

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

BACHELOR OF SCIENCE EDUCATION HONOURS DEGREE IN MATHEMATICS



**THE INTEGRATION OF CRITICAL THINKING INTO THE TEACHING AND
LEARNING OF MATHEMATICS. A CASE STUDY.**

BY

MADHIDHI HAMUTYENI B225700B

TAVONESO MABASAASHE B225660B

KUMBIRE LUKA B225831A

KAMBEZO SEKAI B225577B

YETAMU NETO B225695B

SUPERVISOR: DR .G. ZINYEKA

**A DISSERTATION SUBMITTED TO BINDURA UNIVERSITY OF SCIENCE
EDUCATION**

**IMPARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE BACHELOR OF
SCIENCE EDUCATION HONOURS DEGREE IN MATHEMATICS**

PROJECT DUE DATE: 31 MAY 2024

Release form

Title: The integration of critical thinking into the teaching and learning of Mathematics.

1. To be completed by the student(s):

We certify that this dissertation is in conformity with the presentation guidelines as presented in the Faculty Guide and Instructions for Typing Dissertation.

H.Madhidhi

M.Tavoneso

L.kumbire

S.Kambezo

N.Yetamu

31/May/2024

(Signature of Students)

(Date)

2. To be completed by the Supervisor:

This dissertation is suitable for submission for to the Faculty. This dissertation should be checked for conformity with Faculty guidelines.

.....

...../...../.....

(Signature of Supervisor)

(Date)

3: To be completed by the Chairman of the Department:

We certify to the best of our knowledge that the required procedures have been followed and the preparation criteria have been met for this dissertation.



23/July/2024

(Signature of the Chairman)

(Date)

Approval form

Name of students: MADHIDHI HAMUTYENI B225700B

TAVONESO MABASAASHE B225660B

KUMBIRE LUKA B225831A

KAMBEZO SEKAI B225577B

YETAMU NETO B225695B

Dissertation Title: The integration of critical thinking into the teaching and learning of Mathematics.

Degree Title: HBsc ed Mathematics and HBsc ed Physics for Tavoneso Mabasaashe.

Year of completion: 2024

Permission is hereby granted to Bindura University of Science Education to single copies of this dissertation and to lend or sell such copies for private, scholarly scientific purposes only. The authors reserve the rights and neither the dissertation nor extensive extracts from it be granted or otherwise be replicated without the authors' consent.

Permanent addresses

Madhidhi Hamutyeni

Nemadziva Secondary School

Post Office Box 110

Birchenough Bridge

Yetamu Neto

Chidikamwedzi Secondary school

P Bag 7520

Mvurwi

Kumbire Luka

Chrome Mtorashanga Secondary School

Post Office Box 467

Zvimba

Kambezo Sekai

Kubatana Secondary School

Stand number 9042

Chinhoyi

Tavoneso Mabasaashe

Rio Tinto Zhombe High School

Post Office Box 94

Zhombe

Acknowledgements

First of all, we would like to thank God for giving us the passion of wanting to work with children and for guiding us throughout the period of this research. We also owe a debt of gratitude to our family for supporting and encouraging us at all times. We want to acknowledge with special gratitude to our supervisor Dr. G. Zinyeka who tirelessly guided us in conducting this project. Lastly, we also want to express our gratitude to the school heads and teachers of five secondary schools who spared their time to give their views on the questions presented to them and availed information from their record books for analysis.

Dedication

This research is dedicated to all group members: Mr Madhidhi, Mr Mabasaashe, Mr Neto, Mr Kumbire and Miss Kambezo. From these people, we have learnt to love, live and to get all the best things in life. May the Lord Almighty shower us with lots of blessings.

Abbreviations and Acronyms

CTS	Critical Thinking Skills
HBSc Ed	Honours Bachelor of Science Education Degree
ICT	Information Communication Technology
MoPSE	Ministry of Primary and Secondary Education
ZIMSEC	Zimbabwe School Examinations Council

Abstract

Critical thinking is an important skill for learners to develop, as it enables them to analyse information, solve problems, and make well-reasoned decisions. In the context of mathematics education, the integration of critical thinking can enhance learners' understanding of mathematical concepts and their ability to apply mathematical knowledge to real-world situations. This study explores the importance of integrating critical thinking into the teaching and learning of Mathematics. It examines the key components of critical thinking, such as analysis, evaluation, and problem-solving, and how they can be explicitly integrated into mathematics curriculum and instruction. The study discusses various teaching methods and learning activities that foster critical thinking, such as open-ended problem-solving, inquiry-based learning, and the use of multiple representations. Furthermore, the study presents empirical evidence on the impact of critical thinking integration on learner outcomes in Mathematics. It highlights improved conceptual understanding, increased problem-solving skills, and enhanced mathematical reasoning abilities among learners exposed to critical thinking-focused mathematics instruction. The findings of this study have important implications for mathematics learners, curriculum designers, and policymakers. By prioritising the development of critical thinking skills alongside the mastery of mathematical content, learners can become more engaged, adaptable, and capable problem-solvers, better prepared to navigate the challenges of the 21st century.

Table of contents

Release form	i
Approval form	ii
Permanent addresses	iii
Acknowledgements	iv
Dedication	v
Abbreviations and Acronyms	vi
Abstract	vii
Table of contents	viii
CHAPTER 1	1
1.1 Introduction to the chapter	1
1.2 Background of the study	1
1.3 Statements of the problem	3
1.4 Research objectives	3
1.5 Research questions	3
1.6 Significance of the study	4
1.7 Delimitations of the study	4
1.8 Limitations of the study	5

1.9 Assumptions of the study.	6
1.10 Definition of terms	6
1.11 Summary	7
 CHAPTER 2: LITERATURE REVIEW	 8
2.1 Introduction of the chapter	8
2.2 Relevance and effects of integrating critical thinking into the teaching and learning of Mathematics	8
2.2.1 Enhancing problem solving skills	8
2.2.2 Developing analytical reasoning	9
2.2.3 Fostering higher-order thinking.	9
2.2.4 Encouraging independent thinking.	9
2.2.5 Promoting real life application.	10
2.2.6 Cultivating transferable skills	11
2.3 Summary	12
 CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY. ...13	
3.1 Introduction to the chapter	13
3.2 Research approach	13
3.3 Research design	14
3.4 Triangulation in the study	15
3.5 Population	15

3.6 Sample	16
3.7 Sampling procedure	16
3.8 The development of data collection instruments.	16
3.9 Validation of data collection instruments	16
3.10 Research instruments	17
3.10.1 Interviews	17
3.10.2 Document observations	17
3.11 Data presentation and analysis	17
3.12 Ethical considerations	18
3.13 Summary	19
 CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION	 20
4.1 Orientation to the chapter	20
4.2 Views on the integration of critical thinking into the teaching and learning of Mathematics.	20
4.2.1 Observations on the integration of critical thinking in the teaching and learning of Mathematics	21
4.3 Teachers currently integrating critical thinking into the teaching and learning of Mathematics.	22
4.3.1 Observations on currently integrating critical thinking in the teaching and learning of Mathematics.	23
4.4 Challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.	24
4.4.1 Observations on the challenges faced by teachers when integrating critical thinking in the teaching and learning of Mathematics.	25

4.5 Discussion of the findings	25
4.6 Summary	27
CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	28
5.1 Introduction to the chapter	28
5.2 Summary of the whole study	28
5.3 Conclusion of the findings	29
5.3.1 To identify teachers' views on the integration of critical thinking into the teaching and learning of Mathematics.	29
5.3.2 To examine teachers currently integrating critical thinking skills into the teaching and learning of Mathematics.	29
5.3.3 To investigate the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics	30
5.4 Recommendations	30
5.5 Suggestions for further study	31
References	32
List of appendices	34
Appendix 1: letter of introduction	34
Appendix 2: Approval letters	35
Appendix 3: Interview guide for teachers.	40
Appendix 4: Document observation guide.	43

CHAPTER 1

1.1 Introduction to the chapter

This chapter presents the background of the study, statements of the problem, research objectives, research questions, significance of the study, delimitations, limitations and assumptions, definition of the terms as well as summary of the chapter focusing on the integration of indigenous knowledge into school science teaching.

1.2 Background of the study

Research into the poor performance of learners in Mathematics often reveals a gap in critical thinking skills. Mathematics is among the five core and compulsory learning areas for form one to four learners in Zimbabwe (Mhike, 2024). Investigating the integration of critical thinking into the teaching and learning of Mathematics can shed light on effective strategies for improving learner outcomes. This research aims to identify teachers' views, challenges and best practices in fostering critical thinking within Mathematics, ultimately contributing to more effective teaching methodologies and learner success.

There are a number of reasons that led learners to perform poor in Mathematics. Ministry of Education, Sports and Culture, (2010), states that since the time of independence the facilitation of science subjects in terms of equipment used in Mathematics, availability of Mathematics books as well as small number of Mathematics teachers compared to the number of schools in Zimbabwe has made the performance of subjects to remain poor. In another way, the introduction of new curriculum in 2015 by Ministry of Primary and Secondary Education contribute poor performance in Mathematics because the resources that suit new curriculum were scarce. Raychaudhuri et al (2010), also finds that learners' academic performance in Mathematics depends on a number of socio-economic factors like learner's attendance in the class, family income, parent's education, teacher learner ratio, presence of trained

educators in schools and distance walked by learners to and from school. Here in Zimbabwe teacher learner ratio is twenty-three to twenty-five in secondary schools (MoPSE, 2021). In addition, due to economic hardships graduated teachers are not employed and those who are already at work migrated to other nations, this created large class sizes for the remaining teachers. Due to large class sizes teachers used teacher centred approaches that do not incorporate critical thinking. In rural areas schools are not close as compared to urban areas, learners walked long distances and this led to poor performance of Mathematics.

However, the researchers focus on the integration of critical thinking into the teaching and learning of Mathematics as a science subject in five schools. In Zimbabwe as in other African countries, the persistent poor performance of learners in Mathematics remains to produce worries. Available evidence for the past four years, the pass rate for Mathematics excluding that for private candidates, has remained slightly below twenty percent. In 2019; nineteen comma two three percent of public candidates passed 'O' Level Mathematics and the figure went down to eighteen comma two one in 2021 and slightly up to eighteen comma seven one percent in 2022. In 2023; eighteen comma zero three candidates passed Mathematics (ZIMSEC, 2023).

Teachers are therefore supposed to employ learner centred pedagogical approaches that directly impact on learners' performance such as those recommended by the philosophy of pragmatism that integrate critical thinking. It is against this background that this study was carried out so as to explore on how teachers' methods of Mathematics in schools could be improved, by developing learners' critical thinking skills as one way in which learners' interest in Mathematics and performance could be improved. The use of such learner-centred approaches of teaching has been found to be one of the ways in which teachers' methods of teaching could be improved for improving interest in Mathematics as well as learner performance. In this case some scholars like Dewey (1988), encourages Mathematics teachers to engage learners in learning activities as this develop critical thinking skills. When learners are actively

involved in teaching and learning process they master concepts better rather than sitting listening what the teacher is saying. Critical thinking has been considered to be one of the major principles guiding the new curriculum 2005 of South Africa, premised on the view that if learners are empowered with critical thinking skills, they are likely to participate effectively in all aspects of life (Braund et al, 2012; Scholtz et al; 2007).

1.3 Statements of the problem

The poor performance of learners in Mathematics can be attributed to the lack of integration of critical thinking into the teaching and learning of the subject (Alicke, 2000). The problem lies in the traditional approach to Mathematics education, which often focuses on rote memorization and procedural skills rather than fostering critical thinking skills (Dewey, 2010). Without the incorporation of critical thinking, learners struggle to apply mathematical concepts to real-life situations, analyse problems, and make connections between different mathematical concepts. This deficiency in critical thinking skills limits their ability to solve complex mathematical problems, think creatively, and develop a deeper understanding of the subject. Therefore, addressing this issue necessitates a pedagogical shift towards an instructional approach that actively encourages critical thinking, problem-solving, and reasoning in the teaching and learning of Mathematics.

1.4 Research objectives

1.4.1 To identify teachers' views on the integration of critical thinking into the teaching and learning of Mathematics.

1.4.2 To examine teachers currently integrating critical thinking skills into the teaching and learning of Mathematics.

1.4.3 To investigate the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.

1.5 Research questions

1.5.1 What are the teachers' views on the integration of critical thinking into the teaching and learning of Mathematics?

1.5.2 How are the teachers currently integrating critical thinking into the teaching and learning of Mathematics?

1.5.3 What challenges are faced by teachers when integrating critical thinking skills into the teaching and learning of Mathematics?

1.6 Significance of the study

It is hoped that this research may be beneficial to many stakeholders, among them: teachers, learners, policy makers and members of the society. The researchers acknowledge that this study may help to enlighten teachers on the integration of critical thinking into the teaching and learning of Mathematics. Similarly, the researchers hope implementation of requisite critical thinking on learners will immensely improve their academic achievement, since this integration has positive educational implications if put to good use. Moreover, policy makers may also find this research beneficial as they may borrow recommendations to be proposed from this study and incorporate them in the formulation and design of curricula.

The community may also reap forthcoming from the study as the findings of the study and suggested recommendations will help them to be acquainted with their duties as custodians of learners in aiding their secondary students to attain higher levels of academic achievement. Thus, this study may create a complete cycle of interdependence among all stakeholders in the school on the integration of critical thinking into the teaching and learning of Mathematics.

1.7 Delimitations of the study

According to Creswell (2013: 65) delimitation refers to the limits or boundaries of the study. Creswell goes on to argue that delimitations are those characteristics that limit

the scope and define the boundaries of the study. This study was carried out in secondary schools; the study was confined to only five secondary schools which are Nemadziva, Rio Tinto Zhombe, Chrome Mtorashanga, Kubatana and Chidikamwedzi. This reduced costs and saves time for the researchers since each researcher collected data of one participant per school and then compiled the data. The research participants were Mathematics teachers from those five schools. The researchers worked with a sample of five participants, among them: two female teachers and three male teachers. Then to get more insight into the issue, interviews and document observations were conducted. The main aim of this study was to integrate critical thinking into the teaching and learning of Mathematics.

1.8 Limitations of the study

All research suffers from limitations (Brown, 2020, Bell, & Waters 2014), because of uniqueness of its traits. This study was carried out in an environment infested by a number of impediments. The study experienced the following limitations:

Size of the sample was small which may impact negatively to the generalisation of the research findings to other schools as they needed extreme consideration because the study was limited to only five secondary schools as the number of participants from the schools under study were very few within the area of study and in order to have valid results all science teachers had to be incorporated also.

The researchers have a challenge of limited resources in the form of funds due to liquidity problems experienced in the nation which forced the researchers to mobilise funds from family enterprises to meet the study requirements

In the initial stage the researchers faced resistance as research participants were not cooperative. However, the researchers had to make familiarisation visits to selected schools for a week before data collection to promote rapport with research participants.

The study was carried out during a semester period where the researchers had other

study obligations such as assignments, discussions and examination preparations. However, the researchers relied on electronic sources and information from other related research studies.

1.9 Assumptions of the study

The researchers would seek for permission from the heads of schools to carry out the study. The study assumes that all participants will provide honest responses and accurate data. The questions will be completed and returned without delaying. All ethical issues will be considered. The sample used was a true representation of the population of the five secondary schools.

1.10 Definition of terms

1.10.1 Mulnix, (2012), defines **critical thinking** or reasoning well as that type of thinking that pursues to justify beliefs on the evidential relations that hold between statements. He also points out that in order to reason well, thinkers must be able to give reasons for what they believe and these reasons must essentially support the truth of the belief or statement.

Critical thinking is the systematic evaluation or formulation of beliefs, or statements by rational standards; is systematic because it involves distinct procedures and methods, (Vaughn, 2005: p 4).

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualising, applying, synthesising, and/or evaluating information gathered from, or generate by observation, experience, reflecting, reasoning or communication, as a guide to belief and action, (Scriven and Paul, 2007, p.1)

In other words, **critical thinking** is taken to mean the cautious application of reason to forms of belief, observing the conceivable significance and meaning of claims, essentially involves obtaining, exercising, and developing the ability to understanding

inferential relations holding among statements, and is thinking that has a purpose and assurance to acceptance of the outcomes of that reasoning (Moore and Parker, 2009; Mulnix, 2012; Facione, 2013).

1.10.2 Dewey, (2010), defines a **teacher** as someone who is trained and usually certified to instruct learners in various learning areas, helping them to learn and grow in structured educational settings.

1.10.3 Teaching can be defined as the process of imparting knowledge, skills, or information to others through various instructional methods and techniques. Dewey (1997) states that **teaching** is the ability to assist learners in organising, directing and maximising the stream of developing life experiences.

1.10.4 Learning refers to the acquisition of knowledge, skills, attitudes, or competencies through study, experience, or teaching. Merriam Webster Dictionary (2024) defines **learning** as a process of continuous change in human performance or performance potential.

1.10.5 In education, **integration** refers to the incorporation of different subjects, knowledge domains, or teaching methods to create a cohesive and comprehensive learning experience (Oxford Languages, 2024).

1.10.6 A **view** refers to a perspective, opinion, or belief held by an individual or a group regarding a particular subject or situation (Merriam Webster Dictionary, 2024).

1.11 Summary

The goal of this chapter was to provide an overview of the entire research. This was accomplished by providing a detailed background that inspired the researcher to conduct the research explaining the statements of the problem and unveiling research objectives and research questions. The researchers also discussed the significance of the study to a variety of stakeholders including teachers, learners, school administrators and parents.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to the chapter

Chapter two presents a review of related literature. The chapter presents previous research studies carried out in line with the research questions presented in chapter one. Literature review was done in order to establish what scholars have said about the study and what the researchers have revealed with the topic under study.

2.2 Relevance and effects of integrating critical thinking into the teaching and learning

In this research the researchers in favour of Mulnix, (2012), defines **critical thinking** or reasoning well as that type of thinking that pursues to justify beliefs on the evidential relations that hold between statements. He also points out that in order to reason well, thinkers must be able to give reasons for what they believe and these reasons must essentially support the truth of the belief or statement.

The benefits of integrating critical thinking into the teaching and learning of Mathematics in Zimbabwe are supported by scholarly research, the implementation of this approach requires proper curriculum design, teacher training, and supportive learning environments. It is important to provide teachers with professional development opportunities and resources to effectively integrate critical thinking strategies into their Mathematics instruction. Additionally, fostering a classroom culture that values inquiry, problem-solving, and open discussion is crucial to maximise the impact of critical thinking in Mathematics education. Here are some key points highlighting the relevance and effects of this approach:

2.2.1 Enhancing problem-solving skills

Critical thinking encourages learners to analyse, evaluate, and solve complex mathematical problems. It enables them to think deeply, consider different perspectives,

and apply logical reasoning to arrive at solutions. Research has shown that integrating critical thinking into Mathematics education improves students' problem-solving abilities. Similarly, critical thinking skills and problem solving skills have been placed at the top of the list of learner exit profiles in the new Zimbabwean curriculum, among major skills that learners need for life and work with respect to national development in the emerging socio-economic environment (MoPSE, 2015).

2.2.2 Developing analytical reasoning

Mathematics involves logical reasoning and the ability to identify patterns and relationships. Critical thinking promotes analytical thinking skills, enabling learners to examine mathematical concepts, identify underlying patterns, and make connections between different mathematical ideas. By integrating critical thinking, students can develop a deeper understanding of mathematical concepts and the reasoning behind them. The Zimbabwe Curriculum Framework has made an effort to provide for the acquisition of knowledge and skills “that will make learners productive, employable and competently become employment creators. Learning and innovation include among others, problem solving, critical thinking, learning, innovation skills as well as analytical skills MoPSE (2015 pp. 22-23). In general with the current prevailing socio-economic challenges as well as the need for creating, and maintaining democratic systems in countries such as Zimbabwe, the development of critical thinking skills among learners would be of benefit to the countries.

2.2.3 Fostering higher-order thinking

Critical thinking goes beyond memorization and recall of mathematical formulas and procedures. It encourages learners to engage in higher-order cognitive processes such as analysis, evaluation, and synthesis (Mefor, 2014). By integrating critical thinking into Mathematics education, learners can develop higher-order thinking skills, which are essential for success in problem-solving and real-life applications of Mathematics.

2.2.4 Encouraging independent thinking

Critical thinking fosters independence in learners by encouraging them to question assumptions, evaluate evidence, and develop their own perspectives. This approach empowers students to become active participants in the learning process, rather than passive recipients of information. By integrating critical thinking into Mathematics education, learners in Zimbabwe can develop the ability to think critically and independently, which is crucial for their academic and personal growth. Critical thinking has been considered to be one of the major principles guiding the new curriculum 2005 of South Africa, premised on the view that if learners are empowered with critical thinking skills, they are likely to participate effectively in all aspects of life (Braund et al, 2012; Scholtz et al, 2007). Further that critical thinking is likely to produce independent, critical thinkers who are able to interrogate, weigh evidence, make well informed judgments, and be good decision makers (Braund et al., 2012; Scholtz et al., 2007).

2.2.5 Promoting real-life application

Integrating critical thinking into Mathematics education helps learners understand the relevance and application of mathematical concepts in real-life situations. By engaging in critical thinking activities, learners can explore the practical applications of Mathematics, such as financial literacy, data analysis, and problem-solving in various contexts. This enhances their motivation and appreciation for the subject, as they see the value of Mathematics beyond the classroom. Critical thinking skills have a potential to increase the learner's interest in the subject (motivation) as these skills make the learner engage with what they will be learning, as a result the learner is likely to develop a deeper understanding of the subject (content mastery). The student is also likely to see the relevance of what they learn to real life situations, to be imaginative, innovative, to be a good problem solver and to be a creative thinker (MoPSE, 2021).

The learner is likely to remember what they experience in learning scenarios especially if critical thinking is used in conjunction with learner centered approaches to teaching and learning and is likely to apply the concepts in a responsible way in life/work place.

2.2.6 Cultivating transferable skills

Critical thinking skills are transferable across various disciplines and are highly valuable in the 21st-century workforce. By integrating critical thinking into Mathematics education, learners develop skills such as logical reasoning, creativity, communication, and collaboration, which are essential for success in higher education and future careers. Critical thinking is a vital skill at school/university as well as at work place and later for finding solutions for life challenges/critical consciousness. For instance, scientists and those who produce goods and services need to apply critical thinking skills (CTS) in design thinking to be innovative and to industrialise. Ordinarily, challenges in life require learners to apply critical thinking skills to effectively solve these challenges. Generally, in life and in business and politics in particular people need to know how to question information sources and how to evaluate different arguments. Learners in schools likewise need critical thinking skills as they learn and far ahead at their work places and in life.

In the context of Zimbabwe, where educational reforms often aim to promote more inclusive and equitable education, integrating critical thinking into mathematics teaching and learning can be particularly valuable. It helps address the challenges of a diverse student population and can contribute to reducing the achievement gap among learners with different backgrounds and abilities.

However, successful implementation of critical thinking in Mathematics education requires supportive policies, teacher training, and appropriate instructional resources. It is crucial to provide teachers with professional development opportunities to enhance their understanding of critical thinking strategies and how to integrate them effectively into the mathematics curriculum (Chirume, 2012).

Moreover, the assessment practices should align with the goals of critical thinking integration, focusing on evaluating students' problem-solving processes, reasoning

abilities, and conceptual understanding rather than solely relying on memorization and procedural skills.

Overall, integrating critical thinking into the teaching and learning of Mathematics in Zimbabwe, and other countries, has the potential to improve students' Mathematical abilities, promote deeper understanding, and equip them with essential skills for success in the 21st century.

2.3 Summary

This chapter made a critical analysis of ideas contributed by various educationalists in the field of Mathematics. The researchers examined how Mathematics teachers integrate critical thinking into the teaching and learning of Mathematics.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction to the chapter

This chapter is all about the research methodology and other procedures used to collect and analyses data. It describes the research approach and design, followed by the sampling procedure, the development and validation of collection instruments and ethical considerations.

3.2 Research approach

The researchers used a qualitative research approach involving the case study. Under a case study the researchers used interviews and document observations as research techniques to collect data from the sample.

Creswell (2014) describes research approaches as the plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis and interpretation. According to Budert-Waltz and Moffitt (2023), qualitative research is the collection, analysis and interpretation of comprehensive narrative and visual data to gain insights into a particular phenomenon. For the purpose of this study, the researchers adopted interpretivism as a philosophy of research, highly recommends qualitative research methods such as interviews and document observations for gathering non-numerical data.

The use of qualitative research approach has been found to be the only technique in which the researchers employed to collect non-numerical data such as opinions, feelings and behaviors of participants. Creswell (2012), states that most researchers make use of qualitative approach when they need to capture accurate and in depth insights of participants. It is very useful to capture factual data. The researchers used

this approach because it allowed them to better understand how teachers integrate critical thinking and how learners learn by asking them open-ended questions listening carefully to their answers. The use of open-ended questions and probing gave participants the opportunity to respond in their own words rather than forcing them to choose from fixed responses as quantitative methods do. Creswell (2012) continues saying qualitative research is effective in obtaining culturally specific information about the values, opinions, behaviors, relationships and social contexts of particularly population. Stake (2010), concur with the above points mentioned by Creswell (2012) and he also states that qualitative research approaches are effective in identifying intangible factors such as power, norms, status, gender roles whose in independent outcomes might not be apparent.

3.3 Research design

Research design is an overall plan or strategy used to conduct a research study. A research design, according to Popper (2014), is a program that guides the investigation in the process of collecting, analysing and interpreting data. Similarly, Goodfriend (2023) adds that research design refers to the overall strategy and analytical approach that the researchers choose in order to integrate, in a coherent and logical way, the different components of the study, thus ensuring that the research problem will be thoroughly investigated. A research design, which is the overall structure of a research project, ensures that the collected data effectively answers the research question. According to Creswell (2014), research design is a plan which accounts for a study's epistemological and theoretical framework on the one hand, and the methodological paradigms and methods on the other. Therefore, to be able to understand the integration of critical thinking in the teaching and learning of Mathematics, a highly structured approach is necessary.

In this study a case study was employed as a method of research design. A case study is one of the best designs that can be used when studying few schools. The case study

produces detailed results which can lead into the integration of critical thinking skills in the teaching and learning of Mathematics in secondary schools. According to Creswell (2012) case study gives a detailed analysis of a sample under study. When using a case study the researchers obtain information from documents of the group under study. One of the characteristics of case study is that the researchers can select a group to study in depth. A case study focuses on a specific and interesting case. The findings are only applicable to the place under study.

3.4 Triangulation in the study

The current study adopted a pragmatic approach to data collection, using the sequential triangulation approach in order to enhance, add, expand on and explain the results obtained from the core component data. Bearing this in mind, combining qualitative method would allow for a more comprehensive understanding of the integration of critical thinking in the teaching and learning of Mathematics in schools in Zimbabwe. Mainly, sequential triangulation was seen as a suitable way of investigating the similarities and distinctions between the data collected.

3.5 Population

Population is a group of people which the researcher is interesting and gaining information from and drawing conclusions (Gibson, et al. 2001). The group about whom the researchers want to investigate. In this case, the population of five schools comprises of eighteen Mathematics teachers. The researchers decided not to choose the entire population due financial constraints, time and shortage of resources so there was need for small representation (sample) of the population.

3.6 Sample

A sample is a subset of the population which takes part in the study (Chiromo, 2006). It was a noble idea for the researchers to choose a sample that was truly representative of the population so that the inferences derived from the sample could be generalised

back to the population of interest. In this study, five Mathematics teachers were selected from five sampled schools.

3.7 Sampling procedure

Sampling is a statistical process of selecting a sample from a population of interest to the researchers for the purpose of making observations and statistical inferences about the population (Bhattacharjee, 2012). It is extremely important to choose a sample that is truly representative of the population so that the inferences derived from the sample can be generalised back to the population of interest. The researchers used simple random sampling to come up with five Mathematics teachers. The advantage of this sampling was very easy to use, cost effective, saves time and reduced bias in the sample (Saunders et al, 2009). Random sampling is free from bias because all participants were given equal chances to be selected from the entire population.

3.8 The development of data collection instruments

The development of data collection instruments involves designing tools or methods to gather specific information for research or analysis purposes. The researchers used interviews and document observations that present the needs of the study.

3.9 Validation of data collection instruments

Data collection methods are techniques and procedures used to solicit data for research purposes. The methods used to collect data include interviews and document observations. The benefits of these data collection methods are as follows: determine the quality and accurate of collected data ensures that the data is relevant, valid and reliable. The researchers interviewed Mathematics teachers and documented data on the integration of critical thinking into the teaching and learning of Mathematics. Again, the researchers used document observations to verify aspects from questions and interviews conducted. The document observations' responses were also prepared to

make sure that the correct questions were asked to the respondents and also ensure that the aspects to be observed were correctly spelt.

3.10 Research instruments

The researchers used two instruments to collect data for this study. These research instruments include interviews and document observations. All the two instruments used were made under the following guidelines of the study's research questions.

3.10.1 Interviews

Creswell (2014) avers that interview is a process which involves collecting data through direct verbal interaction between two or more individuals. Interviews were relevant for collecting data even from illiterate respondents because it's oral. There were little possibilities of getting biased information, since it was verbal interaction. Again, interviews help to build good rapport between the researchers and respondents. The researchers would also get sensitive information from the respondents and no interference of other groups of people when the researchers solicit data (Best and Kahn, 2013). Probes should be neutral and the interviewer must allow enough time for respondents to answer and should stop anticipating and cuing potential answers (Creswell, 2014).

3.10.2 Document observations

The researchers used document observations as the systematic processes for collecting data. When doing document observation there was need for agreement between the researchers and the respondents. Brown (2020) defines document observation as a systematic data collection approach where researchers use all of their senses to examine participants in natural settings or naturally occurring situations. Document observations were used by the researchers because they enabled them to directly collect primary data rather than depend on secondary information.

3.11 Data presentation and analysis

Data presentation is the process of visually represent data sets to convey information effectively to audience (Creswell, 2012). The researchers asked participants to tick or write in the appropriate rows or columns as demanded by the research questions. Since data was collected qualitatively so the respondents' responses were represented in the form of text that provides narration. After the information was collected, the researchers organize the data according to themes (on each research question) for easy access. Using pseudonyms to identify participants, the data was organized according to themes. The research questions were used to group the emerging evidence of teacher`s views and practices.

3.12 Ethical considerations

Ethical considerations in research are a set of principles that guide research designs and practices (Bhandari, 2021). These ethical principles include permission for carrying out the study, voluntary participation, informed consent, anonymity, confidentiality, potential for harm and results communication.

The researchers wrote letters to the head of five schools seeking for a permission to carry out the study. The letter clearly stated the details of the researcher and purpose of the study.

The researchers will prevent the participants from any form of harm, be it psychological, social, physical or legal harm. The participants were encouraged to report any sensitive data that could lead to harm them or a breach of privacy.

Borg and Gall (2019), state that the routine collection and storing of data has raised new concerns about confidentiality of information. The researchers took this issue into consideration and made sure that no identifying information from the report. All participants had a right to privacy so the researchers protected their personal data. This gave participants freedom to express their feelings, as they were assured that their responses were used in the research.

The researchers used appropriate ways of communication with the participants. Appropriate way of communication is honest, reliable and credible (Bhandari, 2021). The researchers communicated well with the participants, this made results transparent.

Participants were fully made aware of the nature of the research and their roles within it.

All potential participants who received and understood the nature of the research were given enough time to decide whether they wanted to participate or not. The researchers encouraged participants to sign consent forms showing that they were not coerced to participate in the research.

3.13 Summary

This chapter showed how data was collected for the study. Interviews and document observations were considered as the most appropriate research instruments used to explore approaches which educators engage in integrating critical thinking into the teaching of science. The merits and demerits of the research design as well as those of the data collection were also discussed.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

Qualitative analysis

4.1 Orientation to the chapter

Chapter four presents the results of this study in line with the study's research questions. Section 4.2 is about teachers' views on the integration of critical thinking into the teaching and learning of Mathematics, section 4.3 is about teachers currently integrating critical thinking into the teaching and learning of Mathematics. Finally, section 4.4 is about the challenges faced by teachers when integrating critical thinking skills into the teaching and learning of Mathematics.

4.2 Views on the integration of critical thinking into the teaching and learning of Mathematics.

The first phase of the study focused on research question 1 presented below:

What are the teachers' views on the integration of critical thinking into the teaching and learning of Mathematics?

In an attempt to answer this question interviews and document observations were used as data sources in collecting views on the integration of critical thinking into the teaching and learning of Mathematics. The teachers who were interviewed were five that is to say one Mathematics teacher from each school.

Teachers' voices about their views on the integration of critical thinking into the teaching and learning of Mathematics is presented below and AT1's voice is representative of their views:

AT1 "We believe that traditional teaching methods in Mathematics can limit learners' critical thinking development. We advocate for teaching and learning methods that

encourage open-ended problem-solving, collaborative learning, and the exploration of multiple solutions to promote critical thinking effectively."

BT1 *"Critical thinking can help learners identify and correct misconceptions in Mathematics. We view critical thinking as a tool for learners to analyse their own thinking processes, recognise errors, and develop a more accurate understanding of mathematical concepts."*

CT1 *"Integrating critical thinking in Mathematics empowers learners to think independently explore multiple strategies and find creative solutions. We appreciate the opportunity to cultivate learners' autonomy, enabling them to think outside the box and approach mathematical problems in innovative ways."*

DT1 *"We increasingly emphasise the need to connect Mathematics to real-life situations. Integrating critical thinking in Mathematics instruction allows learners to understand how mathematical concepts apply to everyday scenarios, fostering their ability to think critically about situations that require mathematical analysis."*

ET1 *"We recognise that critical thinking encourages deeper understanding of mathematical concepts rather than simply memorising formulas or procedures. By engaging in critical thinking activities, learners can develop a more profound understanding of mathematical principles and their interrelationships."*

From the interview with the teachers, the researchers noted that the teachers enjoyed using different methods of integrating critical thinking into the teaching and learning of Mathematics depending on the mathematical concept being taught. Most of the teachers used those teaching methods that were suggested by progressivism to integrate critical thinking in the classroom. Teachers allowed learners to be actively engaged in learning of Mathematics so that they develop more accurate and deep understanding of mathematics concepts which they can apply in real-world life.

4.2.1 Observations on the integration of critical thinking in the teaching and learning of

Mathematics.

The research question for this section was to find out the views of the teachers on the integration of critical thinking in the teaching and learning of Mathematics in the classrooms through document observations. The researchers managed to observe five Mathematics teachers' documents that is to say one teacher's four documents from each of the five sampled schools. The researchers observed that Mathematics teachers gave learners open-ended questions that empowers them to think independently, explore multiple strategies, and find creative solutions

4.3 Teachers currently integrating critical thinking into the teaching and learning of Mathematics.

The second phase of the study focused on research question 2 presented below:

How are the teachers currently integrating critical thinking into the teaching and learning of Mathematics?

In an attempt to answer this question interviews and document observations were used as data sources in collecting views on how teachers currently integrating critical thinking into the teaching and learning of Mathematics.

Teachers' views about their views on their currently integrating critical thinking into the teaching and learning of Mathematics is presented below:

AT1 is representative:

AT1 "We promote collaborative learning experiences where learners work in groups to solve mathematical problems. Through discussion and collaboration, learners can analyse different perspectives, evaluate solutions, and construct arguments. This collaborative environment fosters critical thinking by exposing learners to diverse viewpoints and challenging them to defend their ideas."

BT1 "Some of us adopt an inquiry-based approach, where learners actively explore

mathematical concepts through questioning, investigating, and discovering patterns. By engaging in inquiry, Learners develop critical thinking skills as they formulate questions, gather data, analyse patterns, and draw conclusions."

CT1 *"We strive to connect mathematical concepts to real-world situations. By presenting authentic problems and contexts, learners can see the relevance and application of mathematics in their lives. This approach encourages critical thinking as learners analyse real-world situations, make connections, and apply mathematical concepts to solve problems."*

DT1 *"We often use problem-solving tasks and open-ended questions to engage learners in critical thinking. These tasks require learners to analyse the problem, identify relevant information, and apply mathematical concepts to arrive at a solution. By encouraging learners to think critically about different problem-solving strategies, we foster their ability to reason and make logical connections."*

ET1 *"We emphasise the importance of mathematical reasoning and justification in our classrooms. We also encourage learners to explain their thought processes, defend their solutions, and provide evidence for their claims. This approach helps learners develop logical thinking skills and communicate their ideas effectively."*

From the interview with the teachers, the researchers noted that the teachers favoured using learner-centred approaches, where learners actively explore mathematical concepts through questioning, investigating, and discovering patterns. The researchers discovered that teachers to work in groups to solve mathematics problems. This collaborative learning environment fosters critical thinking by exposing learners to diverse viewpoints and challenging them to defend their ideas.

4.3.1 Observations on currently integrating critical thinking in the teaching and learning of Mathematics.

The research question for this section was to find out how teachers currently

integrating critical thinking into the teaching and learning of Mathematics in the classrooms through document observations. The researchers managed to observe five Mathematics teachers that is to say one teacher's four documents from each of the five sampled schools. The textbooks used by both teachers and learners have activities that need collaborative learning where learners work in groups to solve mathematics problems and they have open-ended questions that foster critical thinking.

4.4 Challenges faced by teachers when integrating critical thinking skills into the teaching and learning of Mathematics.

The third phase of the study focused on research question 3 presented below:

What challenges are faced by teachers when integrating critical thinking skills into the teaching and learning of Mathematics?

In an attempt to answer this question interviews and document observations were used as data sources in collecting views on the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.

Teachers' voices about their views on challenges they face when integrating critical thinking in the teaching and learning of Mathematics are presented below:

AT1 *"Covering the required curriculum within a limited timeframe is a common challenge for us as teachers. Integrating critical thinking skills may require additional time for open-ended problem-solving activities, group discussions, and reflection, which can create pressure to balance content coverage and skill development."*

BT1 *"Learners have different levels of readiness and abilities when it comes to critical thinking in Mathematics. We need to differentiate their instruction to meet the diverse needs of learners, providing appropriate support and challenges for each learner. This can be challenging when there is a wide range of abilities within a single classroom."*

CT1 *"Integrating critical thinking skills can require learners to take a more active role in*

their learning process. Some learners may initially struggle with this shift, particularly if they are accustomed to passive learning environments. We may need to employ strategies to engage learners and help them develop the necessary critical thinking skills. ”

DT1 and ET1 concurred with the above points mentioned by AT1, BTI and CTI.

From the interview with the teachers, the researchers noted that teachers had limited time to cover mathematics concepts that integrate critical thinking into the teaching and learning of Mathematics in the classrooms. The researchers discovered that less usage of the progressivism methods was due to other variables such as resource availability and class sizes. Teachers faced challenges in the classrooms as learners resisted to shift from passive learning environments to active. The researchers also noted that teachers failed to cater for individual differences, as learners had different levels of readiness and abilities when it comes to critical thinking in Mathematics.

4.4.1 Observations on the challenges faced by teachers when integrating critical thinking in the teaching and learning of Mathematics.

The research question for this section was to find out the challenges faced by teachers when integrating critical thinking in the teaching and learning of Mathematics in the class through document observations. The researchers managed to observe five Mathematics teachers that is to say one teacher's four documents from each of the five sampled schools. Majority of the teachers failed to cover the syllabus due to limited timeframe for their lessons. Assignments given to learners were not marked because teachers had no time to mark both daily exercises and assignments. Reading materials like learners' textbooks was a great challenge in all five sampled schools. This was an obstacle for teachers to integrate critical thinking in the teaching and learning of Mathematics in the classrooms.

4.5 Discussion of the findings

When syncing the data obtained by the two research tools used to gather data in this study the researchers noticed some similarities and differences. The researchers noticed that the mathematics teachers integrate critical thinking in the teaching and learning of Mathematics by promoting collaborative learning, where learners work in groups to solve mathematics problems. The discussions and collaborations helped learners analyse different perspectives, evaluate solutions, and construct positive arguments. This collaborative learning environment fosters critical thinking by exposing learners to diverse viewpoints and challenging them to support their ideas.

The majority of the teachers used diversified teaching and learning methods to integrate critical thinking as recommended by progressivism (Dewey, 1988). As regards the use of teaching and learning methods recommended by progressivism practices, it emerged from the findings that most mathematics activities were punctuated by learner-centred methodologies. The reliance on the problem-solving teaching approach is supported by Singh (2017), who avers that one of the chief signs of integrating critical thinking in mathematics education is the use of learner-centred approaches like the problem-solving method, which prepares learners to face real-world situations.

The document observations done on the teachers showed that teachers asked open-ended questions so that learners think independently, explore multiple strategies, and find creative solutions. The researchers observed that assignments and daily exercises given to learners develop their critical thinking.

However, the researchers noted that educators faced different challenges when integrating critical thinking into the teaching and learning of Mathematics in the classrooms. Most of the teachers had limited timeframe to cover the required mathematics concepts. Open-ended problem-solving activities, group discussions, and reflection require additional time to integrate critical thinking skills into the teaching and learning of Mathematics in the classrooms.

Learners had different levels of readiness and abilities so it was a common challenge

for teachers to integrate critical thinking in Mathematics. Teachers need to vary their teaching methods to cater for individual differences.

The researchers noted that teachers faced a challenge in shifting learners from passive learning to active participation since integrating critical thinking skills can require learners to take a more active role in their learning. Teachers may have to use methods that involve learners and help them develop the appropriate critical thinking skills.

4.8 Summary

The chapter presented, interpreted and analysed the responses collected from different participants. Pseudo names were used to present, interpret and analyse the data collected through interviews and document observations in line with the research objectives.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction to the chapter

This chapter provides a detailed summary of the entire study and discussed the research findings as from the research questions. As a reminder these are the research questions: i) What are the teachers' views on the integration of critical thinking into the teaching and learning of Mathematics? ii) How are the teachers currently integrating critical thinking into the teaching and learning of Mathematics? iii) What challenges are faced by teachers when integrating critical thinking skills into the teaching and learning of Mathematics? Thereafter, conclusions were drawn mainly based on the research findings and recommendations for future studies.

5.2 Summary of the whole study

This study was carried out in 2024, on five secondary schools. The main purpose of doing this study was to integrate critical thinking into the teaching and learning of Mathematics. The main research objectives were to: identify teachers' views on the integration of critical thinking into the teaching and learning of Mathematics, examine teachers currently integrating critical thinking skills into the teaching and learning of Mathematics and investigate the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.

The literature review section made critical analysis of views contributed by a wide range of educationalists in the field of Mathematics education. The researchers identified teachers' views on the integration of critical thinking into the teaching and learning of Mathematics, examined teachers currently integrating critical thinking skills into the teaching and learning of Mathematics and investigated the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.

The study adopted a case study as a research design and a research approach, that was, qualitative research. Interviews and document observations were considered as the most appropriate research instruments used to explore the integration of critical thinking into the teaching and learning of Mathematics. The strengths of the research design as well as those of the data collection instruments were examined. The researchers gave ways through which data was collected, presented, analysed and interpreted. Finally, the researchers gave ethical considerations that guided the study. The researchers worked with a total sample of ten participants, all of them were Mathematics teachers from those randomly selected five sampled secondary schools.

5.3 Conclusion of the findings

5.3.1 To identify teachers' views on the integration of critical thinking into the teaching and learning of Mathematics.

The researchers established that the mathematics teachers integrate critical thinking into the teaching and learning of Mathematics. The majority of the mathematics teachers employed diversified teaching and learning methods to integrate critical thinking in Mathematics as suggested by progressivism, subscribes to the variances of teacher-centred methodologies, particularly those that are learner-centred.

5.3.2 To examine teachers currently integrating critical thinking skills into the teaching and learning of Mathematics.

The data collected indicated that all teachers encouraged learners to explore mathematical concepts through open-ended questions that promote problem solving. The researchers observed that the teachers' preference of currently integrating critical thinking into the teaching and learning of Mathematics depended much on various factors, among them: class sizes, the topic being taught as well as the time available for the lessons. It also emerged that the reliance on the problem-solving teaching method prepares learners to face real-world situations.

5.3.3 To investigate the challenges faced by teachers when integrating critical thinking into the teaching and learning of Mathematics.

The researchers noted that educators faced different challenges when integrating critical thinking in the teaching and learning of Mathematics in the classrooms. Covering the required mathematics concepts within a limited timeframe was a common challenge for teachers. Learners had different levels of readiness and abilities when it comes to critical thinking in Mathematics. Integrating critical thinking skills can require learners to take a more active role in their learning but some learners resisted with that shift because they were accustomed to passive learning environments. The researchers observed that those challenges were due to other variables such as resource availability, class sizes and time constraints.

5.4 Recommendations

In the light of the findings of this research and in order to improve the implementation of integrating critical thinking in the teaching and learning of Mathematics, the following recommendations were brought forward.

5.4.1 The study should be carried on many schools to enable gathering of data from a remarkable population that can allow for generalisations of findings.

5.4.2 Schools should offer technical support to teachers in terms ICT tools, textbooks and other valuable sources of media to mitigate challenges when integrating critical thinking in the teaching and learning of Mathematics.

5.4.3 The Zimbabwean government should also be on the ground with tangible assistance when recommending the integration of critical thinking in the teaching and learning of Mathematics.

5.4.4 Parents of secondary school learners should also help integrating critical thinking in the teaching and learning of Mathematics, such as ensuring resource availability.

5.5 Suggestion for further study

The researchers recommend other researchers to use a sample of schools in the entire country and use panel data. Further, the researchers recommend other researchers to use more variables to control for other factors.

REFERENCES

- Alicke. M.D. (2000). Culpade Control and the Psychology of Blame. *Psychological Bulletin*, 126, 556-574.
- Bell, J. and Waters, K. (2014), *Doing your research project: A guide for first-time researchers in education, health and social science*. Maidenhead, England: Open University Press.
- Bhattacharjee, A. (2012). *Social science research: Principles, methods and practices*. Scholar Commons: University of Florida.
- Borg, W. and Gall, J. (2019). *Educational Research: An introduction* (6th ed). White Plains, NY: Longman
- Braund. M; Hewson. P; Scholtz. Z; Sadeck. M; Koopman. R. (2012) Learning to teach argumentation: facilitated reflection on a pre-service curriculum in South Africa. *Education as Change* 15(supplement, SI), 579-593.
- Brown, H. (2020). *Methods of social research* (2nd ed.) New York: Free Press
- Chiromo, A. S. (2006). *Research methods and statistics in Education*. Gweru: Beta Print.
- Chirume, J. (2012). *The Zimbabwean 'O' Level Mathematics Curriculum and Students' Career Applications in Shurugwi and Gweru District*. Harare, Zimbabwe Open University.
- Creswell, J. W. (2012). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (Third Edition): London, Sage publications..
- Creswell, J. W. (2014). *Qualitative Inquiry and Research Design. Choosing among five approaches*, (3rd ed). Thousand Oaks: Sage.
- Dewey, J. (1988). *Experience and education*. In J.A Boydston (Ed) *John Dewey: The later works 1925-1953: Vol 13, 1938-1989* (pp. 1-6). Carbondale: Southern Illinois University Press

Facione, P.A. (2007). Critical thinking: What it is and why it counts. Retrieved January 2. 2008, from [https://www.telacommunication.com/nutshell/critical thinking, htm](https://www.telacommunication.com/nutshell/critical%20thinking,htm)

Gibson, I., Allen, G. and Sturman, A. (2001). Research methods in Education. Queensland: The Distance Education Centre.

Merriam-Webster Dictionary. (n.d.). Teaching. In Merriam-Webster.com dictionary. Retrieved April 21, 2024, from <https://www.merriam-webster.com/dictionary/teaching>

Mefor .C. (2014). Nigeria: Identifying Problems of Poor Performance in Mathematics and Way out, Njoro: Event in University Press.

Ministry of Primary and Secondary Education. (2015). The Curriculum Framework for Primary and Secondary Education in Zimbabwe 2015-2022. Harare: Curriculum Development and Technical Services Unit.

Ministry of Primary and Secondary Education. (2015). Primary and Secondary Education statistics report.

Mulnix, J. W. (2012). Thinking Critically about Critical Thinking. Education Philosophy and Theory, 44, 464-479. [https:// doi org/10.1111/ j. 1469-5812. 2010.00673.x](https://doi.org/10.1111/j.1469-5812.2010.00673.x)

Oxford Languages. (n.d.). Integration. In Oxford Languages. Retrieved April 21, 2024, from <https://languages.oup.com/google-dictionary-en/>

Saunders, M., Lewis, P. and Thornhill, A. (2009). Research methods for business students. Harlow: Prentice Hall.

Scriven,M. & Paul, R. (2008b) Our Concept of Critical Thinking, Foundation for Critical Thinking. Available at: <http://www.criticalthinking.org/aboutCT/ourConceptCT.cfm>>

Singh, M. P. (2017). Teacher' s handbook of mathematics. New Delhi, India: Anmol Publications Pvt. Ltd.

APPENDIX 1: LETTER OF INTRODUCTION

ADDRESS

DATE

Dear Sir/Madam

**RE: LETTER OF INTRODUCTION FOR DATA COLLECTION
INSTRUMENTS**

This is to inform you that we are Bachelor of Science Education Honours Degree in Mathematics and Physics students at Bindura University carrying out an academic research study focusing on, “The integration of critical thinking into the teaching and learning of Mathematics: in secondary schools: A case of five schools.

Upon the completion of the research, we presume the findings will provide valuable insights to the government, Ministry of Primary and Secondary Education, school heads and teachers at large towards effective integration of critical thinking in the teaching and learning of Mathematics in schools. Your input will highly contribute to the success of this research.

Attached please find an interview that kindly requests you to provide answers to the questions as precisely and honest as possible. Information collected will be treated with utmost confidentiality. Please do not write your name or that of your school anywhere on the interview.

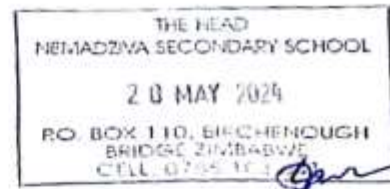
Thank you in advance.

**MADHIDHI HAMUTYENI
TAVONESO MABASAASHE
KUMBIRE LUKA
KAMBEZO SEKAI
YETAMU NETO**

APPENDIX 2: APPROVAL LETTERS

Nemadziva Secondary School
Post Office Box 110
Birchenough Bridge

20 May 2024



The Head of Department
Bindura University of Science Education
Private Bag 1020
Bindura
Zimbabwe

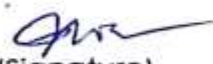
Dear Sir/Madam

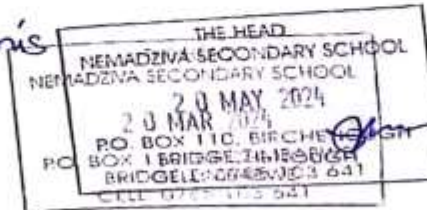
RE: PERMISSION TO CARRY OUT AN ACADEMIC RESEARCH

Madhidhi Hamutyeni, EC number (0991958P) is a teacher at Nemadziva Primary School. He has been granted permission to carry out an academic research at the school on, "The integration of critical thinking into the teaching and learning of Mathematics."

Yours faithfully

Musungwa Adonis
(Head)


(Signature)



(Phone number)

0773995624



RIO TINTO ZHOMBE HIGH SCHOOL

P.O Box 94
Zhombe
Tel/ Fax: +263 55 2520068
Cell: +263 782 753 487
Email: riotintozhombe@gmail.com



MINISTRY OF PRIMARY AND SECONDARY EDUCATION

27 May 2024

THE HEAD OF DEPARTMENT
BINDURA UNIVERSITY OF SCIENCE EDUCATION
PRIVATE BAG 1020
BINDURA

DEAR SIR/MADAM

RE: PERMISSION TO CARRY OUT EDUCATIONAL RESEARCH

This letter serves to inform you that Mabasaashe Tavoneso, EC No. : 2012985B is a teacher at Rio Tinto Zhombe High School. We have allowed him to do an educational research at the school on the topic: "The integration of critical thinking into the teaching and learning of Mathematics."

Thank you.

Yours faithfully

Kwashira J

HEAD

0773413350



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



Ref: C/246/1/MW

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

22/05/2024

The District Schools Inspector
Zimbabwe District

AUTHORITY TO CARRY OUT EDUCATIONAL RESEARCH: SCHOOLS IN
ZIMBABWE DISTRICT: MR/MRS/MS: KUMBIRE LUISA
EC.NO/IDNO: J484627C STATION VANAD PA4
DISTRICT ZIMBABWE INSTITUTION PUSE
REG.NO: B225831A PROGRAMME H.C.S.F.D.M.T.

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

Research Topic THE INTEGRATION OF CRITICAL THINKING ONTO TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS
Period of research 01/05/24 to 21/05/24

Targeted school/s CHROME SECONDARY SCHOOL

Method of research INTERVIEWS AND OBSERVATION

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.

FOR: ACTING PROVINCIAL EDUCATION DIRECTOR
MASHONALAND WEST PROVINCE



Kubatana Secondary School
Stand number 9042
Ruvimbo
Chinhoyi

15 May 2024

The head of Department
Bindura University of Science Education
Private bag 1020
Bindura

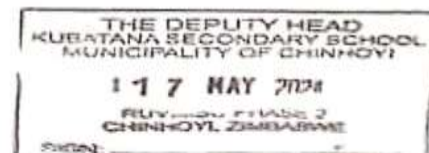
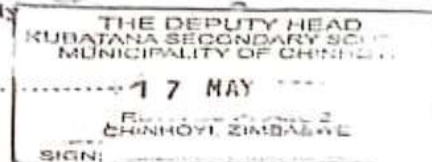
Dear Sir / Madam

RE: PERMMISION TO CARRY OUT EDUCATION RESEARCHE

This letter serves to inform you that Kambezo Sekai EC No. 5300790C is a teacher at Kubatana Secondary School. She has been granted permission to carry out academic research at the school on the "Integration of critical thinking into the teaching and learning of maths

Yours faithfully


Head
Signature



Scanned with CamScanner

REF: C/426/3 Mash Central

EC No: 0128355

All communications should be addressed to "The Provincial Education Director Mashonaland Central Province"

Telephone: 0271- 6948/6996/7134/6994

Fax: 0271-6997



ZIMBABWE

Ministry of Primary and Secondary Education

Mashonaland Central Province

P.O Box 340

Bindura

Zimbabwe

24/05/2024

YETAMU N
CHIDIKAMWEDZI SOI SCHOOL
P.B. 4520 MUYENI

RE: PERMISSION TO COLLECT DATA FOR RESEARCH PURPOSES IN MASHONALAND
CENTRAL PROVINCE... MUZASABANI... DISTRICT/S
CHIDIKAMWEDZI... PRIMARY/SECONDARY SCHOOLS

Reference is made to your application to carry out research at the above mentioned district in Mashonaland Central Province on the title:

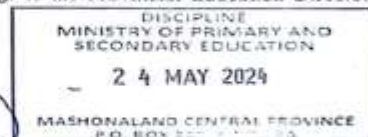
"THE INTEGRATION OF CRITICAL THINKING
IN THE TEACHING AND LEARNING OF MATHEMATICS
A CASE STUDY"

I am pleased to inform you that the Provincial Education Director has granted you permission to carry out your research in Mashonaland Central Office. You should, however, liaise with D.S.I. Muzasabani District before you start. You should ensure that your research work does not disrupt the normal operations of the school. Where students are involved, parental consent is required.

Finally, you are advised to submit a copy of your findings to the Provincial Education Director (PED) Mash Central for Primary and Secondary Education.


CHIMOMBE C (Mr)

FOR: PROVINCIAL EDUCATION DIRECTOR
MASHONALAND CENTRAL PROVINCE



Scanned with CamScanner

APPENDIX 3

INTERVIEW GUIDE FOR TEACHERS

Good morning/afternoon Sir/Madam

This research interview is aimed at focusing on "**the integration of critical thinking into the teaching and learning of Mathematics.**" Information provided will be confidential and will be used for academic purposes only. May you kindly answer the interview questions objectively and truthfully as possible. Do not write your name or that of your school on the interview guide. Please tick [] where appropriate or fill in the required information on the spaces provided.

SECTION A: Demographic data

1. Sex Male [] Female []

2. Age a) Under 35 years []

 b) Between 35 - 40 years []

 c) Between 40 - 45 years []

 d) Between 45 - 50 years []

 e) Above 50 years []

3. Educational Qualifications

a) Certificate in education []

b) Diploma in education []

c) Degreed (with education) []

d) Degreed (without education) []

Others (Specify).....

4. Working experience

a) Less than 5 years []

b) Between 5 - 10 years []

c) Between 10 - 15 years []

d) Between 15 - 20 years []

e) Above 20 years []

5. Subject specialisation

SECTION B: Interview questions

6. What are your views on the integration of critical thinking into the teaching and learning of Mathematics?

7. How do you currently integrating critical thinking into the teaching and learning of Mathematics?

8. What challenges you face when integrating critical thinking skills into the teaching and learning of Mathematics?

APPENDIX 4

DOCUMENT OBSERVATION GUIDE

This research document observation is aimed at focusing the integration of critical thinking into the teaching and learning of Mathematics. Information provided will be confidential and will be used for academic purposes only. May you kindly allow me make a few observations to find answers to my research.

Tick and support your answer for each document

Document	Excellent	Very good	Good	Poor
Schemes of work				
Test records				
Learners' exercise books				
Textbooks				

Overall comment
