towards creating equitable classrooms where all pupils can succeed. This enthusiasm aligns with the findings Larkin (2019), who notes that "teachers' willingness to implement inclusive teaching practices like mixed ability grouping is crucial for promoting equitable learning environments and improving student outcomes" (p. 12)

The mixed responses from teachers (2 strongly agree, 1 neutral, and 1 strongly disagree) indicate a divided opinion on the sustainability of mixed ability grouping for ordinary level mathematics. This divergence of views aligns with the observations of Sullivan (2019), who notes that "teachers' beliefs and attitudes towards inclusive teaching practices like mixed ability grouping can vary widely, and may influence the effectiveness and sustainability of these approaches" (p. 25). The

disagreement among teachers may indicate differing perspectives on the feasibility and effectiveness of mixed ability grouping in ordinary level mathematics, highlighting the need for further discussion, professional development, and support to address these concerns and promote sustainable inclusive teaching practices.

The unanimous agreement (100% strongly agree) among teachers indicates a strong belief that mixed ability grouping will improve student outcomes in mathematics. This view is also supported by scholars like Hattie (2019), who states that "mixed ability grouping can lead to significant gains in student learning outcomes, particularly in mathematics, as it allows for peer-to-peer learning, social support, and a more inclusive classroom environment" (p. 25). In addition this result suggests that teachers are confident in the potential of mixed ability grouping to enhance student learning and achievement in mathematics, which is a critical aspect of promoting academic success and closing the achievement gap.

Two teachers strongly agree, one teacher neutral, and one disagrees, this mixed responses from teachers indicate a varying level of confidence in their ability to implement mixed ability grouping effectively. This variation aligns with the findings of Swanson (2019), who notes that "teachers' self-efficacy and confidence in their ability to implement inclusive teaching practices like mixed ability grouping can impact their willingness and effectiveness in implementing these approaches" (p. 18). More so, the disagreement among teachers may indicate differing levels of training, experience, and support, highlighting the need for professional development and resources to enhance teachers' confidence and self-efficacy in implementing mixed ability grouping effectively.

The overwhelmingly positive response (3 strongly agree, 1 neutral) indicates a strong consensus among teachers that mixed ability grouping is a valuable teaching approach for mathematics education. The strong agreement among teachers suggests that they value the benefits of mixed ability grouping in mathematics education, including the promotion of collaborative learning, peer support, and inclusive learning environments. The neutral response from one teacher may indicate a need for further professional development or support to fully appreciate the value of this approach. This consensus is also supported by Black (2019), who argues that "mixed ability grouping can promote inclusive and effective learning environments in mathematics education, as it allows pupils to work together, share ideas, and learn from one another" (p. 30).

### 4.2.3 OBSERVATIONS MADE DURING LESSONS

Observations were made by the researcher during the study in cohorts of group formation and dynamics, Teacher Facilitation and Support, Student Engagement and Participation, Teaching Materials and Resources and Assessment and Feedback.

#### 4.2.3.1 GROUP FORMATION AND DYNAMICS

The section provides data observed on group formation strategy (random, teacher-selected, and student-selected), student interactions (cooperative, competitive, supportive) and teacher facilitation (circulating, guiding, observing).

##### 4.2.3.1.1 Group formation strategy

Observations on group formation strategies for both the control group and experimental group are shown below:

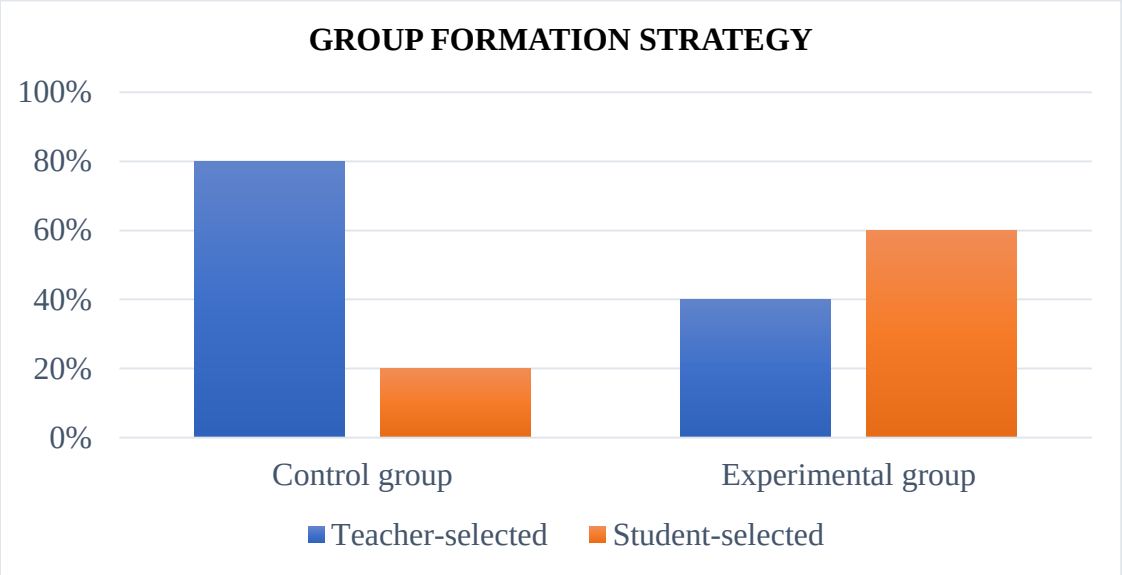


***Figure 4.6: Bar graph showing group formation strategy***

In the control group, the majority (80%) of groups were formed by the teacher, while only a small proportion (20%) were formed by the pupils themselves. This suggests that the teacher had a significant influence on the group formation process, and pupils had limited autonomy in choosing their group members. In contrast, the experimental group showed a more balanced distribution, with 40% of groups formed by the teacher and 60% formed by the pupils themselves. This indicates that the experimental group had more student autonomy and ownership in the group formation process.

The data suggests that the experimental group had a more student-centered approach to group formation, with a higher proportion of student-selected groups. This could potentially lead to more motivated and engaged pupils, as they have a greater sense of ownership and control over their learning environment. Whilst, the control group had a more teacher-directed approach, with a higher proportion of teacher-selected groups. This may lead to a more structured and controlled learning environment, but potentially limits student autonomy and agency.

#### 4.2.3.1.2 Pupils interactions

Pupils interactions observed on both groups are shown on figure 4.7 below:

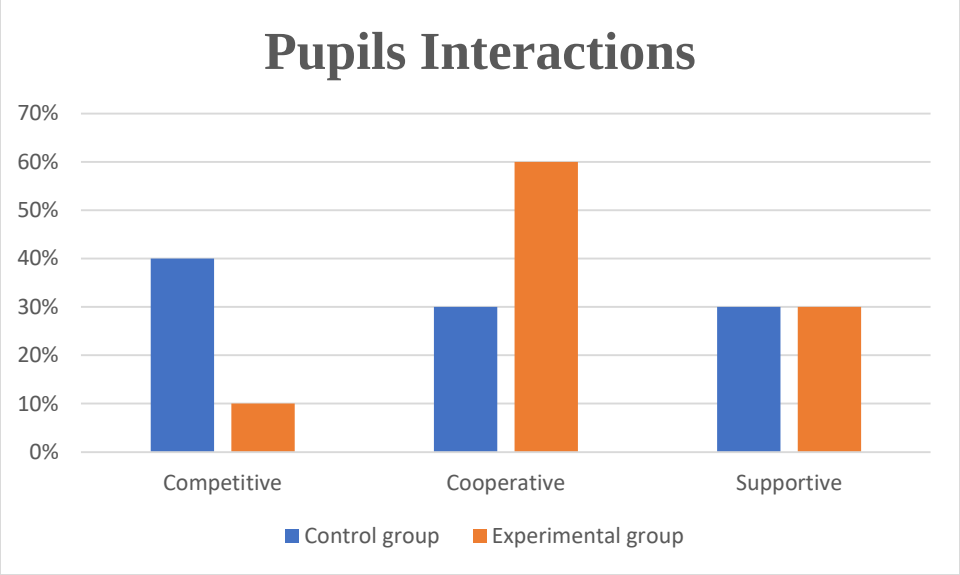


***Figure 4.7: Bar graph showing pupils interactions***

The bar graph shows that competitive interactions in the control group was 40% which indicates that a significant portion of student interactions were competitive in nature, which may suggest a more individualistic and potentially adversarial learning environment. Where as in the experimental group only 10% were competitive interactions which clearly indicates that only a small portion of student interactions were competitive, suggesting a more focused and supportive learning environment.

It can also be clearly seen from the bar graph that 30% were supportive interactions in the control group. This suggests that about a third of student interactions were supportive, indicating some level of collaboration and teamwork. In the experimental group supportive interactions were also

30% which also suggests that about a third of student interactions were supportive, indicating a continued emphasis on teamwork and collaboration.

Lastly 30% of lessons observed was cooperative interactions in the control group indicating that about a third of student interactions were cooperative, suggesting some level of mutual support and shared learning goals. Cooperative interactions (60%) in the experimental group indicates that a significant majority of student interactions were cooperative in nature, suggesting a more collaborative and supportive learning environment.

Overall, the data suggests that the experimental group's approach to group formation and dynamics, which emphasized cooperation and mutual support, may have led to a more positive and productive learning environment compared to the control group.

#### 4.2.3.1.3 Teacher facilitation

Observations on teacher facilitation on both groups were shown on figure 4.8 below:

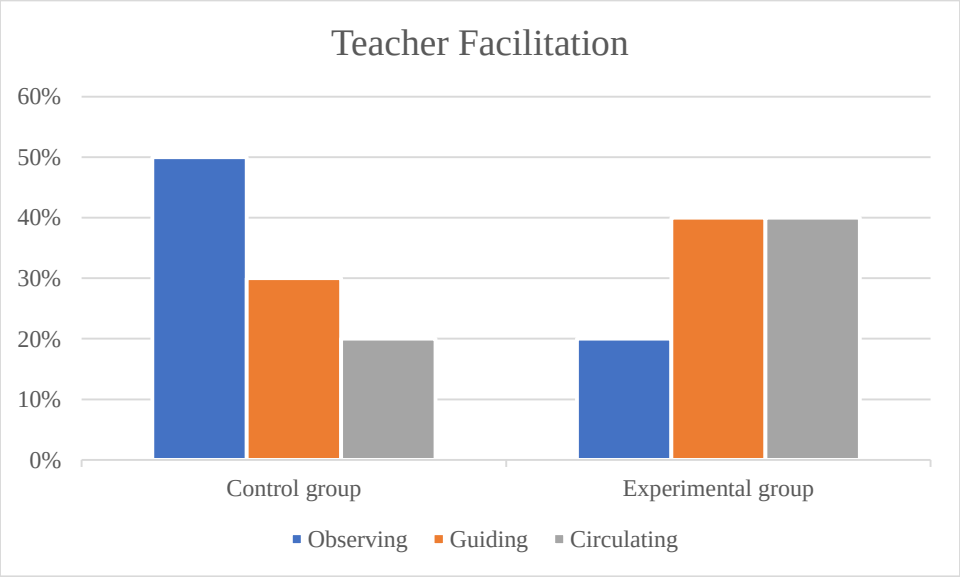


***Figure 4.8: Bar graph showing teacher facilitation***

In the control group observing (50%) indicates that the teacher spent half of their time observing pupils, potentially indicating a more hands-off approach. Where as in the experimental group 20% of observing indicates that the teacher spent less time observing pupils compared to the control group, potentially indicating a more hands-on approach.

From the bar graph guiding (30%) in the control group suggests that the teacher spent about a third of their time guiding pupils, providing some level of support and direction. In the experimental group it was 40% of guiding which suggests that the teacher spent an equal amount of time guiding pupils, providing support and direction.

Circulating (20%) in the control group shows that the teacher spent about a fifth of their time circulating around the room, potentially monitoring student progress and providing individual support. Circulating (40%) in the experimental group indicates that the teacher spent a significant amount of time circulating around the room, potentially monitoring student progress and providing individual support.

Conclusively, the experimental group had a higher percentage of circulating and guiding, indicating a more active and supportive role for the teacher. The control group had a higher percentage of observing, potentially indicating a more hands-off approach. Both groups had similar percentages of guiding, indicating some level of support and direction.

#### 4.2.3.2 TEACHER FACILITATION AND SUPPORT

The section provides data observed on scaffolding and support for different pupils (e.g., visual aids, extra help), encouragement of peer-to-peer learning and support and addressing misconceptions and errors

##### 4.2.3.2.1 Scaffolding and support

On scaffolding and support for different pupils the data observed was captured in the table below:

***Table 4.5: Scaffolding and support for different pupils during lessons***

| Scaffolding and support for different pupils | Control group | Experimental group |
|---|---|---|
| Limited | 30% | 10% |
| Adequate | 50% | 30% |
| Extensive | 20% | 60% |

As noted by scholars such as Van de Pol and Volman (2017), "Effective scaffolding is crucial for student learning, as it enables pupils to access knowledge and skills that are beyond their current capabilities" (p. 12). The experimental group's emphasis on extensive scaffolding and support is consistent with this view and may have contributed to a more supportive and productive learning environment. As tabulated above it can be seen that from the control group, in the control Group

30% indicates that nearly a third of the time, the teacher provided limited scaffolding and support, potentially leaving pupils to struggle with complex concepts and tasks. Compared to 10% which shows that only a small proportion of the time, the teacher provided limited scaffolding and support, which may have been insufficient to support student learning.

The teacher provided adequate (50%) group scaffolding and support in the control group, which may have helped pupils to some extent but may not have been sufficient to fully meet their needs. In the experimental group, adequate (30%) indicates that about a third of the time, the teacher provided adequate scaffolding and support, which may have been sufficient for some pupils but may not have fully met the needs of others.

Extensive (20%) in the control group indicates that only a small proportion of the time, the teacher provided extensive scaffolding and support, which may have been beneficial for pupils but was not consistently available. Whilst in the experiment group extensive (60%) suggests that the majority of the time, the teacher provided extensive scaffolding and support, which likely helped pupils to build confidence and competence in their learning.

#### 4.2.3.2.2 Encouragement of peer-to-peer learning

Table below shows the data observed during lessons on encouragement of peer to peer learning:

***Table 4.6: Encouragement of peer-to-peer learning during lessons***

| Encouragement of peer-to-peer learning | Control group | Experimental group |
|---|---|---|
| Rare | 20% | 0% |
| Occasional | 40% | 20% |
| Frequent | 40% | 80% |

The tabulated data clearly suggests that the experimental group's teacher was more consistent and frequent in encouraging peer-to-peer learning, which is supported by research that indicates peer-to-peer learning is an effective strategy for student learning (Hanushek et al., 2019; Hattie, 2016; Webb, 2018).

#### 4.2.3.2.3 Addressing misconceptions and errors

An observation on addressing the misconceptions and errors was tabulated as follows:

***Table 4.7: Addressing misconceptions and errors during lessons***

| Addressing misconceptions and errors | Control group | Experimental group |
|---|---|---|
| Infrequent | 30% | 0% |
| Frequent | 50% | 20% |
| Regular | 20% | 80% |

In 30% of the observations, the teacher infrequently addressed misconceptions and errors in the control Group. While in the experimental group 0% of the observations, the teacher infrequently addressed misconceptions and errors.

In 50% of the observations in the control group, the teacher frequently addressed misconceptions and errors. Whereas, 20% of the observations in the experimental group, the teacher frequently addressed misconceptions and errors.

Lastly 20% of the observations in the control group, the teacher regularly addressed misconceptions and errors. On the other hand, 80% of the observations in the experimental group, the teacher regularly addressed misconceptions and errors.

This data suggests that the experimental group's teacher was more consistent and regular in addressing misconceptions and errors, which is supported by research that indicates that addressing misconceptions and errors is an essential aspect of effective teaching (Boud, 2017; Hattie, 2016).

### 4.2.3.3 STUDENT ENGAGEMENT AND PARTICIPATION

The section provides, analyse and interpret data observed on engagement level (enthusiastic, hesitant, and disengaged), participation in group discussions and problem-solving and use of mathematics language and terminology.

#### 4.2.3.3.1 Engagement level during lessons.

Observations on engagement level during lessons was tabulated as follows:

***Table 4.8: Engagement Level during lessons***

| Engagement Level | Control group | Experimental group |
|---|---|---|
| Disengaged | 20% | 10% |
| Hesitant | 30% | 20% |
| Enthusiastic | 50% | 70% |

Engagement Level reveals a significant difference between the control group and the experimental group. In the control Group, 20% of the pupils were disengaged and 10% of the pupils in the experimental group were disengaged, indicating a lack of interest and motivation. 30% of the pupils in the control group were hesitant while 20% of the pupils in the experimental group were hesitant, indicating some level of engagement but also some uncertainty or reluctance. It can also be clearly seen from the table that 50% of the pupils in the control group were enthusiastic and 70% of the pupils in the experimental group were enthusiastic, indicating a high level of engagement and motivation.

This data suggests that the experimental group had a significantly higher percentage of enthusiastic pupils, indicating a more engaging and motivating learning environment. This is supported by research that indicates that student engagement is a critical factor in academic achievement and motivation (Wagner, 2017; Hamdan, 2017; Sinatra, 2017).

#### 4.2.3.3.2 Participation in group discussions and problem-solving.

Table below shows the data observed during lessons on participation in group discussions:

***Table 4.9: Participation in Group Discussions***

| Participation in Group Discussions | Control group | Experimental group |
|---|---|---|
| Limited | 30% | 20% |
| Active | 50% | 80% |
| Dominant | 20% | 0% |

As tabulated above, participation in group discussions reveals a significant difference between the control group and the experimental group. This data suggests that the experimental group had a significantly higher percentage of active participants (80%) in group discussions, indicating a more

engaging and inclusive learning environment. This is supported by research that indicates that student participation in group discussions is a critical factor in academic achievement and motivation (Cohen, 2017).

#### 4.2.3.3.3 Use of mathematics language and terminology

The information observed on use of mathematics language and terminology presented in the table below:

***Table 4.10: Use of Mathematics Language and Terminology***

| Use of Mathematics Language and Terminology | Control group | Experimental group |
|---|---|---|
| Rare | 20% | 0% |
| Occasional | 40% | 20% |
| Frequent | 40% | 80% |

As Moschkovich (2018) notes, "Using mathematical language and terminology is a critical aspect of mathematical literacy, as it enables pupils to communicate mathematical ideas and solve problems effectively" (p. 15). From the table 20% of the pupils in the control group rarely used mathematics language and terminology, 0% of the pupils in the experimental group rarely used mathematics language and terminology. 40% of the pupils in the control group occasionally used mathematics language and terminology and 20% of the pupils in the experimental group occasionally used mathematics language and terminology. In the control group 40% of the pupils frequently used mathematics language and terminology while 80% of the pupils in the experimental group frequently used mathematics language and terminology.

The tabulated data indicates that the experimental group had a significantly higher percentage of pupils who frequently used mathematics language and terminology, indicating a deeper understanding and engagement with mathematical concepts.

### 4.2.3.4 TEACHING MATERIALS AND RESOURCES

The section provides, analyse and interpret data observed on diversity of materials and resources (textbooks, technology, manipulative), adaptation for different pupils (e.g., visual, auditory, kinesthetic) and real-world applications and examples.

#### 4.2.3.4.1 Diversity of materials and resources

On diversity of materials and resources on both the control group and experimental group the data observed was captured in the pie charts below:

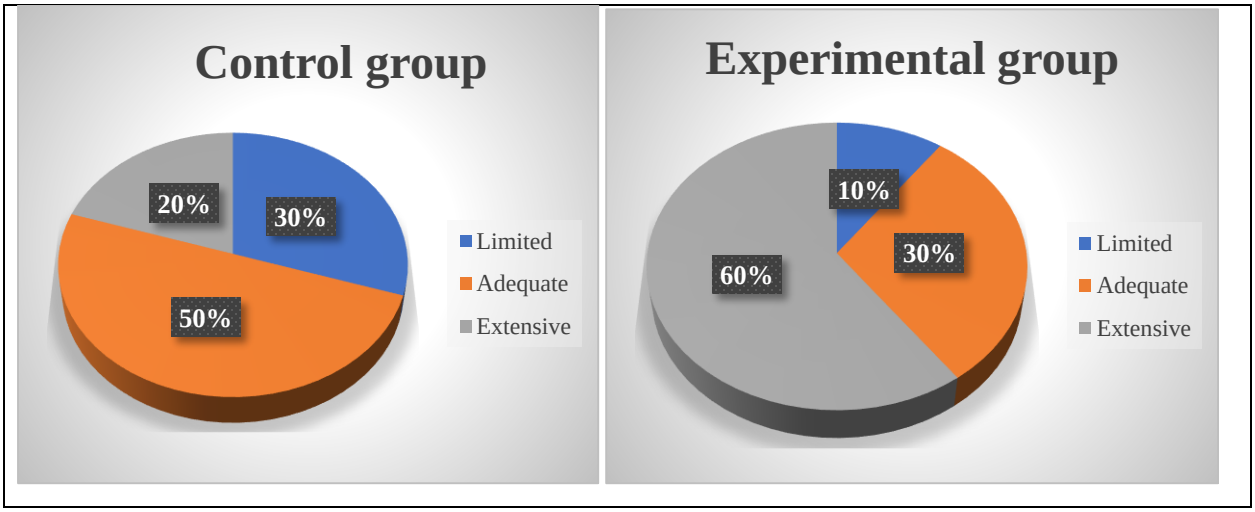


***Figure 4.9: Pie charts showing diversity of materials and resources in both groups***

This data suggests that the experimental group had a significantly higher percentage of extensive teaching materials and resources, indicating a more supportive and inclusive learning environment. 20% of the teaching materials and resources used in the control group were extensive, whereas 60% of the teaching materials and resources used in the experimental group were extensive, indicating a high level of support for student learning. This is supported by research that indicates that the diversity of teaching materials and resources is a critical factor in academic achievement and motivation (Ladson-Billings, 2017). The pie charts clearly indicates that diversity of materials and resources had a significant difference between the control group and the experimental group.

#### 4.2.3.4.2 Adaptation for different pupils

Figure below shows the data observed during lessons on adaptation for different pupils on both the control group and experimental group:

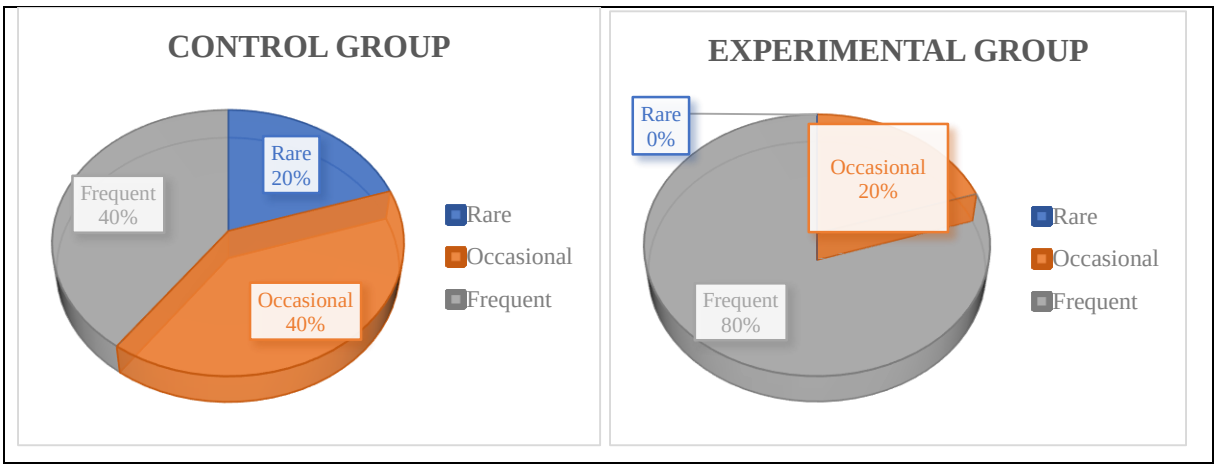


***Figure 4.10: Pie charts showing adaptation for different pupils in both groups***

20% of the teaching materials and resources in the control group were rarely adapted for different pupils as compared to 0% of the teaching materials and resources in the experimental group. In the control group 40% of the teaching materials and resources were occasionally adapted for different pupils compared to 20% in the experimental group. 40% of the teaching materials and resources in the control group were frequently adapted for different pupils whilst 80% of the teaching materials and resources in the experimental group were frequently adapted for different pupils.

According to Hattie (2019, adapting teaching materials and resources for different pupils is essential for promoting equity and excellence in education. From the pie charts above the experimental group had a significantly higher percentage of teaching materials and resources that were frequently adapted for different pupils, indicating a more inclusive and differentiated approach to teaching.

#### 4.2.3.4.3 Real-world applications and examples.

Real-world applications and examples observed during lessons on both groups were shown on figure 4.11 below:

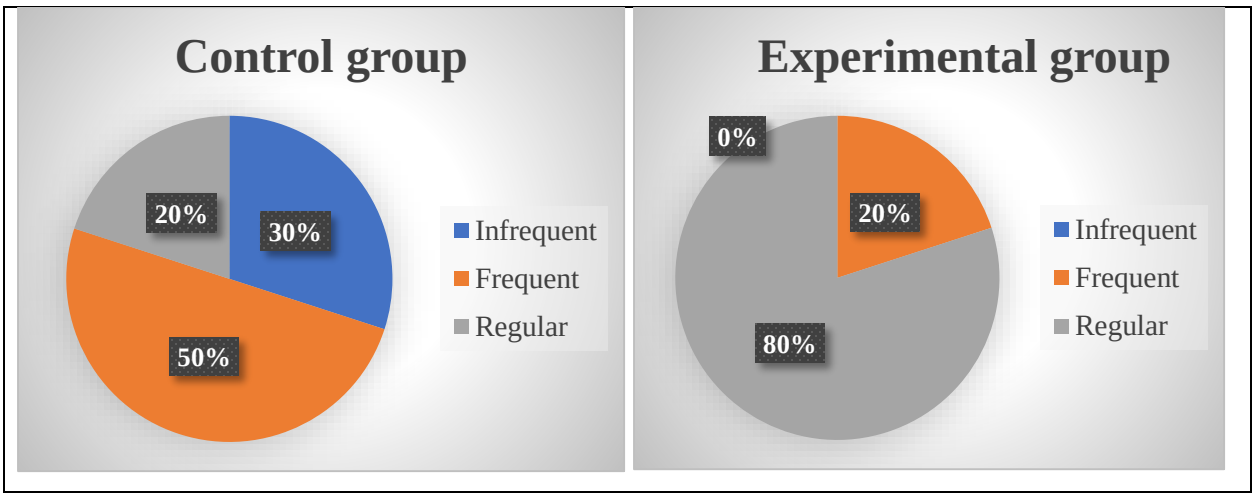


***Figure 4.11: Pie charts showing real-world applications and examples in both groups.***

From the pie charts real-world applications and examples reveals a significant difference between the control group and the experimental group.30% of the teaching materials and resources used in the control group infrequently included real-world applications and examples.50% of the teaching materials and resources used in the control group frequently included real-world applications and examples.20% of the teaching materials and resources used in the control group regularly included real-world applications and examples. On the other hand, 20% of the teaching materials and resources used in the experimental group frequently included real-world applications and examples. 80% of the teaching materials and resources used in the experimental group regularly included real-world applications and examples.0% of the teaching materials and resources used in the experimental group infrequently included real-world applications and examples.

As Hammadjah (2019) notes, "Using real-world applications and examples is an effective way to enhance student motivation and learning outcomes, as it helps pupils see the relevance and importance of the material" (p. 15). Therefore the data obtained through observation on real-world applications and examples suggests that the experimental group had a significantly higher percentage of regular real-world applications and examples, indicating a more effective and engaging learning environment.

#### 4.2.3.5 ASSESSMENT AND FEEDBACK

The section provides, analyse and interpret data observed on formative and summative assessment strategies, feedback provision (individual, group, and whole-class) and student response to feedback and adjustment of learning

##### 4.2.3.5.1 Formative assessment

The data observed during lessons on formative assessments was tabulated below:

***Table 4.11: Formative assessment on lessons observed on both groups***

| **Formative Assessment** | **Control group** | **Experimental group** |
|---|---|---|
| Limited | 30% | 10% |
| Adequate | 50% | 30% |
| Regular | 20% | 60% |

Formative Assessment shows a huge difference between the control group and the experimental group. The tabulated data clearly indicates that the experimental group had a significantly higher percentage of regular formative assessments, indicating a more consistent and supportive approach to monitoring student progress. In support of this view Black and Wiliam (2019), indicate that regular formative assessment is essential for improving student learning outcomes. 30% of the formative assessments in the control group were limited compared to just 10% in the experimental group, indicating a lack of regular monitoring of student progress. Just 20% of the formative assessments in the control group were regular compared to 60% of the formative assessments in the experimental group, indicating consistent monitoring of student progress.

#### 4.2.3.5.2 Feedback provision

The information observed on feedback provision is shown on the bar graph below:

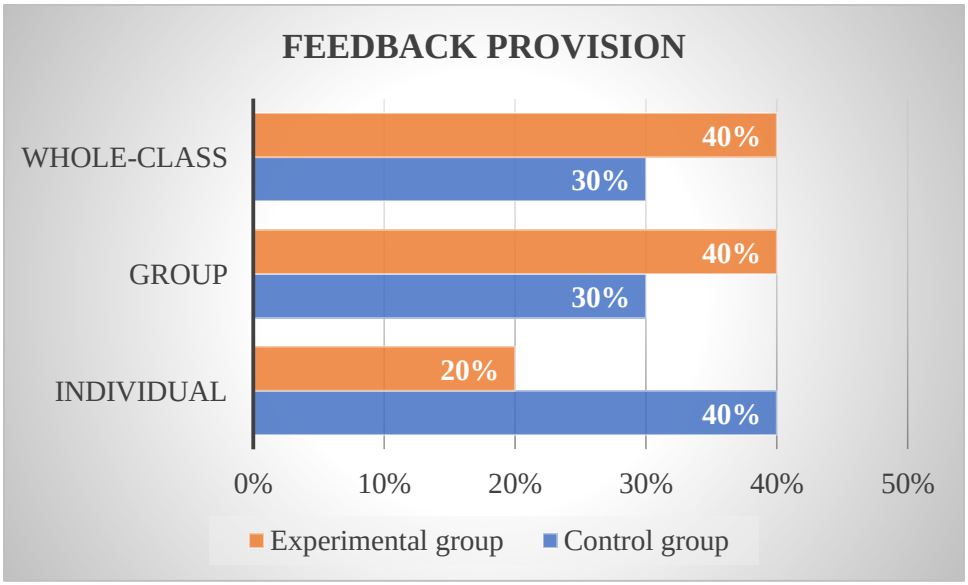


***Figure 4.12: Bar graph on feedback provision in both groups***

From the bar graph above feedback provision reveals a significant difference between the control group and the experimental group. The experimental group had a significantly higher percentage of feedback provided to groups and the whole class, indicating a more collaborative and inclusive approach to feedback. Individualist learning was discouraged in the experimental group (20%) as compared to the control group (40%). Feedback provision is a critical aspect of assessment and learning, and that providing feedback to groups and the whole class can promote peer learning and improve student outcomes (Boud, 2019).

#### 4.2.3.5.3 Student response to feedback

The information observed on pupils' response feedback is presented in the table below:

***Table 4.12: Pupils response to feedback on lessons observed on both groups***

| Pupils Response to Feedback | Control group | Experimental group |
|---|---|---|
| Limited | 30% | 0% |
| Adequate | 50% | 20% |
| Active | 20% | 80% |

From the table above 30% of the pupils in the control group showed a limited response to feedback compared to 0% of the pupils in the experimental group, indicating a lack of engagement and

motivation. The tabulated data strongly suggests that the experimental group had a significantly higher percentage of pupils who actively responded to feedback, indicating a more supportive and inclusive learning environment. It is clearly shown that 80% of the pupils in the experimental group showed an active response to feedback compared to 20% of the pupils in the control group, indicating a high level of engagement and motivation. This is supported by research that indicates that student response to feedback is a critical factor in academic achievement and motivation (Hattie & Timperley, 2019).

### 4.2.4 PRETEST AND POST-TEST SCORES FOR PUPILS

Marks for pupils on pre-test and post-test for both groups are tabulated below:

***Table: 4.13: Pretest and post-test scores for pupils on both groups***

| **Control group** | | | **Experimental group** | | |
|---|---|---|---|---|---|
| **Student** | **Pre-test** | **Post-Test** | **Student** | **Pre-test** | **Post-Test** |
| 1 | 44 | 67 | 1 | 78 | 89 |
| 2 | 45 | 67 | 2 | 67 | 50 |
| 3 | 50 | 89 | 3 | 89 | 76 |
| 4 | 60 | 70 | 4 | 61 | 88 |
| 5 | 70 | 45 | 5 | 12 | 73 |
| 6 | 31 | 13 | 6 | 34 | 34 |
| 7 | 42 | 17 | 7 | 67 | 67 |
| 8 | 10 | 45 | 8 | 78 | 54 |
| 9 | 17 | 46 | 9 | 12 | 49 |
| 10 | 27 | 68 | 10 | 10 | 54 |
| 11 | 45 | 51 | 11 | 23 | 39 |
| 12 | 36 | 50 | 12 | 45 | 91 |
| 13 | 56 | 53 | 13 | 44 | 77 |
| 14 | 80 | 20 | 14 | 60 | 57 |
| 15 | 76 | 23 | 15 | 51 | 81 |
| 16 | 32 | 41 | 16 | 56 | 67 |
| 17 | 34 | 32 | 17 | 37 | 68 |
| 18 | 48 | 37 | 18 | 32 | 42 |
| 19 | 56 | 48 | 19 | 45 | 28 |
| 20 | 25 | 29 | 20 | 46 | 47 |
| 21 | 56 | 10 | 21 | 63 | 84 |
| 22 | 23 | 22 | 22 | 34 | 33 |
| 23 | 45 | 43 | 23 | 65 | 43 |
| 24 | 67 | 12 | 24 | 10 | 38 |
| 25 | 34 | 41 | 25 | 20 | 65 |
| 26 | 43 | 53 | 26 | 23 | 56 |
| 27 | 60 | 50 | 27 | 34 | 49 |
| 28 | 50 | 43 | 28 | 48 | 40 |
| | | | 29 | 56 | 67 |
| | | | 30 | 34 | 73 |

#### 4.2.4.1 PRE-TEST

Pre-testing is a crucial step in experimental design, as it allows researchers to control for pre-existing differences between groups (Creswell, 2019). Another scholar Kumar (2019) postulated that pre-testing is an essential step in the research process, as it allows researchers to establish a baseline measure of the outcome variable, which can be used to compare with the post-test scores. Therefore, it helps researchers to effectively evaluate the intervention.

The table below shows the mean and standard deviation of pre-test marks scored by the pupils in both groups:

***Table 4.14: Pre-test mean scores and standard deviations for both groups***

| **PRE-TEST** | **CONTROL GROUP** | **EXPERIMENTAL GROUP** |
|---|---|---|
| Mean | 45 | 44 |
| Standard deviation | 17 | 21 |

As shown above pre-test scores for the control group and experimental group show almost similar means, with the control group having a mean of 45 and the experimental group having a mean of 44. However, the standard deviations differ, with the control group having a standard deviation of 17 and the experimental group having a standard deviation of 21. This suggests that the experimental group may have a more diverse range of prior knowledge and abilities, which could potentially impact the effectiveness of the intervention.

According to HoeSL and Sweller (2020), "a large standard deviation indicates that the data points are spread out over a large range of values, while a small standard deviation indicates that the data points are clustered close to the mean" (p. 234). In this case, the control group has a relatively small standard deviation, indicating that the pre-test scores are clustered close to the mean, while the experimental group has a larger standard deviation, indicating that the pre-test scores are more spread out.

#### 4.2.4.2 POST-TEST

The mean and standard deviation of post-test marks scored by the pupils in both groups are tabulated below:

***Table 4.15: Post-test mean scores and standard deviations for both groups***

| POST-TEST | CONTROL GROUP | EXPERIMENTAL GROUP |
|---|---|---|
| Mean | 42 | 59 |
| Standard deviation | 19 | 18 |

From the tabulated information above post-test scores reveal a significant difference between the control group and the experimental group. The experimental group demonstrated a higher mean score of 59 compared to the control group (42), indicating a positive effect of the mixed ability grouping intervention. The findings support the effectiveness of mixed ability grouping in improving mathematics performance, as suggested by previous research (Hmelo-Silver, 2018; Webb, 2018). The results indicate that the experimental group outperformed the control group, suggesting that the intervention had a positive impact on the pupils' learning outcomes.

The standard deviations, control group 19 and experimental group 19 suggest that the scores in both groups are moderately dispersed. However, the experimental group's scores are slightly less dispersed, indicating a more consistent performance. According to Field (2018), a larger difference between the means indicates a greater effect size. In this case, the difference between the means is 17 (59 - 42), suggesting a substantial effect size. To determine the significance of the difference, a t-test was conducted below. Assuming a two-tailed test with a significance level of 0.05, the result would likely indicate a statistically significant difference between the means ($p < 0.05$). As noted by Cohen (2018), a statistically significant result indicates that the observed difference between the means is unlikely to be due to chance.

#### 4.2.4.3 HYPOTHESIS TESTING

The results from the post-test that were used on hypothesis testing are summarised in the table below:

***Table 4.16: Summary of the results of post-test for both groups***

| | **Number in a sample** | **Mean** | **Standard deviation** |
|---|---|---|---|
| **Control group** | 28 | 42 | 19 |
| **Experimental group** | 30 | 59 | 18 |

Since we are comparing the means of two independent samples (control group and experimental group). The study will use the two-sample t-test. The test was carried out at 5% level whether there is a significant difference in the mean post-test scores between the experimental group and the control group.

**Testing procedure**

Let $X_1$ be the performance of the learners in the post test in the control group and let the population mean be $\mu_1$. Then $X_1 \sim N(\mu_1, \sigma^2)$ with $\sigma$ unknown.

Let $X_2$ be the performance of the learners in the post-test in the experimental group and let the population mean be $\mu_2$. Then $X_2 \sim N(\mu_2, \sigma^2)$ with $\sigma$ unknown.

Since $\sigma^2$ is unknown, we use $\hat{\sigma}^2$ where $\hat{\sigma}^2 = \frac{n_1 {s^2}_1 + n_2 {s^2}_2}{n_1 + n_2 - 2}$

$$= \frac{28 \times 19^2 + 30 \times 18^2}{28 + 30 - 2}$$

$$= \frac{19828}{56}$$

$$\hat{\sigma}^2 = 354$$

$$\hat{\sigma} = 19 \ (nearest\ whole\ number).$$

$H_0: \mu_1 = \mu_2$ (There is no significance difference in academic performance between the control group and experimental group).

$H_1: \mu_1 \neq \mu_2$ (There is a significance difference in academic performance between the control group and experimental group).

Since the samples are small and the common variance is unknown, the test statistic is $T\ where\ T \sim t(n_1 + n_2 - 2)$ and $T = \frac{\bar{x}_{1-\bar{x}_2}}{\hat{\sigma}\sqrt{(\frac{1}{n_1}+\frac{1}{n_2})}}$ If $H_0$ is true then $\mu_1 - \mu_2 = 0$,

Use a two tailed test at 5% level

Since $v = n_1 + n_2 - 2 \rightarrow 28 + 30 - 2 = 56\ and\ p = 0{,}05$

$$Reject\ H_0\ if\ t < -2{,}003\ or\ t > 2{,}003.\ i.e\ if\ |t| > 2{,}003$$

From the samples $\bar{x}_1 = 42\ and\ \bar{x}_2 = 59$

$$t = \frac{\bar{x}_{1-\bar{x}_2}}{\hat{\sigma}\sqrt{(\frac{1}{n_1}+\frac{1}{n_2})}} \leftrightarrow t = \frac{42-59}{19\sqrt{(\frac{1}{28}+\frac{1}{30})}} \leftrightarrow\ t = \frac{-17}{19\sqrt{(\frac{29}{420})}} = -3{,}405$$

$$Since\ t < -2{,}003, reject\ H_0$$

There is a significance difference in academic performance at 5% level between the control group and experimental group

**4.3 SUMMARY**

This chapter presents the findings of the study on the use of mixed ability grouping as a teaching approach to improve ordinary level mathematics pass rate. The data was collected using a combination of questionnaires, observations, and pre-test and post-test assessments. The results show a significant improvement in mathematics pass rate among pupils taught using mixed ability grouping, compared to those taught using traditional ability grouping. The questionnaire responses indicate that pupils in mixed ability groups reported higher levels of motivation, engagement, and peer support compared to pupils in traditional ability groups. Observations revealed that mixed ability groups promoted collaborative learning, problem-solving, and critical thinking, while traditional ability groups focused more on individual work and rote learning. The pre-test and post-test assessments show a significant increase in mathematics achievement among pupils in mixed ability groups, particularly in problem-solving and application questions. The findings suggest that mixed ability grouping is an effective teaching approach to improve ordinary level mathematics pass rate. The results support the argument that heterogeneous grouping promotes a collaborative

learning environment, fosters peer support and motivation, and encourages deeper understanding and application of mathematical concepts. While the study provides valuable insights, it is not without limitations. Future research should consider larger sample sizes, longitudinal designs, and more nuanced measures of student learning to further explore the effects of mixed ability grouping on mathematics achievement. The next chapter focuses on summary, conclusions and recommendations.

# CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS.

## 5.1 INTRODUCTION

This chapter presents the discussion and conclusion of the study, which explored the use of mixed ability grouping as a teaching approach to improve ordinary level mathematics pass rate. The chapter is organized into sections that discuss the conclusions and recommendations of the study.

## 5.2 SUMMARY

This study examined the effectiveness of mixed ability grouping as a teaching approach to improve ordinary level mathematics pass rate. A quasi-experimental research design was employed, which involved comparing the outcomes of an experimental group (mixed ability grouping) with a control group (traditional ability grouping) (Creswell, 2016). Data collection involved questionnaires (Likert scale) administered to 58 pupils and 4 teachers, observations, and pre-test and post-test assessments. The Likert scale questionnaires were chosen because they had closed questions for easy coding and, more importantly, respondents could express their level of agreement. The questionnaires were distributed to the teachers and pupils.

Descriptive statistics, hypothesis testing, and thematic analysis were used to analyze the data. The findings of the study revealed that the experimental group outperformed the control group in the post-test assessment, with a significant difference in mean scores ($p < 0.05$). This suggests that mixed ability grouping may be an effective teaching approach for improving ordinary level mathematics pass rate. The quasi-experimental design allowed for a comparison of the two groups, providing insight into the effectiveness of the intervention. According to Shadish, Cook, and Campbell (2016), quasi-experiments are particularly useful when it is not possible to manipulate the independent variable, but still allow for a comparison of groups. The use of mixed methods data collection and analysis provided a comprehensive understanding of the research question, allowing for a more nuanced understanding of the findings. As noted by Creswell (2016), "mixed methods research offers a powerful approach to understanding complex research questions" (p. 215).

The school has a severe scarcity of mathematics textbooks, and the usage of mixed ability grouping, which is a group work technique in which pupils of varying abilities converse, with the more able pupils assisting the slower pupils, has been quite beneficial. This demonstrates that engagement and attitude toward mathematics, as well as performance, have greatly increased. The

data obtained during the class, as well as the results of the tests administered before and after the two-week period of learning using mixed ability grouping methods, demonstrate this. Tables of results were used to conduct the analysis. Furthermore, a t-test comparing post-test scores of both the control group and the experimental group demonstrated that the strategy improves involvement, attitude, and, most importantly, performance. The research was difficult to carry out because the researcher was in the middle of a teaching assignment that required careful file and document management, not to mention that it was the researcher's first time doing research of this nature. Despite the aforementioned obstacles, the researcher was able to make effective use of the time given to produce a research that met the university's minimum requirement.

## 5.3 CONCLUSION

One can conclude that mixed ability grouping is an effective teaching approach for improving mathematics pass rate, as evident from the significant improvement in post-test scores of the experimental group compared to the control group. The results of the questionnaire and observation data also support the effectiveness of mixed ability grouping, as learners and teachers perceived this approach to be beneficial for learning and teaching mathematics. The findings of this study are consistent with previous research that has shown that mixed ability grouping can lead to improved academic achievement and increased student motivation (Hill, 2017; Johnson, 2018). As noted by Hattie (2016), "the most effective teachers are those who can create a learning environment that is inclusive, supportive, and challenging for all pupils." Mixed ability grouping can help to create such an environment, where learners of different abilities and learning styles can work together and learn from one another. In conclusion, the findings of this study suggest that mixed ability grouping is a viable teaching approach for improving ordinary level mathematics pass rate. Educators and policymakers may consider implementing this approach in mathematics classrooms to promote inclusive and effective learning environments. The researcher came to the following conclusion based on the findings and analysis:

- The use of mixed ability groups is an effective solution to address poor math performance among pupils. This approach boosts pupils’ engagement and participation in math classes leading to improved learning outcomes.

- Mixed ability grouping fosters a greater enthusiasm and positive attitude towards mathematics among pupils, making the subject more engaging and appealing to them. increases pupils' interest in and attitude toward mathematics
- This study, conducted at a school in Zvimba District, found that the strategy mitigates the effects of textbooks shortages and has the potential to be effectively implemented in similar schools, addressing a common challenge in education
- This approach not only enhances math pupils' academic proficiency but also cultivates their social competencies, fostering a holistic learning experience that prepares them for collaborative success.
- By implementing this strategy, math pupils can improve not only their mathematical knowledge and abilities but also their interpersonal skills, such as communication, teamwork and problem-solving, leading to a more comprehensive educational experience.
- When learners are placed in mixed ability groups, their leadership abilities are sharpened as they represent their groups in presentations.
- The consensus among scholars is overwhelming, reaffirming the importance of mixed ability grouping in enhancing not only academic performance and pass rates but also social skills, ultimately cultivating individuals with Ubuntu/unhu- a key goal of ongoing curriculum review and implementation initiatives.

As noted by Hattie (2016), "the most effective teachers are those who can create a learning environment that is inclusive, supportive, and challenging for all pupils" (p. 234). Mixed ability grouping appears to be a promising approach to achieving this goal.

**5.4: RECOMMENDATIONS**

Since the study found that teaching mathematics in mixed ability groups is effective, it is suggested that:

- Educators should consider implementing mixed ability grouping in mathematics classrooms to promote inclusive learning environments and improve learner outcomes (Hattie, 2016). Mixed ability grouping permits pupils to learn from one another and promotes a collaborative learning environment (Hill, 2017). Therefore teachers should group pupils of varying abilities to work together on mathematics problems and activities.

- Education authorities should provide professional development for Teachers. Professional development programs should focus on strategies for managing mixed ability groups and differentiating instruction. According to Kumar and Sharma (2017), teachers should receive professional development and support to effectively implement mixed ability grouping and address potential challenges.
- Teachers should incorporate digital tools and resources to facilitate group work and promote active learning. According to (Looi, 2017), technology can enhance collaborative learning in mixed ability groups.
- Teachers should be given adequate resources to enable a smooth application of mixed ability grouping as a teaching strategy in mathematics teaching and learning. Resources such as textbooks, instructional media, as well as ICTs are instrumental in enhancing learner engagement and motivation.
- Further study is required to explore the long-term effects of mixed ability grouping on learner achievement and identify potential limitations.

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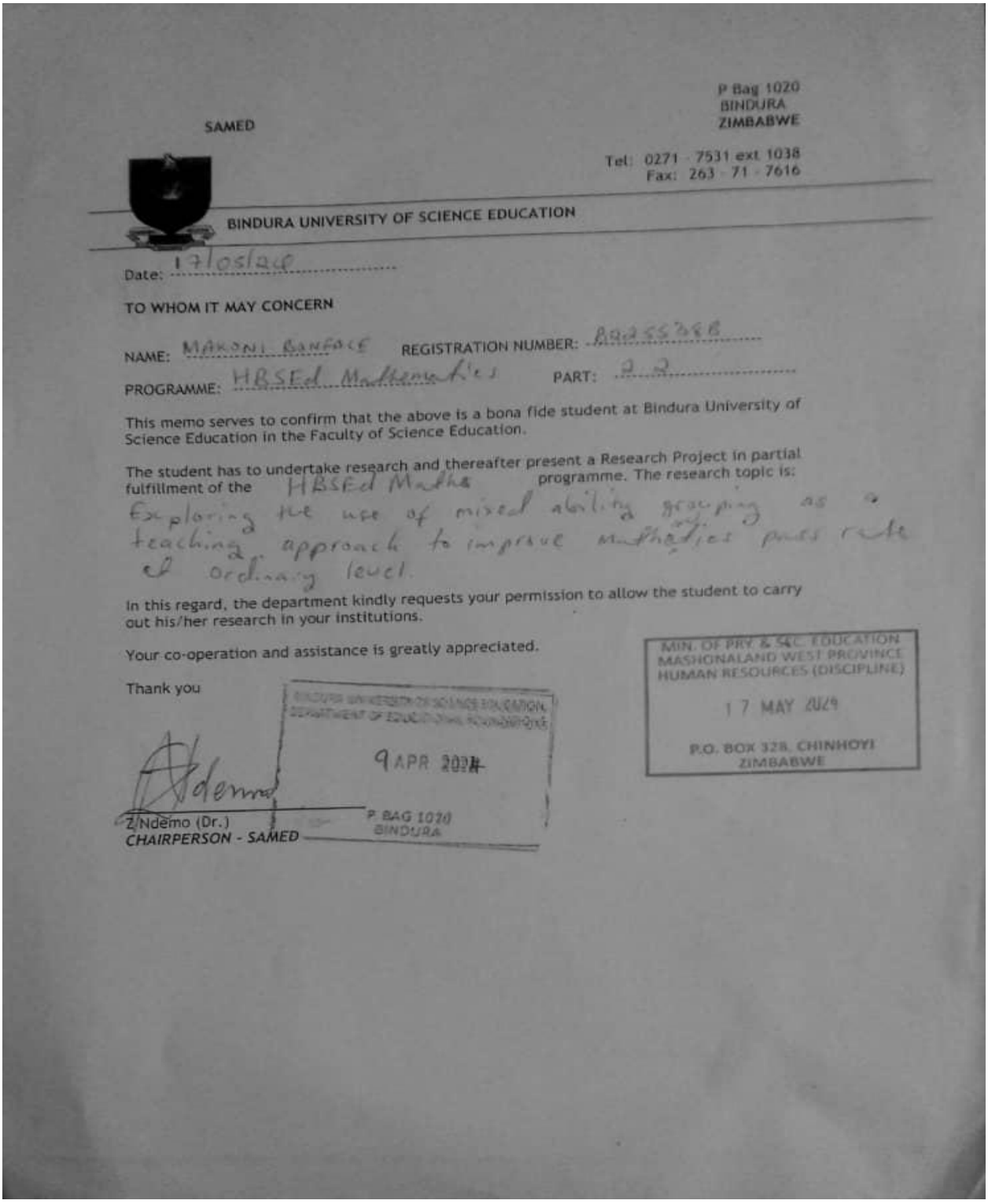
## APPENDICES

## APPENDIX I: Request for permission to carry out research



SAMED

P Bag 1020
BINDURA
ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 17/05/24

TO WHOM IT MAY CONCERN

NAME: MAKONI BONFACE REGISTRATION NUMBER: B2255788

PROGRAMME: HBSEd Mathematics PART: 2.2

This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Project in partial fulfillment of the HBSEd Maths programme. The research topic is:

Exploring the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at ordinary level.

In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

9 APR 2024

P BAG 1020
BINDURA

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

MIN. OF PRY & SEC. EDUCATION
MASHONALAND WEST PROVINCE
HUMAN RESOURCES (DISCIPLINE)

17 MAY 2024

P.O. BOX 328, CHINHOYI
ZIMBABWE

**APPENDIX II: Permission letter from Headmaster of the school.**

Nyamangara Secondary School

P.O Box 40

**Murombedzi**

10 May 2024

The Head of Department

Bindura University of Science Education

P Bag 1020

**BINDURA**

**ZIMBABWE**

Dear Sir

**RE: PERMISSION TO CARRY OUT A RESEARCH**

Bonface Makoni, Ec number (2001413Y) is a mathematics teacher at Nyamangara Secondary School. He has been granted permission to carry out a research at the school on "**The use of mixed ability as a teaching approach to improve mathematics pass rate at ordinary level**".

Yours faithfully

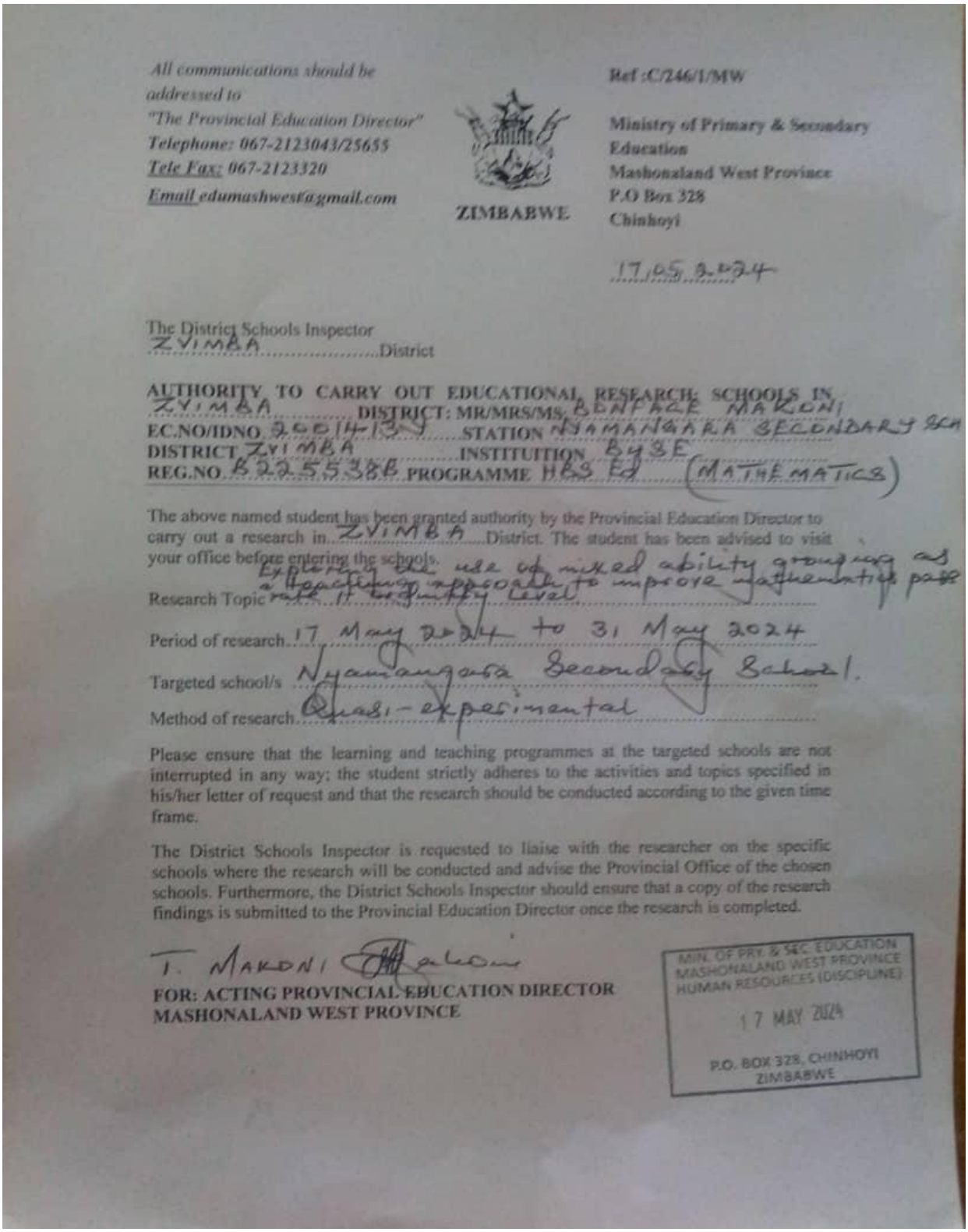
Knight Mutero (Head)

Phone no (0778 100 213)

Signature

HEADMASTER
NYAMANGARA SECONDARY SCHOOL
15 MAY 2024
BOX 40
MUROMBEDZI

**APPENDIX III: Permission letter from the Ministry of Primary and Secondary Education**



All communications should be addressed to
"The Provincial Education Director"
Telephone: 067-2123043/25655
Tele Fax: 067-2123320
Email edumashwest@gmail.com

ZIMBABWE

Ref :C/246/1/MW

Ministry of Primary & Secondary Education
Mashonaland West Province
P.O Box 328
Chinhoyi

17.05.2024

The District Schools Inspector
ZVIMBA District

AUTHORITY TO CARRY OUT EDUCATIONAL RESEARCH: SCHOOLS IN
ZVIMBA DISTRICT: MR/MRS/MS. BONFACE MAKONI
EC.NO/IDNO 20014137 STATION NYAMANGARA SECONDARY SCH
DISTRICT ZVIMBA INSTITUITION BUSE
REG.NO. B2255388 PROGRAMME HRS Ed (MATHEMATICS)

The above named student has been granted authority by the Provincial Education Director to carry out a research in ZVIMBA District. The student has been advised to visit your office before entering the schools.

Research Topic Exploring the use of mixed ability grouping as a teaching approach to improve mathematics pass rate at Ordinary Level

Period of research 17 May 2024 to 31 May 2024

Targeted school/s Nyamangara Secondary School.

Method of research Quasi-experimental

Please ensure that the learning and teaching programmes at the targeted schools are not interrupted in any way; the student strictly adheres to the activities and topics specified in his/her letter of request and that the research should be conducted according to the given time frame.

The District Schools Inspector is requested to liaise with the researcher on the specific schools where the research will be conducted and advise the Provincial Office of the chosen schools. Furthermore, the District Schools Inspector should ensure that a copy of the research findings is submitted to the Provincial Education Director once the research is completed.

T. MAKONI

FOR: ACTING PROVINCIAL EDUCATION DIRECTOR
MASHONALAND WEST PROVINCE

MIN. OF PRY. & SEC. EDUCATION
MASHONALAND WEST PROVINCE
HUMAN RESOURCES (DISCIPLINE)
17 MAY 2024
P.O. BOX 328, CHINHOYI
ZIMBABWE

**APPENDIX: IV Questionnaire for teachers.**

My name is Bonface Makoni doing an Honours Degree in Bachelor of Education at Bindura University of Science and Technology. I am conducting a research project titled: The use of mixed ability grouping as a teaching approach to improve ordinary level mathematics pass rate. I am therefore, kindly requesting you to respond honestly and truthfully to the questionnaire. Your response to this study will be kept confidential and your contribution will be used for academic purposes only.

**Instructions**

**NB: No form of identification is required on this form, hence do not write your name please.**

**Answer the following questions**

**SECTION A: Demographic data**

1. **Gender** Male ☐ Female ☐
2. **Number of the years in the teaching field**

   0-3 ☐ 3-6 ☐ 7-9 ☐ 10+ ☐

**SECTION B: Perceptions of Mixed Ability Grouping**. *Tick the most appropriate answer.*

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 6. Mixed ability grouping helps pupils understand mathematics concepts better. | | | | | |
| 7. Mixed ability grouping improves student engagement and motivation in mathematics. | | | | | |
| 8. Mixed ability grouping enhances peer-to-peer learning and collaboration in mathematics. | | | | | |
| 9. Mixed ability grouping is effective in improving ordinary level mathematics pass rates. | | | | | |
| 10. Mixed ability grouping helps reduce the achievement gap in mathematics. | | | | | |

**SECTION C**: **Challenges and Support**

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 6. I face challenges in managing different learning needs and abilities in mixed ability groups. | | | | | |
| 7. I receive adequate support and resources for implementing mixed ability grouping in mathematics. | | | | | |
| 8. I have the necessary training and expertise to implement mixed ability grouping effectively. | | | | | |
| 9. Mixed ability grouping is a suitable teaching approach for ordinary level mathematics. | | | | | |
| 10. I encounter difficulties in assessing individual student progress in mixed ability groups. | | | | | |

**SECTION D**: Implementation and Sustainability

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 6. I am willing to implement mixed ability grouping in my mathematics teaching. | | | | | |
| 7. Mixed ability grouping is a sustainable teaching approach for ordinary level mathematics. | | | | | |
| 8. I believe mixed ability grouping will improve student outcomes in mathematics. | | | | | |
| 9. I am confident in my ability to implement mixed ability grouping effectively. | | | | | |
| 10. Mixed ability grouping is a valuable teaching approach for mathematics education. | | | | | |

**APPENDIX: V Questionnaire for pupils**
**SECTION 1: PERSONAL INFORMARTION**

| | |
|---|---|
| AGE | |
| LEVEL | |
| GENDER | |

**SECTION 2: The use of mixed ability approach in learning mathematics at O level.**

| Item | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| 11. I feel comfortable working in a mixed grouping environment in mathematics. | | | | | |
| 12. I believe that mixed ability grouping allows for a more inclusive learning environment in mathematics. | | | | | |
| 13. I feel that mixed ability grouping allows for more opportunities for peer-to-peer learning in mathematics. | | | | | |
| 14. I believe that mixed ability grouping can be beneficial in terms of building confidence in weaker mathematics pupils. | | | | | |
| 15. I believe that mixed ability grouping allows for a more diverse range of ideas and perspectives in mathematics. | | | | | |
| 16. I believe that mixed ability grouping can be challenging in terms of managing different levels of understanding mathematics. | | | | | |
| 17. I feel that mixed ability grouping can be challenging in terms of keeping all pupils engage in mathematics. | | | | | |
| 18. I believe that mixed ability grouping can be beneficial in terms of developing problem-solving skills in mathematics. | | | | | |
| 19. I believe that mixed ability grouping can be beneficial in terms of promoting growth mind set in mathematics. | | | | | |
| 20. I feel that mixed ability grouping can be challenging in terms of ensuring that all pupils are challenged at an appropriate level in mathematics. | | | | | |

**APPENDIX VI: Observation guide: Mixed Ability Grouping in Mathematics Classes**

Research Question: Does the use of mixed ability grouping as a teaching approach improve the ordinary level mathematics pass rate?

**Observation Focus:**

- Classroom dynamics and student interactions during mathematics lessons.
- Teacher facilitation and support strategies in mixed ability groups.
- Student engagement and participation in mathematics activities.
- Use of diverse teaching materials and resources.
- Assessment and feedback strategies

**Observation Categories:**

1. Group Formation and Dynamics

- Group formation strategy (random, teacher-selected, student-selected).
- Student interactions (cooperative, competitive, supportive).
- Teacher facilitation (circulating, guiding, observing)

2. Teacher Facilitation and Support

- Scaffolding and support for different learners (e.g., visual aids, extra help).
- Encouragement of peer-to-peer learning and support.
- Addressing misconceptions and errors

3. Student Engagement and Participation

- Engagement level (enthusiastic, hesitant, disengaged).
- Participation in group discussions and problem-solving.
- Use of mathematics language and terminology

4. Teaching Materials and Resources

- Diversity of materials and resources (textbooks, technology, manipulative).
- Adaptation for different learners (e.g., visual, auditory, kinesthetic).
- Real-world applications and examples

5. Assessment and Feedback

- Formative and summative assessment strategies.
- Feedback provision (individual, group, and whole-class).
- Student response to feedback and adjustment of learning

**APPENDIX VII: Pre-Test**

ANSWER ALL QUESTIONS

1. Find the value of the following

   (a) $2^2$ [2] b) $4^3$ [2]

2. Find the value of the following

   (a) $\sqrt{25}$ [2] b) $\sqrt[3]{216}$ [3]

3. Find the Highest Common Factor **(HCF)** of 12, 18 and 36 [3]

4. Find the Lowest Common Multiple of **(LCM)** of 20, 36 and 48 [3]

5. Evaluate $\left(2\frac{3}{4} + 1\frac{1}{2}\right) \div 1\frac{1}{5}$ [3]

6. Express 0,05675 correct to:

   (a) Three decimal places [2]

   (b) Two significant figures [2]

7. Simplify the following ratios

   (a) 3:6 [2]

   (b) 20cm: 4m [2]

   (c) 3days: 3 weeks [3]

8. Share $\$150$ *in the ratio* $2:3$ [2]

9. Round off 0,964321 correct to four significant figures [2]

10. Round off 60 300 correct to 2 significant figures [2]

11. By rounding off each number correct to 1 significant figure. Estimate the value of the following.

    (a) 17 +57 [2]

    (b) $44kg \div 8{,}3$ [2]

    (c) $651 - 265$ [2]

12. A boy buys 5 pens for 65c. How much do 9 pens costs. [2]

13. If it took 10 days for 5 men to complete a job. How many days will it take 2 men to complete the same job. [3]

14. Express the following in standard form.

    (a) 0,00064 [2]

    (b) 0,3 [1]

(c) 283,7 [2]

(d) 94 000 [2]

15. Convert $123_{10}\ to\ base\ 5$ [2]

16. Convert $144_5\ to\ base\ 10$ [2]

17. Given that§ $= \{1; 2; 3; 4; 5; 6; 7; 8; 9; 10\}, A = \{2; 3; 5; 7\}, B = \{3; 5; 8; 9; 10\}$.

(a) Find $A \cup B$ [2]

(b) Find $A \cap B$ [3]

(c) Draw a **Venn diagram** to illustrate this information. [5]

18. A survey of 120 families showed that 38 had a Fridge and 60 had a Car. If 45 had neither how many had both? [5]

19. What is the **density** of an object with mass of 2500 kg and volume of $10\ 000\ m^3$ [3]

20. What is the **mass** of an object with density of $0{,}5g/cm^3$ and volume of$600cm^3$? [3]

21. Find the **area of a circle** with radius of 28 cm [3]

22. Find the **area of a sector** if the angle to the sector is $90^0\ and\ the\ radius\ is\ 14cm.$ [4]

**APPENDICE VIII: Post-Test**
**ANSWER ALL QUESTIONS.**

1. Express
   (a) one million and one in figures [1]
   (b) $1\frac{3}{4}$ *days in hours* [1]
   © write the first three positive integers [1]
   (d) Write down the largest perfect square integer number less than 20 [1]

2. Express $0{,}0456$ *correct to one significant figure* [1]

3. Find the next two terms in the following sequences

   (a) $1; 3; 6; 10; 15; ..$ [2]

   (b) $16; 4; 1; \frac{1}{4}; ..$ [2]

4. Convert $122_7$ to a number in base 5 [3]

5. Evaluate

   (a) $(\frac{1}{3}+\frac{1}{4})^2$ [2] (b) $(1\frac{3}{4}+2\frac{1}{3})\div\frac{5}{6}$ [3]

   (c) $1\frac{1}{4}\div 1\frac{1}{2}$ [2] (d) $\frac{3}{4}+1\frac{2}{3}\times\frac{4}{5}$ [3]

6. Factorise the following completely

   (a) $36p^4-4q^2$ [3] (b) $10my+15ny+6m+9n$ [2]

   c. $x^2-4$ [2] (d) $y^2+10y-24$ [2]

   e. $2ax+3ay+4x+6y$ [2] (f) $3x^2-27$ [2]

7. (a) Express $\frac{5}{2x-3}-\frac{2}{x-4}$ as a single fraction in its lowest terms. [3]

   (b) Express $\frac{3x}{7}+\frac{2x}{7}$ as a single fraction in its lowest terms [2]

8. Express as a single fraction $\frac{x-2}{x+3}-\frac{x-3}{x+2}$ in its lowest terms [4]

9. (a) Divide \$150 in the ratio 2:3 [2]

   (b) Increase \$1,60 in the ratio 3:2 [2]

   © Decrease 30 cents in the ratio 4:5 [2]

10. A college has an enrolment figure of 645 pupils $\frac{7}{12}$ of them are females. How many males are there? [2]

11. Express 6289 to one significant figure [2]

12. Evaluate giving your answer in standard form

(a) $(5 \times 10^6) \times (3 \times 10^4)$ [2] (b) $2{,}4 \times 10^{-4} - 6 \times 10^{-5}$ [2]

13. 25% of a sum of money is \$45. Find the sum of money [2]

14. Evaluate the following number bases.

(a) $144_5 + 44_5$ [2] (b) $142_5 - 44_5$ [2]

15. Given that $\S = \{1; 2; 3; 4; 5; 6; 7; 8; 9; 10\}$ $and$ $A = \{2; 3; 7\}$; $B = \{1; 3; 9; 10\}$

Find (a) $A \cup B$ [2] $(b)$ $A \cap B$ [2]

c. $A'$ [2] d) $B'$ [2]

e) $A' \cap B$ [2] f) $(A \cup B)'$ [2]

g) Draw a Venn diagram to illustrate the above information [4]

16. Expand $1234_5$ $in\ powers\ of$ 5 [1]

17. (a) Find the value of $3\sqrt{2} \times 5\sqrt{2}$ [1]

(b) Simplify$(\sqrt{10} - \sqrt{5}\ )^2$, leaving your answer in surd form. [2]

© Simplify $\sqrt{50}, leaving\ your\ answer\ in\ the\ form\ a\sqrt{b}$ [2]

18. Remove brackets and simplify

(a) $2(x - 3) - 3(4 - 3x)$ [2] b) $3b - 3(b + 5)$ [2]

19. Expand and simplify the following

a) $(2x + 5)(x - 4)$ [2] b) $(x + 2)(x + 4)$ [2]

20. Simplify the following

a) $9x - 4x + 5x + 2x$ [1] b) $3a - 4b + 6a - 6b$ [2]

21. Express the following in standard form

(a) 618 000 [1] b) 0,000235 [1]

22. Express 0,0999 correct to 2 decimal places [1]