

**CHALLENGES FACED IN TEACHING SCIENCE TO PUPILS WITH VISUAL
IMPAIRMENT: A CASE STUDY OF PHATLOGO PRIMARY
SCHOOL IN FRANCISTOWN, BOTSWANA**

By

KGOMOTSO CHABONGWA

21105986

**A dissertation submitted to The University of Zambia Institute of Distance Education in
partial fulfillment of the requirement for the award of a Masters Degree in Primary
Education.**

@ FEBRUARY 2025

COPYRIGHT

All rights reserved. No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form or by any means - electronic, mechanical, photocopying, recording or otherwise-without prior written permission of the author or the University of Zambia.

© Kgomotso Chabongwa, 2025

DECLARATION

I, **Kgomotso Chabongwa** hereby declare that this thesis represents my own work, except where acknowledgments indicate otherwise. Neither the whole work nor any part of this work has been submitted before for **Masters** at the University of Zambia or other Universities.

Signed (Candidate) Date.....

Signed (Supervisor) Date.....

APPROVAL

This thesis of Kgomotso Chabongwa is hereby approved as fulfilling the requirements for the degree of Masters of Education at Institute of distance education of the University of Zambia.

Name

Signature

Date

Examiner 1

Dr. K. Kahinaposo  02/05/2025

Examiner 2

Zanzini B. Ndilima (PhD)  05/05/2025

Examiner 3

Dr. G. Kaulu  05/05/2025

Chairperson, Board of Examiners

Dr. M. Simuchimba  05/05/2025

Supervisor

 Hwambokoma 2/05/2025

Dr. C. Hwambokoma

DEDICATION

I dedicate this work to my precious father David Uyapo, mother Susan David, grandmother Keitsheletse Chabongwa and my lovely son Tlotso Ogha David.

And in memory of my late grandfather Edward Chabongwa Mphusu.

ACKNOWLEDGMENTS

First and foremost, I would like to express my sincere and intense sense of gratitude to my advisor Dr Christopher Haambokoma for his judicious guidance, constant encouragement, inspiration, and facilitation during my Masters studies. His experience and mentor-ship have been critical in motivating me to work diligently on my research project. I am thankful to him for providing timely feedback and inputs related to my work and for the preparation of this manuscript.

I express a deep sense of gratitude to my family for providing motivation, encouragement, everlasting affection, and moral support during the course of my Masters studies. Huge thanks to my closest friends who have always believed in me and have rooted for me as I was pursuing my academic endeavors.

I would like to express my gratitude to all the participants in the research.

Most importantly, I want to thank the Almighty God for his Grace and guidance upon my life.

Abstract

This study examined the challenges and methods associated with teaching science to visually impaired learner. The objectives of this study were to establish the methods used in teaching science to the visually impaired pupils for the completion of the science school curriculum, identify challenges teachers face when teaching science to learners with visual impairment as well as determine solutions to the challenges faced by teachers when teaching science to visually impaired learners.

The study was qualitative in nature and used a case study design. The research involved 22 teachers and 6 visually impaired learners from grades 5 and 6. Purposive sampling was used to select teachers of visually impaired learners. Data from the teachers was collected using semi-structured questionnaires, interviews and observations. The data was analysed thematically which involved coding and categorizing data to generate themes which were descriptively presented. The themes are supported by direct quotations from participants. To maintain anonymity, participants were identified using codes. The major identified grouped in to themes identified include classroom size/ workloads, material resources, attitudes of learners, teaching methods, curriculum adaptation, professional development, teaching strategies, school support system, strategies for a more inclusive science education. Teachers reported that large class sizes hinder personalized support for visually impaired learners, while the scarcity of specialized materials limits hands-on learning experiences. Negative learner attitudes towards science, exacerbated by a lack of inclusive teaching methods, further challenge educational outcomes. The study underscores the need for better resource allocation, teacher training in inclusive strategies, and development of adaptive materials to improve science education for visually impaired learners.

Keywords: visually impaired learners, science, teaching

TABLE OF CONTENTS

COPYRIGHT.....	II
DECLARATION	III
APPROVAL	Error! Bookmark not defined.
DEDICATION.....	V
ACKNOWLEDGMENTS	VI
Abstract	VII
LIST OF FIGURES	XI
LIST OF TABLES.....	XII
ABBREVIATIONS AND ACRONYMS	XIII
CHAPTER ONE:	1
INTRODUCTION	1
1.0 Overview	1
1.1 Background of the Study	1
1.2 Statement of the Problem	5
1.3 Purpose of the study	6
1.4 Objectives of the Study	6
1.5 Research Questions	6
1.6 Significance of the Study	7
1.7 Delimitations of the study	Error! Bookmark not defined.
1.8 Limitations of the Study.....	7
1.9 Theoretical Framework	8
1.10 Conceptual Framework	Error! Bookmark not defined.
1.11 Structure of the Thesis	9
1.12 Operational definition of terms	11
CHAPTER TWO:	11
REVIEW OF RELATED LITERATURE	11

2.0 Overview	11
2.1 Global view of children with special needs	12
2.2 Education of learners with special needs	15
2.3 Challenges and Criticism of teaching science in special schools	19
2.4 Teachers Opinion on visual impairment	21
2.5 Effective Strategies for Teaching Learners with Visual Impairments	22
2.6 Summary	24
CHAPTER THREE:	26
RESEARCH METHODOLOGY	26
3.0 Overview	26
3.1 Research paradigm	26
3.2 Research approach.....	27
3.3 Case Study design	29
3.4 Location of Study	30
3.5 Study Population	30
3.6 Sample Size	30
3.7 Sampling Techniques	32
3.8 Data Collection Instrument	32
3.9 Pilot Study	33
3.10 Data Collection Procedure	34
3.11 Data Analysis	35
3.12 Systematic data Integration	36
3.13 Measures To Ensure Trustworthiness	37
3.14 Ethical Considerations.....	37
CHAPTER FOUR;.....	38
PRESENTATIONS OF RESEARCH FINDINGS	38
4.0 Overview	38
a) Teaching Methods Used for Visually Impaired learners	Error! Bookmark not defined.

b) Adaptation of Science Curriculum for Visually Impaired learners	Error! Bookmark not defined.
c) Specific Teaching Strategies Effective for Visually Impaired learners	Error! Bookmark not defined.
d) Challenges Encountered in Teaching Science to Visually Impaired Pupils	Error! Bookmark not defined.
e) Strategies and Accommodations to Address Challenges	Error! Bookmark not defined.
4.2 Teaching Methods Used for Visually Impaired learners	39
4.3 Adaptation of Science Curriculum for Visually Impaired learners.....	41
4.4 Specific Teaching Strategies Effective for Visually Impaired learners	42
4.5 Challenges Encountered in Teaching Science to Visually Impaired Pupils	44
CHAPTER FIVE	55
DISCUSSION OF FINDINGS	55
5.0 Overview	56
5.1 Discussion of findings	56
CHAPTER SIX.....	60
CONCLUSION AND RECOMENDATIONS OF THE STUDY	61
6.1 CONCLUSION	61
6.2 RECOMENDATIONS.....	62
REFERENCES	65
APPENDICES	73
Appendix A.....	73
Appendix B	75
Appendix C	77
Appendix D.....	79

LIST OF FIGURES

<i>Figure 1: Systematic data integration.....</i>	<i>37</i>
<i>Figure 2: different teaching methods the teachers said they use.....</i>	<i>40</i>

LIST OF TABLES

Table 1 : Demographic Information Background of the Participants.....	31
Table 2 : Profiles of Learners with Visual Impairment (LVI).....	32
<i>Table 3 : Responses on the size question.....</i>	<i>49</i>
<i>Table 4 : Responses “Do the learners have negative attitude towards school”</i>	<i>51</i>

ABBREVIATIONS AND ACRONYMS

WHO-World Health Organization

NFB- National Federation for the Blind

HIV/AIDS- Human Immune Virus/ Acquired Immune Deficiency Syndrome

MOE- Ministry of Education

UNICEF- United Nations Children's Fund

SEN- Special Educational Needs

CRPD- Convention on the Rights of Persons with Disabilities

MoEDS- Ministry of Education and Skills Development

TVET- Technical Vocational Education and Training

STEM-Science, technology, engineering and mathematics -

AT- assistive technologies

OCR- Optical Character Recognition

DPE- Diploma in Primary Education

B. Ed- Bachelor of Education

B.Ed Special- Bachelor of Education in Special Education

HOD- Head of Department

LD-Learning Disabilities

SPED- Special Education

CHAPTER ONE:

INTRODUCTION

1.0 Overview

This introductory chapter provides a comprehensive overview of the study, encompassing the background, statement of the problem, and research objectives that this study aims to achieve. It outlines the research questions designed to attain these objectives and explains the significance of the topic within the context of educational science for visually impaired learners. The chapter also comprises the following sections: operational definitions of key terms, theoretical framework, interpretation of my research model, scope of the study and chapter Summary.

1.1 Background of the Study

The incidence of visual impairment has been steadily increasing over the years, as highlighted by Resnikoff, S., et al.(2017). Global figures indicate that approximately one child loses their vision every minute, resulting in around 500,000 children worldwide annually (World Health Organization-WHO, 2012). In the America alone, the estimated number of blind school children surpasses 1million with the expected to double by 2050 (NIH. 2016).

The scenario in Africa mirrors this trend, particularly concerning the impact of Human Immune Virus/Acquired Immune Defficiency Syndrome (HIV/AIDS), which has contributed to an increase in visual impairment cases.

Lupiya (2017) notes that Zambia holds the highest rate of blindness in Southern Africa, with more than 105,000 visually impaired. These individuals often face socio-economic disadvantages due to inadequate access to essential resources. Consequently, they necessitate specialized educational support and appropriate assistive technologies to optimize their academic capabilities (Ministry of

Education-MOE, 1996; Lupiya, 2017). Ensuring that all learners receive high-quality education is a primary responsibility shared by educators and stakeholders within the Ministry of Education , Vocational Training, and Early Education . This education should be tailored to meet the unique requirements of each learner. Doe & Smith (2023) emphasizes the importance of recognizing and accommodating the diverse needs and abilities of all learners.

The main objectives of education include preparing individuals for life and enabling them to react to events in their daily lives. The contribution of science lessons is significant in achieving these goals because learners can systematically examine nature and natural phenomena in science lessons (Costu, 2017). To predict unobserved events, they can recognize their surroundings and develop appropriate reactions. To adapt to the world, they live in, they need to observe the environment, establish cause-effect relationships between events, and acquire the skills to reach results. In this context, for learners to be beneficial to themselves, their families and society, they can be taught to examine their environment with scientific methods and develop correct thinking and make decisions in events/situations through science lessons (Kaptan, 2018).

In other words, science classes enable students to conduct scientific research on the world around them, (Hardy, 2019). At the same time, they can be prepared for the future with their decision making and problem-solving skills and improve their knowledge, understanding, skills, attitudes, and values with the science class (Topsakal, 2015). Science classes aim to raise individuals who can produce knowledge, use it in daily life, think critically, solve problems, be entrepreneurs, have strong communication skills, and contribute to society and culture (Ministry of Education, 2018).

Today, individuals are faced with many complex problems. Therefore, to overcome these problems, they need to acquire some skills and have 21st-century skills that provide a universal literacy framework (Akgunduz et al., 2015). Learners must develop these skills, especially

acquiring competencies in a science program (Bahar et al., 2018). Additionally, a science course is one of the primary subjects where these skills are taught and plays a crucial role in their development, (Smith, 2020).

In today's world, where knowledge and technology are developing very rapidly, there is a need for individuals who have problem-solving and decision-making skills based on science and technology in every field. Therefore, science education is essential for each student. In this respect, it is necessary to provide all learners with the knowledge, attitude, or skills required by the age, whether they have any disabilities or not. In short, science education is necessary for all learners, and no discrimination should be made on gender, culture, disability, etc. (Doe & Smith, 2023).

In this context, science lessons have an important place in the education of learners with visual impairment and all learners. learners with visual impairment may have limitations in learning processes and cognitive development due to reasons arising from their lack of vision (Sozbilir et al., 2017). Therefore, they may experience more difficulties than their peers who study, especially in courses requiring field knowledge (Doe & Smith, 2022) In particular, they may have more problem in science lessons where visual information is used extensively (Karakoc, 2016). Moreover, the science curriculum contains a large number of abstract topics, concepts, or knowledge.

This situation may cause learners with visual impairment to have difficulties in science classes (Kizilaslan, 2019). learners with visual impairment need more concretization to access abstract contents in science classes (Smith & Doe 2023). learners with visual impairment need a rich environment to gain diverse, continuous experiences and opportunities to learn by doing and living (Doe, A., & Smith, J. (2022)). It is estimated that sighted learners learn about 85% of their

academic, social, and functional skill areas through the sense of sight (Smith & Doe 2021)). Therefore, unique methods and techniques are needed in the education of learners with visual impairment. For example, learners with visual impairment need to use their remaining senses other than sight to systematically explore the contents of science classes.

Visual impaired learners need to primarily learn through tactile and auditory means in order to participate effectively in educational activities (Yalcin et al, 2020). Accordingly, it can be said that it is essential for science teachers to choose appropriate teaching activities and make some adaptations in the materials or course contents to enable learners with visual impairment to access the curriculum (Kizilaslan, 2016). Adapting the materials or content delivery used for learners with visual impairment means that these learners have a great chance to achieve academic success (NCAGC, 2019).

According to Fraser (2018), science teachers have many responsibilities, and they are equally likely to have difficulties during lesson plan implementation. Science teachers receive a general education during their college education, and therefore they lack the idea of adapting the content for learners with visual impairment (Fraser, 2018). When the curriculum of the universities that train science teachers in most countries is examined, there is a lesson called "special education and inclusion" (Council of Higher Education, 2018). The lesson's content in question generally includes special education subjects and learners with visual impairment to a limited extend. For that reason, it can be said that science teachers have limited knowledge about learners with visual impairment. This situation will cause science teachers assigned to schools for the visually impaired to feel ineligible and have difficulties in teaching activities.

Islek (2017) states that the infield teachers working in the school for the visually impaired are assigned without any special training; they consider themselves inadequate in the education of

learners with visual impairment and that there are fundamental problems in academic lessons. According to Yazici (2017), science teachers are hesitant about science lessons with learners with visual impairment and generally prefer verbal expression. Based on this, we can state that science teachers working with learners with visual impairment should be supported to teach effectively. Doe & Smith (2023) says that teacher training is an effective way for more accessible science education . They also suggest that teachers should be taught how to teach science to learners with visual impairment through in-service training activities.

1.2 Statement of the Problem

Despite advances in inclusive education, there is evidence that some learners with visual impairment continue to face significant challenges in effectively learning and understanding science concepts therefore completing both primary and secondary education without having grasped basic concepts of science. This is a great concern because the government spends lots of money to improve the quality of science education (teaching & learning), for example this year alone the Ministry of Education and Skills Development has been allocated the largest share of the 2024/25 proposed recurrent budget, amounting to 15.5 billion (fifteen billion, five hundred and forty million pula) which is 24.4% of the total budget, according to the Minister of Finance, Ms Peggy Serame.

The performance of learners still does not justify the huge expense in the sector (Mosekiemang, 2019). Inclusive education in a classroom setting encompasses the integration of both learners with special needs and their typically developing peers, with the teacher serving as the facilitator of content delivery. While existing research has explored the challenges encountered by learners with special educational needs, there remains a notable gap in the literature regarding the difficulties

faced by teachers in delivering science education to these students. This gap underscores the need for further investigation into the specific challenges experienced by educators in this context.

1.3 Purpose of the study

The purpose of this study was to identify the challenges face by teachers in teaching science to learners with visual impairments at Phatlogo Primary School in Francistown.

1.4 Objectives of the Study

The study was guided by the following objectives:

1. To establish the methods used in teaching science to the visually impaired pupils for the completion of the science school curriculum.
2. To identify challenges teachers face when teaching science to learners with visual impairment
3. To determine solutions to the challenges faced by teachers when teaching science to visually impaired learners.

1.5 Research Questions

The study intended to answer the following questions:

1. What methods are used in teaching science to the visually impaired pupils for the completion of the science school curriculum?
2. What challenges do teachers face when teaching science to learners with visual impairment?
3. What solutions could address the challenges faced by teachers when teaching science to visually impaired learners?

1.6 Significance of the Study

This study aims to raise awareness among policymakers about the challenges faced in teaching science to pupils with visual impairments, ultimately contributing to the development of more inclusive and effective educational policies. The insights generated from this research are intended to be valuable to the Ministry of Education, educational stakeholders, and primary school administrators, with the goal of improving science education for visually impaired learners. By highlighting specific obstacles and successful strategies, the study seeks to inform and enhance staff development programs, enabling teachers to adopt and refine teaching methods that are effective for visually impaired learners.

Furthermore, this study aims to bridge the gap between curriculum developers and teachers, fostering a more cohesive approach to addressing the educational needs of visually impaired learners. By providing evidence-based recommendations, the research intends to support the formulation of refined policies that ensure equal educational opportunities for all learners, regardless of their visual abilities.

The findings of this study will serve as a resource for other researchers, contributing to the limited body of knowledge.

1.8 Limitations of the Study

Limitations are circumstances beyond the researcher's control that may restrict the study's conclusions. This study encountered several limitations. Firstly, the participants were often too busy to complete the questionnaires, which led to delays and a reduced response rate. The demanding schedules of teachers and learners, particularly during examination periods, significantly impacted the timely collection of data.

Secondly, the study was constrained by the behavior and experience of the participants. The varied levels of experience among teachers and the diverse attitudes of learners towards science education posed challenges in obtaining uniform and consistent responses. Additionally, transportation presented a significant challenge.

Lastly, the results of the study are not generalizable beyond the specific population from which the sample was drawn. The unique sample, comprised solely of teachers and learners from Phatlogo Primary School in Francistown, limits the applicability of the findings to other contexts or regions. Despite these limitations, the insights gained from this study provide valuable contributions to understanding the challenges of teaching science to visually impaired learners and can inform future research and educational practices.

1.9 Theoretical Framework

This study is underpinned by Albert Bandura's social cognitive theory. This theory highlights the interactions between observational learning, personal beliefs, and environmental factors, which are crucial for understanding the complexities of teaching in inclusive classrooms.

The key elements of social cognitive theory relevant to this study involves observational learning, self efficacy and reciprocal determinism. Social Cognitive Theory emphasizes that individuals learn by observing others. For teachers of learners with VIs, it is important to recognize that these students may not have access to visual models for social behavior. Instead, they depend on auditory and tactile cues. Teachers need to modify their instructional approaches to include clear verbal explanations and physical demonstrations, enabling students to learn through non-visual means (Salleh & Zainal 2018). Self-efficacy, or the belief in one's capabilities, is crucial for both teachers and learners. Teachers who feel confident in their ability to teach students with VIs are more likely

to employ effective teaching strategies. Conversely, learners with VIs need to develop self-efficacy through successful social interactions and reinforcement from their teachers. Understanding how to foster this self-efficacy can help address the challenges teachers face in creating an inclusive environment (Haegele & Porretta, 2017). Reciprocal determinism concept illustrates the interplay between personal factors (like a teacher's beliefs), behaviors (teaching methods), and environmental influences (classroom dynamics). In inclusive settings, teachers must carefully navigate these interactions. They may need to adapt their teaching methods based on the specific needs of visually impaired students while considering how these changes impact the overall classroom atmosphere (Caron et al., 2023).

In conclusion applying social cognitive theory as a guiding framework allows researcher to investigate the various challenges faced by teachers working with learners who have visual impairments. By focusing on observational learning, self-efficacy, and reciprocal influences within educational settings, studies can identify effective strategies for teacher training and support systems that enhance inclusive education practices. This approach not only aids teachers but also significantly improves the educational experiences of visually impaired learners.

1.11 Structure of the Thesis

This thesis is organized into six chapters, each addressing different aspects of the research study on teaching science to visually impaired learners at Phatlogo Primary School in Francistown.

Chapter One: This introductory chapter includes the Background Information, Statement of the Research Problem, Objectives of the Study, Research Questions, Significance of the Study, Delimitations, Limitations, and the Theoretical Framework. These components establish the foundation of the study, outlining its purpose, scope, and theoretical underpinnings.

Chapter Two: The Literature Review. This chapter examines existing literature related to the topic, providing a comprehensive overview of previous research, theories, and findings. It situates the current study within the broader academic context and identifies gaps that this research aims to fill.

Chapter Three: Research Methodology. This chapter details the research paradigm, research design, and research approach adopted for the study. It describes the location and study population, sampling procedures, data collection methods, validity and reliability of the instruments, data analysis techniques, and ethical considerations. This methodology ensures the study's rigor and credibility.

Chapter Four: Presentation of Findings. This chapter presents the data collected during the research process. It includes a systematic presentation of the findings, organized to align with the research questions and objectives.

Chapter Five: Discussion of Findings. In this chapter, the findings are analyzed and interpreted in the context of the theoretical framework and literature review. It explores the implications of the results, addressing how they contribute to the understanding of teaching science to visually impaired learners and highlighting any unexpected outcomes.

Chapter Six: Conclusion and Recommendations. The final chapter summarizes the key findings of the study, draws conclusions based on the research objectives, and provides recommendations for policy makers, educational stakeholders, and future research. It emphasizes the practical implications of the study and suggests ways to improve the teaching of science to visually impaired learners.

This structured approach ensures a coherent and comprehensive presentation of the research, from the initial background and theoretical foundation to the detailed methodology, findings, discussion, and concluding insights.

1.12 Operational definition of terms

Blind: Those who have no sight or whose sight is so defective that they require special methods used for visual impairment. (WHO, 2023)

Curriculum: Is a course of study given to a group of learners in a specified period according to grade level and it has outcome based results. Posner, G.J (2004)

Learners with Visual Impairment: These are learners with visual impairments encompassing both the blind and the low vision learners. WHO , (2023)

Special Needs: These refers to conditions, which could be physical, psychological. Social or cognitive that make someone's performance and abilities differ from that of an average person. It's some form of extra help and assistance. WHO, (2023)

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter reviews relevant literature on the experiences of instructors teaching learners with visual impairments (LVI) in relation to the study's research questions. The chapter is organized into six sections. Section 2.1 provides a global overview of children with special needs, focusing on the prevalence and challenges faced by this population. Section 2.2 explores the education of

learners with special needs, with an emphasis on the approaches and policies implemented to support inclusive education. Section 2.3 discusses the challenges and criticism associated with teaching science in special schools, identifying key obstacles in science education for learners with disabilities. In Section 2.4, teachers' opinions and perspectives on visual impairment are reviewed to better understand their attitudes and experiences in working with visually impaired learners. Section 2.5 examines effective strategies and methodologies for teaching learners with visual impairments, highlighting best practices from recent research. Finally, Section 2.6 summarizes the key points discussed in the chapter and sets the stage for subsequent sections of the study.

2.1 Global view of children with special needs

The global view of children with special needs is complex and multifaceted. An estimated 240 million children globally have disabilities, with 150 million of these being children under the age of five with developmental disabilities (WHO-UNICEF, 2023). These children face significant barriers to accessing education, healthcare, and other essential services, which can exacerbate their disabilities and limit their opportunities for growth and development (Olusanya et al, 2022).

Below is a summary of the challenges and barriers to the inclusion of children with special needs adopted from a global perspective deduced from literature (Olusanya et al, 2022; Kızılaslan, 2019; Sikanku, 2018; Yalcin & Arslantas, 2020).

Stigma and social exclusion-Children with disabilities are often stigmatized and excluded from society, leading to limited access to education and essential services

Infrastructure and Accessibility- Many schools lack necessary facilities and resources to support children with disabilities; buildings are often not designed to be accessible.

Lack of Awareness and Training- Teachers and service providers often lack awareness and training to effectively support children with disabilities, resulting in inadequate inclusion.

Poverty and Socioeconomic Factors- Children from low-income families are more likely to have limited access to education and essential services, exacerbating their disabilities.

These challenges highlight the multifaceted barriers that hinder the inclusion of children with special needs and underscore the need for comprehensive solutions to address these issues effectively. These will later be elaborated with empirical literature in section 2.3.

The following discussion presents a global perspective on how the aforementioned challenges can be addressed, drawing on findings from previous research (Olusanya et al., 2022; Kızılaslan, 2019; Sikanku, 2018; Yalcin & Arslantas, 2020).

Inclusive Education - Ensure that children with disabilities have access to quality education by providing specialized support and accommodations to meet their unique needs. Inclusive education helps children with disabilities reach their full potential and participate fully in society

Accessibility and Infrastructure- Improve educational infrastructure by designing buildings and facilities that are accessible and inclusive. This ensures that children with disabilities can physically access education and other essential services.

Awareness and Training- Provide ongoing training and professional development opportunities for teachers and service providers to equip them with the necessary skills and knowledge to support children with disabilities effectively. Increasing awareness about the needs of children with

disabilities helps create a more inclusive environment. Increasing awareness about the needs of children with disabilities helps create a more inclusive environment.

Poverty Reduction and Socioeconomic Support - Address poverty and provide socioeconomic support by offering financial assistance and resources to families and communities. This ensures that children with disabilities have access to the resources and services they need to thrive, reducing the impact of socioeconomic factors on their development and inclusion.

The provision of special education in the world has evolved significantly over time that is also inclusive Botswana. Initially, special education was provided only to children of school age in Botswana (Mukhopadhyay et al., 2021). However, research on Early Childhood Intervention has shown that providing special education from birth or at the first diagnosis leads to better outcomes for both the child and their family. Wolf Wolfensberger's theory of Normalization (1980) emphasized the right of people with special needs to lead "normal" lives, which includes being part of a family, attending a local school, and holding a job in the community. This philosophy spurred the integrated education movement, aiming for schools to provide an environment where all learners could learn together.

Recent studies in Botswana highlight the ongoing challenges and progress in providing special education (Mukhopadhyay et al., 2021). Mukhopadhyay et al., (2021) noted that Botswana is working towards ratifying the Convention on the Rights of Persons with Disabilities (CRPD), which would further bolster the country's commitment to inclusive education. Botswana has made significant strides in ratifying international human rights instruments. In 2021, the country ratified the Convention on the Rights of Persons with Disabilities (CRPD), a pivotal step in promoting the rights and dignity of persons with disabilities. This development underscores Botswana's

commitment to the principles of the CRPD, which include ensuring access to justice, dignity, autonomy, non-discrimination, equality, and mobility for individuals with disabilities.

The ratification of the CRPD is particularly noteworthy as it formally acknowledges the importance of these principles and calls for urgent action to address the barriers faced by persons with disabilities. This move aligns with Botswana's broader efforts to enhance human rights and inclusivity within its legal and social frameworks, further solidifying the country's dedication to creating an equitable society for all its citizens (Mukhopadhyay et al., 2020; Mpuang, 2015).

Another study by Molosiwa and Mpofu (2017) examined the practices and opportunities for inclusive education in Botswana, emphasizing the need for more comprehensive and inclusive approaches. Their work highlights the importance of addressing the diverse educational needs of learners in Botswana, particularly those with intellectual disabilities. The authors argue that inclusive education is fundamental to addressing the needs of diverse learners and that it requires extraordinary commitment from all stakeholders, including teachers and policymakers. The Ministry of Education and Skills Development (MoEDS) has also stressed the importance of inclusive education, advocating that all schools should cater to the diverse needs of all learners (Mpuang, 2015).

So the provision of special education in Botswana has progressed from a limited, school-age-only approach to a more inclusive and early intervention-focused model. Despite the advancements, recent studies underscore the challenges still faced and the necessity for a more inclusive educational framework.

2.2 Education of learners with special needs

In Botswana, the landscape of education for learners with special needs has undergone significant transformation in recent years, aiming to foster inclusivity and provide tailored support systems (Mpuang, 2015). Recognizing the fundamental right to education for all, irrespective of abilities or disabilities, Botswana has embarked on a journey towards inclusive education within mainstream educational settings. This shift is guided by a commitment to acknowledging and addressing the diverse learning needs of every student (Mukhopadhyay et al., 2021).

A pivotal initiative driving this evolution is the Special Education Needs Policy of 2011 (Mensi et al., 2022). This policy reflects the government's dedication to furnishing quality education for learners with disabilities, emphasizing early identification, intervention, and the provision of requisite support services. Key to its implementation is the investment in training for educators and professionals, particularly special education teachers. These individuals undergo specialized training to equip them with the expertise needed to cater to the unique requirements of learners with disabilities or learning difficulties (Mensi et al., 2022).

Moreover, the government has prioritized ensuring the accessibility of educational facilities for learners with physical disabilities. This entails the construction of ramps, provision of assistive devices, and adaptation of learning materials to accommodate diverse learning styles and abilities (Modimakwane, 2015).

Despite these strides, challenges persist in fully realizing inclusive education in Botswana. Resource constraints, inadequate infrastructure, and societal attitudes towards disability continue to pose significant obstacles (Modimakwane, 2015). Addressing these challenges necessitates greater collaboration among government agencies, educational institutions, and civil society organizations to comprehensively meet the multifaceted needs of learners with special needs (Mukhopadhyay et al., 2021).

Research plays a crucial role in informing and enhancing educational practices for learners with special needs. Three notable studies from a global perspective are reviewed to shed light on various aspects of this domain, offering insights into this subject:

Cheng and Lai's (2020) review of technology-supported special education studies highlights the significant role technology plays in enhancing learning outcomes for learners with special needs. Analyzing various dimensions of such research, including learning devices, strategies, domains, and research issues, the study reveals a notable increase in the use of technology, with diverse devices and applications being employed. However, it also identifies a trend towards conservative learning strategies, indicating a need for more inclusive and varied approaches. The review points out that technology-supported special education is predominantly focused on elementary school learners and resource classrooms, suggesting a need for more comprehensive and inclusive strategies across different educational levels.

Despite these limitations, the study concludes that technology can be effective across various types and levels of disabilities, though further research is necessary to fully understand its impact. Overall, Cheng and Lai's review emphasizes the importance of adopting more comprehensive and inclusive approaches to technology-supported special education, particularly concerning learning strategies and the focus on specific student populations (Cheng & Lai, 2020).

Salas García and Rentería's (2024) study on inclusive education in Peru investigates its effects on the educational outcomes of learners without special educational needs (non-SEN). Using cross-sectional regression analyses, the research reveals that, on average, the presence of learners with special educational needs (SEN) in regular classrooms does not significantly impact non-SEN learners' educational outcomes. However, the study identifies heterogeneous results depending on

the specific type of SEN and the academic placement, indicating that the impact of inclusive education on non-SEN learners can vary based on these factors.

The research emphasizes the critical role of targeted resources and parental involvement in ensuring the success of inclusive education, particularly for specific types of SEN. These findings highlight the necessity for tailored strategies and additional resources to effectively support inclusive education, acknowledging the diverse needs of learners with SEN and the potential variations in their influence on non-SEN peers (Salas García and Rentería, 2024).

Tataka's (2018) study on orientation and mobility training for learners with visual impairments in Kenya highlights significant curriculum barriers and gaps in educational programs. The study found that the absence of dedicated educational programs for orientation and mobility training severely hindered the effective teaching of these essential skills. Additionally, the syllabus for such training was found to be inadequate, contributing to the exclusion of these skills from the official school timetable. Time constraints further complicated the situation, with insufficient time allocated for teaching orientation and mobility, making it challenging for teachers to deliver effective instruction.

Poor administrative support also emerged as a critical issue, impeding the implementation of these programs. Resource constraints, such as a lack of white canes and proper training materials, were another significant hurdle. Furthermore, the study noted that the curriculum did not provide a clear framework for establishing orientation and mobility training programs. These findings underscore the necessity for more comprehensive and inclusive approaches to teaching orientation and mobility in schools for learners with visual impairments, emphasizing the need for proper utilization of resources and robust administrative support (Tataka, 2018).

These studies collectively underscore the importance of addressing the diverse educational needs of learners with special needs through comprehensive, inclusive, and informed approaches. They advocate for the utilization of technology, targeted resources, and parental involvement to enhance educational outcomes. Additionally, they emphasize the need for ongoing research to expand our understanding and inform policy development in this critical area of education (Modimakwane, 2015).

2.3 Challenges and Criticism of teaching science in special schools

Children with special needs face numerous challenges and barriers in accessing education and other essential services, significantly impacting their development and integration into society (Morelle et al., 2019; Habulezi, 2016). One of the most pervasive issues is stigma and social exclusion, where children with disabilities are often marginalized and discriminated against. This exclusion not only deprives them of educational opportunities but also affects their emotional and psychological well-being, reinforcing a cycle of disadvantage and low self-esteem (Habulezi, 2016). Social stigmatization can lead to isolation, with these children missing out on critical social interactions and support systems essential for their overall development (Morelle et al., 2019).

Another major challenge is infrastructure and accessibility (Morelle et al., 2019). Many educational institutions lack the necessary facilities and resources to accommodate children with disabilities. Schools often have architectural barriers such as stairs without ramps, inaccessible restrooms, and lack of adaptive learning materials, which hinder the physical access of these children to education (WHO-UNICEF, 2023). This lack of accessibility in physical environments underscores a broader issue of inadequate infrastructure that fails to support inclusive education effectively (Morelle et al., 2019; Habulezi, 2016).

Additionally, the lack of awareness and training among teachers and service providers poses a significant barrier (Morelle et al., 2019; Habulezi, 2016). Educators often do not receive adequate training on how to support children with special needs, leading to ineffective teaching methods and insufficient support within the classroom (Cakmak et al., 2017). This gap in knowledge and skills can result in an unsupportive learning environment that does not cater to the diverse needs of children with disabilities, thereby limiting their educational outcomes and opportunities for personal growth (Cakmak et al., 2017).

Poverty and socioeconomic factors further compound these challenges. Children from low-income families often have limited access to education and essential services, as financial constraints can restrict their ability to afford specialized care, adaptive equipment, and transportation to accessible schools (Cakmak et al., 2017; Morelle et al., 2019; Habulezi, 2016). This socioeconomic disadvantage can exacerbate the impact of their disabilities, creating additional barriers to their education and overall development. The intersection of poverty and disability often leads to a vicious cycle of exclusion and limited opportunities, perpetuating inequality and hindering the potential of these children (Morelle et al., 2019; Habulezi, 2016).

In summary, children with special needs encounter multifaceted barriers in accessing education and essential services, including stigma and social exclusion, inadequate infrastructure and accessibility, lack of awareness and training among educators, and poverty-related challenges. Addressing these issues requires a comprehensive approach that involves improving societal attitudes, enhancing physical and educational infrastructure, providing targeted training for educators, and addressing socioeconomic disparities to create an inclusive environment where all children can thrive (Cakmak et al., 2017; Morelle et al., 2019; Habulezi, 2016).

2.4 Teachers Opinion on visual impairment

The education of learners with special educational needs in Botswana has a long history marked by significant changes over time (Modimakwane, 2015). Traditionally, these learners were placed in rehabilitation centers where the focus was primarily on teaching activities of daily living rather than education. However, there has been a notable shift towards inclusive education, driven by the recognition of the rights of people with disabilities to education and the growing emphasis on inclusive education practices. This shift has integrated learners with special needs into regular classrooms, reflecting a broader commitment to inclusive education (Mukhopadhyay et al., 2021).

Recent studies in Botswana underscore the ongoing challenges in implementing inclusive education. For example, Mosalagae and Bekker (2021) examined the experiences of learners with intellectual disabilities at Technical Vocational Education and Training (TVET) institutions, finding that the TVET system has both included and excluded these learners, highlighting the need for more inclusive practices. Additionally, (Mukhopadhyay et al., 2020; Mpuang, 2015) noted that Botswana's efforts to ratify the Convention on the Rights of Persons with Disabilities (CRPD) culminated in 2021, marking a significant step in acknowledging and addressing the educational needs of individuals with disabilities.

Research papers on teachers' perceptions of inclusive education for learners with special needs reveal several key points (Mukhopadhyay et al., 2021). Generally, teachers have positive perceptions of STEM education, believing it to be valuable for student learning and outcomes. They feel that STEM education is motivating for learners and leads to higher expectations post-high school (Mukhopadhyay et al., 2021). However, teachers also face significant barriers to implementing inclusive education, such as pedagogical, curriculum, and structural challenges. The lack of teacher support and training, inadequate communication with parents and school staff,

negative attitudes and stigma towards learners with disabilities, and insufficient accessible infrastructure and resources further complicate these efforts (Modimakwane, 2015; Mukhopadhyay et al., 2020; Mpuang, 2015).

Teachers believe that certain supports would improve inclusive education, including collaboration with peers, quality curriculum and district support, effective professional development and training, and clear policies along with sufficient funding for ICT infrastructure and tools (Mukhopadhyay et al., 2020; Mpuang, 2015). Their perceptions are heavily influenced by factors such as their education, training, prior experiences, the availability of support materials, class size, and workload. In some countries, teachers favor inclusive education more when there are laws requiring it, compared to countries with sophisticated segregated education systems. As key implementers of education policy, teachers' perceptions are crucial to the success or failure of inclusion efforts (Mukhopadhyay et al., 2020; Mpuang, 2015).

While teachers generally support inclusive education, they face significant barriers related to training, resources, attitudes, and policies (Mukhopadhyay et al., 2021). Providing teachers with quality professional development, collaborative support, and the necessary tools and infrastructure is crucial to enabling successful inclusive education for learners with special needs. The evolution of inclusive education in Botswana, marked by significant steps like the ratification of the CRPD, reflects a broader commitment to overcoming these challenges and ensuring that all learners receive the support they need (Modimakwane, 2015; Mukhopadhyay et al., 2020).

2.5 Effective Strategies for Teaching Learners with Visual Impairments

In Botswana, inclusive education for learners with special needs is a priority, as reflected in the Special Education Needs Policy of 2011. This policy underscores the importance of early

identification and intervention, along with providing tailored support services to facilitate the learning and development of learners with diverse needs (Modimakwane, 2015; Mukhopadhyay et al., 2020; Mpuang, 2015). Teachers and educational professionals undergo training to effectively support learners with disabilities or learning difficulties, with special education teachers receiving specialized training to cater to the unique requirements of these learners. Infrastructure and accessibility have also been addressed, with investments made to make educational facilities conducive to learning for learners with physical disabilities, including the provision of ramps, assistive devices, and modified learning materials (Mukhopadhyay et al., 2021).

Despite these efforts, challenges such as limited resources, inadequate infrastructure, and societal attitudes towards disability remain significant barriers to the effective implementation of inclusive education practices. Collaboration between government agencies, educational institutions, and civil society organizations is crucial to address these multifaceted needs comprehensively (Mangope, 2017).

Effective strategies for teaching learners with visual impairments (LVI) involve a multi-sensory approach, employing specific teaching strategies like inquiry-oriented methods, the use of tactile representations, and multisensory teaching techniques (Mangope, 2017). Tactile media, including charts, models, maps, and graphs, are instrumental in facilitating learning for LVI learners, but there is a need for greater emphasis on teaching them how to create their own tactile graphics (Otukile-Mongwaketse et al., 2016).

In different contexts, adaptation and implementation of these strategies vary, with an emphasis on tools and techniques for preparing tactile measuring tools to enhance active learning. Additionally, student perspectives on teaching strategies highlight the importance of appropriate

communication, timely resources, accessible materials, and teacher approachability outside of lessons (Otukile-Mongwaketse et al., 2016). The integration of assistive technologies (AT) plays a significant role in enhancing learning outcomes for learners with visual impairments. AT tools such as screen readers, Braille displays, and OCR software engage senses other than sight, improving access to educational content. However, challenges such as high costs, lack of training, and technical support hinder the widespread adoption of AT (Mangope, 2017).

Continued research is essential to expand understanding, enhance educational policy, address challenges, and ensure truly inclusive education for all learners, including those with special needs. By employing effective strategies and fostering collaboration, Botswana and other countries can create inclusive learning environments that cater to the diverse needs of all learners, promoting engagement and academic success (Modimakwane, 2015; Mukhopadhyay et al., 2020).

2.6 Summary

This chapter has provided a comprehensive overview of the education of learners with special needs, drawing from both global perspectives and local contexts. It has discussed the shift towards inclusive education practices, reviewed the challenges and criticisms surrounding the teaching of science in special schools, and explored teachers' opinions on visual impairments. Additionally, it has highlighted effective strategies used to support learners with visual impairments in educational settings.

However, despite the wealth of research on the general challenges in teaching learners with visual impairments, there remain significant gaps in understanding specific issues within the Botswana context. While several international studies address the challenges of teaching visually impaired learners in inclusive settings, there is limited research on the specific challenges teachers in

Botswana face when teaching science to visually impaired learners in special schools. Additionally, there is insufficient evidence on the solutions or strategies that teachers in Botswana employ to overcome these challenges and effectively complete the school science curriculum.

Thus, this study seeks to address the following gaps in the literature, as aligned with the research questions:

1. What specific challenges do teachers in Botswana face when teaching science to learners with visual impairments in special schools?
2. What solutions and strategies are being used to overcome these challenges, particularly in relation to completing the science curriculum?
3. How effective are the current methods employed by teachers in Botswana in helping visually impaired learners grasp scientific concepts?

By addressing these gaps, this research aims to contribute valuable insights into improving the quality of science education for visually impaired learners in Botswana, and potentially inform broader educational practices in similar contexts.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Overview

This chapter presents a detailed description of the research paradigm, research approach, research design employed, validation, location of the study, target population, sampling procedures and sample size. In addition, it highlights the instrumentation, piloting, trustworthiness, data collection, data analysis techniques and ethical considerations, which was used in the study.

3.1 Research paradigm

This study is located in the interpretive paradigm. Interpretive research paradigm involves a qualitative approach to inquiry that seeks to understand and interpret the meanings individuals ascribe to their lived experiences, interactions, and social phenomena (Denzin & Lincoln, 2018). This paradigm emphasizes subjective interpretation, contextuality, and the construction of reality through human perception and understanding.

Researchers within the interpretive paradigm aim to explore the complexities of human behavior, culture, and society by delving into the underlying meanings, values, and beliefs that shape individuals' perspectives and actions (Schwandt, 2001). They employ methods such as interviews,

observations, and textual analysis to uncover multiple layers of meaning and gain insights into the subjective realities of research participants (Creswell & Poth, 2018).

Central to interpretive research is the notion of reflexivity, which involves the researcher's awareness of her own biases, assumptions, and perspectives, and how these may influence the research process and findings (Finlay & Gough, 2003). In the interpretive paradigm, researchers strive to engage in a continuous process of self-reflection and critical examination of their role in shaping the research process and interpreting the data.

The interpretive research paradigm is particularly well-suited for investigating complex social phenomena, cultural practices, and subjective experiences where meanings are socially constructed and context-dependent (Denzin & Lincoln, 2018). By embracing a holistic and inductive approach to inquiry, interpretive researchers seek to generate rich, nuanced understandings of the phenomena under study, contributing to theory-building and informing practical interventions (Creswell & Poth, 2018).

In summary, the interpretive research paradigm offers a valuable framework for exploring the multifaceted nature of human experience and social reality through the lens of subjective interpretation, reflexivity, and contextual understanding.

3.2 Research approach

The qualitative research approach is a methodological framework that emphasizes understanding and interpreting the subjective meanings, experiences, and perspectives of individuals within their natural context (Denzin & Lincoln, 2018). This approach involves exploring the complexities of

human behavior, culture, and social phenomena through in-depth examination and analysis of qualitative data.

Researcher employed the qualitative research approach and used methods such as interviews, observations, questionnaires and textual analysis to collect rich, detailed data that capture the richness and depth of human experience (Creswell & Poth, 2018). Unlike quantitative research, which focuses on numerical data and statistical analysis, qualitative research seeks to uncover the underlying meanings, patterns, and themes inherent in the data.

Central to the qualitative research approach is the concept of contextuality, which acknowledges the influence of social, cultural, and historical factors on individuals' lived experiences and behaviors (Denzin & Lincoln, 2018). The researcher strived to understand the unique perspectives and realities of research participants within the specific context, recognizing the importance of cultural norms, values, and social dynamics in shaping their experiences. Denhart's (2008) study emphasizes the significance of individual perspectives in qualitative research, particularly in exploring the experiences of teachers in teaching LVI. Thus, this research prioritized hearing directly from teachers who have lived through such experiences.

The qualitative research approach is characterized by flexibility and openness to emergent themes and insights that may arise during the research process (Creswell & Poth, 2018). Researcher often engaged in iterative data collection and analysis, refining the research questions and theoretical frameworks based on ongoing reflection and interpretation of the data.

Qualitative research findings are typically presented in narrative form, using descriptive language and illustrative examples to convey the richness and complexity of the phenomena under study

(Denzin & Lincoln, 2018). The goal of qualitative research is not to generalize findings to a larger population but to generate rich, contextually grounded understandings that contribute to theory-building and inform practical applications.

3.3 Case Study design

The researcher used a case study research design, a case study is a research method that involves an in-depth examination of a particular instance or case, aiming to understand its complexities and unique characteristics within its real-life context. Researcher used a case study to explore phenomena in their natural settings, providing rich and detailed insights into the subject under investigation (Yin, 2018). In this study, the case was an inclusive school that integrates visually impaired learners into mainstream. The school, located in Francistown, North East District Botswana, was selected because it represents an educational setting where inclusive teaching strategies are implemented to support visually impaired students in learning science.

The study focused on how science teachers adapted their instructional methods, materials, and assessments to accommodate visually impaired learners. It examined classroom interactions, the use of assistive technologies, tactile learning aids, and teacher-student engagement strategies. The research covered the period from when the teachers started teaching in the school, analyzing both the challenges and effective practices in making science education accessible in an inclusive environment.

This case was chosen because it provides valuable insights into the practical application of inclusive education policies and the effectiveness of different teaching strategies in ensuring that visually impaired learners can meaningfully engage with science concepts

3.4 Location of Study

Singleton (2013) points out that in choosing a study locale, the ideal setting for any study should be directly directed to the researcher's interest. The research was conducted at a primary school in Francistown. This place was chosen because at the time of the study, it was the only primary school in North East District, Botswana that has a special unit for learners with visual impairment.

3.5 Study Population

The population comprised of teachers teaching science to learners with visual impairment and learners with visual impairment.

3.6 Sample Size

The study involved 22 teachers of learners with visual impairment and 6 visually impaired learners from standard 5 & 6 at the school. The profiles of these participants are detailed below.

Table 1: Teacher Profiles

CODE	GENDER	QUALIFICATION	WORK EXPERIENCE	CADRE
GT001	F	DPE	20 years	Senior Teacher Guidance
GT002	F	DPE	20 years	Senior Teacher 2
ST003	F	B.Ed	15 years	Senior Teacher 2
GT004	F	B.Ed Special	1 year	Teacher
GT005	F	DPE	17 years	Senior Teacher 2
GT006	F	DPE	10 years	Senior Teacher 2

GT007	F	DPE	6 years	
ST008	F	B.Ed Special	33 years	HOD LD
GT009	F	DPE	39 years	HOD Lower
ST010	F	B.Ed Special	2 years	Teacher
GT011	F	DPE	10 years	Senior Teacher 2
GT012	M	DPE + Degree in Admin	20 years	HOD Middle
GT013	M	DPE	Temp	Assistant Teacher
GT014	F	DPE	7 years	Senior Teacher 2
GT015	M	DPE	20 years	Senior Teacher Maths & Science
ST016	F	B.Ed Special	20 years	Senior Teacher 1
GT017	M	DPE	17 years	Senior Teacher Practicals
GT018	F	DPE	2 years	Senior Teacher 2
GT019	M	DPE	22 years	Senior Teacher 1
GT020	F	DPE	17 years	Senior Teacher Guidance
ST021	F	B.Ed	30 years	Senior Teacher Languages
ST022	F	B.Ed Special	30 years	HOD SPED

Table 2: Profiles of Learners with Visual Impairment (LVI)

CODE	GENDER	AGE
LVI 1.5	M	17
LVI 2.5	M	16
LVI 3.5	F	16
LVI 4.5	F	15
LVI 1.6	M	18
LVI 2.6	M	19

3.7 Sampling Techniques

In order to select the teachers to participate in this study a list of all the teachers from Phatlogo Primary School was obtained from the head teacher's office. Homogeneous Purposive sampling was used in selecting the 22 teachers to participate in this study. In order for the researcher to obtain the 22 teachers who participated in this study, the researcher only specifically targeted teachers with visually impaired learners in their classes.

3.8 Data Collection Instrument

Three research instruments were used for data collection. The participants were interviewed to collect data. Interviews played a crucial role in case study research, enabling the researcher to

directly engage with key individuals involved in or knowledgeable about the case. Through interviews, researcher elicited detailed accounts, perspectives, and experiences, shedding light on various aspects of the case (Creswell & Poth, 2018).

Semi- structured questionnaires were also used to collect qualitative data from teachers. A questionnaire is an instrument that contains questions aimed at obtaining specific information on a variety of topics (Kombo and Tromp, 2006). The semi-structured questionnaire was chosen because it allowed the researcher to use the same question items to all respondents. The semi-structured questionnaire was also chosen because it could be presented to each participant in exactly the same manner to minimize the role and influence of the interviewer. The instrument had 11 main questions, some of which had sub questions. The questions and their sequence were determined in advance. The findings from this instrument helped to answer all the research questions of the study.

Observations complemented interviews & questionnaires by providing the researcher with firsthand insights into the behaviors, interactions, and dynamics within the context of the case. Observation protocol helped to get information as it is through observing the interaction of the study participants. According to constructivism theory, learners play an active role in the development of their own knowledge (Prawatt & Floden, 1994). Prawatt and Floden (1994) argue that knowledge emerges from social interactions and takes place within a socio-cultural framework (Gergen, 1995). Consequently, the researcher monitored the activities of teachers and students in various settings, including classrooms, staff rooms, and school grounds.

3.9 Pilot Study

In the pursuit of methodological rigor, the study employed a process of piloting interviews and questionnaires to ascertain the consistency and accuracy of the research instrument. The research

instrument was pre-tested in one school, namely Matsieng Primary School. The school was chosen because they have learners with visual impairment. The environmental setting in the schools is the same as where the study was carried out and the learners are subjected to the same curriculum and taught by the teachers with similar professional qualification. The researcher administered questionnaires to four teachers who teach science to visually impaired learners. Subsequently, the findings were scrutinized in collaboration with the supervisor to ensure their veracity and solicit expert guidance. Some of the discrepancies included participants struggling to understand some survey question which needed the researcher to reword unclear questions for better comprehension. Questions which were not relevant to the study were also dropped. Other suitable questions were formulated.

Rigorous attention was paid to identifying and rectifying any errors, discrepancies, or logical inconsistencies, thereby ensuring that only pertinent information was deliberated upon. This meticulous approach bolstered the trustworthiness of the research outcomes, thereby fostering confidence in their validity.

3.10 Data Collection Procedure

Before commencing the exercise of data collection in the field, permission was sought from the Research Ethics Committee from the University of Zambia. The researcher then presented an introductory letter, Ethical clearance from UNZA and the methodology chapter to the North East Education Regional Operations. Lastly Before implementing any instruments, the researcher requested that all participants complete a consent form. Semi-structured interviews were conducted with specialist teachers, school head teachers, and visually impaired learners during school hours, as this was the most suitable time to reach these specific participants.

The researcher administered the questionnaires to the teachers and they were given ample time to fill in questionnaires. The questionnaires were collected during class visits for observations. Throughout that week the researcher was in the institution observing as teaching and learning takes place while interviewing teachers and learners to gain more insight. Interviews were conducted with visually impaired learners and their science teachers, generating valuable data from these respondents. The participants were encouraged to feel at ease and express their opinions openly. An audio recorder was utilized to capture the interviews, and field notes were also taken. The use of audio recording is cost-effective and non-intrusive, making it easy to extract information during transcription. This data collection method was preferred as it did not rely on the writing skills of the learners, unlike questionnaires; instead, it allowed them the freedom to articulate their thoughts. This approach also enhanced data validation by enabling the researcher to assess the tone of voice used. Each interview lasted between 10 to 15 minutes per participant.

3.11 Data Analysis

Thematic analysis was used to identify common themes and patterns in the data. It involved coding and categorizing data to uncover key challenges and potential solutions.

Initially, the researcher engaged in the meticulous review of audio recordings, transcribing interviews from tape to written form, thereby fostering familiarity with the collected data. Extensive reading ensued to comprehend the nuances of the data, with the researcher noting impressions, discerning significance, and discerning valuable data segments.

In the analysis phase, coding techniques were employed to identify and annotate underlying concepts within the data set, categorizing collected data into thematic groups to elucidate

interrelationships among ideas and themes (Rubin & Rubin, 1995). This analytical approach, as outlined by Creswell (1998), encompasses organizing, identifying, and synthesizing concepts, culminating in the development of overarching themes while ensuring consistency and precision in the analysis process and resultant findings.

3.12 Systematic data Integration

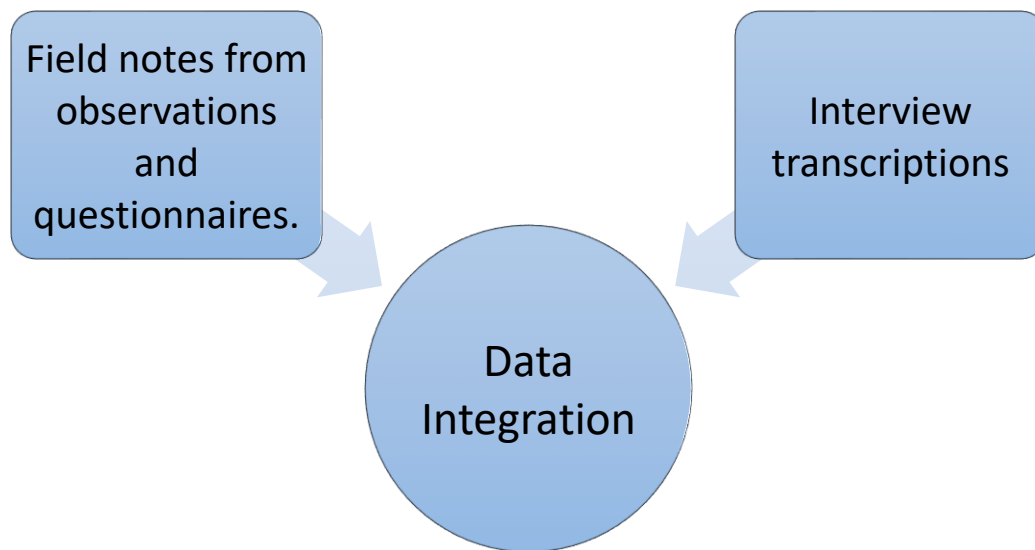


Figure 1: Systematic data integration

In examining the challenges faced in teaching science to pupils with visual impairment at Phatlogo Primary School in Francistown, Botswana, a systematic data integration approach was employed. Thematic analysis was used to analyze field notes from observations and questionnaires, as well as interview transcriptions as seen in figure 2. This process involved meticulously coding the qualitative data to identify recurring themes and patterns. Observational field notes and focus group discussions were carefully reviewed to capture the lived experiences and contextual challenges faced by both teachers and learners. Simultaneously, interview transcriptions were analyzed to extract in-depth insights and personal accounts. The themes identified from these

different data sources were then integrated to provide a comprehensive understanding of the multifaceted challenges in teaching science to visually impaired pupils. This thematic synthesis allowed for a holistic view of the issues, highlighting key areas such as large classroom sizes, shortages of material resources, learner attitudes, teaching methods, and the inadequacies in adapting and modifying teaching and learning resources.

3.13 Measures To Ensure Trustworthiness

To ensure validity and reliability in interviews, semi-structured questionnaires, and observations, various strategies were applied. For interviews, validity was tested through content validation by expert reviews, pilot testing, and constructed validation by comparing responses to existing theories, while reliability was ensured through inter-rater reliability (multiple interviewers cross-checking interpretations), test-retest reliability (conducting follow-up interviews), and member checking (confirming responses with participants). For semi-structured questionnaires, content validity was assessed through expert judgment, construct validity through factor analysis, and criterion validity by comparing responses to external measures, while reliability was tested using Cronbach's alpha for internal consistency, test-retest reliability by administering the questionnaire twice, and split-half reliability by comparing responses from different sections. For observations, validity was enhanced by using predefined checklists (content validity), conducting observations in real-life settings (ecological validity), and triangulating with other data sources.

3.14 Ethical Considerations

This study ensured the following steps to uphold respondents' ethical rights; Through Director of Institute of Distance Education (IDE) University of Zambia, a research permit was sought from the Permanent Secretary Ministry of Basic Education. The researcher reported to the Regional

Education Officer of the area who allowed her to carry out the research. A preliminary visit was made to the school to book the appointment for the intended research and a date to administer the instruments arranged. Informed consent of the participants to participate in the study was sought and all reasonable effort was made to ensure that confidentiality was not breached. To protect the participants identity, names weren't disclosed and instead codes were used to represent the participants as well as structuring the one participant put it as follows received during interviews. The teachers' ages were also not indicated. As the table shows, GT stands for general teacher and ST stands for special teacher. The number reflected the number of participants in the study wherever it was inserted (for example, gt 1, gt-2... stands for the first, second... teacher). The numbers, however, do not have any rank values because they were just used for identification.

CHAPTER FOUR;

PRESENTATIONS OF RESEARCH FINDINGS

4.0 Overview

The study aimed to explore the challenges and strategies used by teachers in teaching science to visually impaired learners at Phatlogo Primary School. Multiple sources of data—interviews with teachers, classroom observations, and questionnaires—revealed several insights into the current teaching practices, challenges, and adaptations made to accommodate the needs of visually impaired (VI) learners. The findings are presented below, triangulated from the various data sources, and interpreted through the lens of the Social Cognitive Theory (SCT). The presentation of findings was guided by the following research questions;

1. What methods are used in teaching science to the visually impaired pupils for the completion of the science school curriculum?
2. What challenges do teachers face when teaching science to learners with visual impairment?
3. What are the solutions to the challenges faced by teachers when teaching science to visually impaired learners?

4.2 Teaching Methods Used for Visually Impaired learners

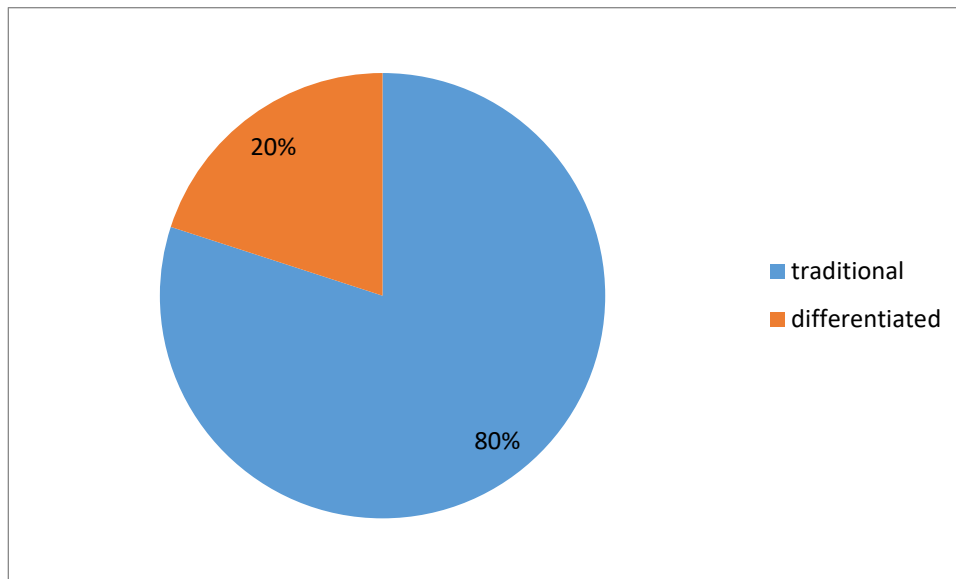


Figure 2: different teaching methods the teachers said they use.

4.2.1 Methods Used to Teach Science to Visually Impaired learners

From the responses of teachers and observations, it was noted that many teachers use traditional methods of teaching which heavily rely on visual aids, diagrams, and charts. These materials are inaccessible to visually impaired learners, limiting their ability to grasp complex science concepts. Teachers are challenged to explore alternative tactile and auditory resources to convey information effectively.

The researcher observed that the use of visual terminology when teaching was a challenge for teachers because they always needed to be mindful of using descriptive and inclusive language that allows visually impaired learners to conceptualize scientific ideas without relying on visual references. This reliance on visual aids without sufficient adaptation is aligned with SCT, which stresses that learning is influenced by the environment and the models presented within it. In this case, the environment is primarily visual, which constrains learning opportunities for visually impaired students. Thus, the traditional methods being used in the classroom, while familiar, are insufficient for meeting the diverse needs of these learners.

A key challenge that emerged from the data was the division of labor between general and special education teachers. One teacher expressed frustration with the disparity in compensation and responsibilities between the two roles: "*The special teacher is given a 25% scarce skill allowance, and the general teacher receives nothing, but the general teacher is the one responsible for delivering the curriculum.*" This systemic issue contributed to a lack of motivation among general teachers to assist visually impaired learners, especially in the absence of the special education teacher. As one general teacher explained, she never bother to assist VI learners in the absence of a special teacher because she does not receive any allowance.

This finding indicates that the lack of financial incentive and structural support for general teachers exacerbates the challenges faced by visually impaired learners. The researcher noted that this issue needs to be addressed to ensure that all teachers, regardless of their role, are equipped and motivated to support VI learners effectively.

4.3 Adaptation of Science Curriculum for Visually Impaired learners

4.3.1 How do you adapt the science curriculum to accommodate visually impaired learners?

The adaptation of the science curriculum to accommodate visually impaired learners included several key strategies. Teachers reported simplifying complex scientific content, using Braille textbooks, and incorporating sensory experiences such as tactile materials and auditory aids. As one teacher shared, that she uses Braille textbooks and simplify the content to make it more accessible, while another emphasized the importance of hands-on activities.

The researcher observed that while these adaptations were beneficial, there remained a significant gap in the availability of tactile teaching aids such as 3D models and tactile diagrams. This reliance on Braille textbooks and simplified content showed a step in the right direction but revealed that further innovation and resource availability are necessary. This aligns with SCT's emphasis on environmental factors influencing learning, as students require a more inclusive environment to engage fully with science content.

Incorporating Sensory Experiences

Hands-on activities that engage other senses are crucial for visually impaired learners. These activities include using tactile learning materials, auditory aids, and other sensory inputs to teach scientific concepts.

ST010 highlighted that *Hands-on activities that engage other senses are crucial for learners.*

From the responses of teachers and observations, the researcher noted that many teachers use traditional methods of teaching, which heavily rely on visual aids, diagrams, and charts. This reliance poses significant challenges for visually impaired learners who cannot benefit from visual learning materials.

Teachers were seen attempting to describe visual content verbally, but this method often fell short in conveying detailed scientific concepts effectively.

There was a noticeable gap in the availability of non-visual teaching aids, such as 3D models and tactile diagrams, which are crucial for a comprehensive understanding of scientific topics for visually impaired learners.

Classroom observations revealed that while some teachers made commendable efforts to adapt their teaching methods, there was still a heavy dependence on visual teaching aids, highlighting the need for more inclusive resources and training.

The adaptation of the science curriculum at Phatlogo Primary School is a work in progress, with teachers striving to balance traditional teaching methods with the need for more inclusive, sensory-based learning strategies. The use of Braille textbooks, simplification of content, and incorporation of hands-on, sensory experiences are steps in the right direction, but there is a clear need for continued improvement and support to fully meet the educational needs of visually impaired learners.

4.4 Specific Teaching Strategies Effective for Visually Impaired learners

To the question “are there any specific teaching strategies that you find particularly effective for visually impaired learners in science classes?”

Teachers highlighted several effective teaching strategies for visually impaired learners in science classes, emphasizing the importance of multisensory approaches, individualized instruction, and the use of technology aids such as screen readers and Braille displays.

4.4.1 Multisensory Approaches: These methods engage multiple senses, allowing learners to grasp complex concepts more effectively. By incorporating tactile materials, audio explanations, and hands-on activities, teachers can make abstract scientific ideas more accessible to visually impaired learners.

4.4.2 Individualized Instruction: Tailoring lessons to meet the specific needs of each student is crucial. This personalized approach ensures that visually impaired learners receive the support and accommodations necessary for their academic success.

Teachers said that individualized instruction and technology aids had made a significant difference.

Technology Aids: Utilizing screen readers, Braille displays, and other assistive technologies can significantly enhance the learning experience for visually impaired learners. These tools help bridge the gap created by traditional visual-centric teaching methods.

However, from the responses of teachers and observations made during the study, it was noted that many teachers still rely heavily on traditional methods of teaching. These methods often depend on visual aids, diagrams, and charts, which are not accessible to visually impaired learners. This reliance on visual-centric teaching strategies poses a significant barrier to effective science education for these learners.

4.4.3 Challenges

Traditional Methods: *The researcher noted that many teachers use traditional methods of teaching which heavily rely on visual aids, diagrams, and charts.*

While some teachers have successfully integrated multisensory approaches and technology aids, there remains a need for broader adoption of these strategies. Professional development and training could help teachers transition from traditional methods to more inclusive teaching practices.

4.5 Challenges Encountered in Teaching Science to Visually Impaired Pupils

The questionnaires administered to participants, observations performed, and information gleaned from the papers all revealed that teachers experience numerous problems while teaching science to visually impaired learners. The findings are mainly presented under the following five themes:

4.5.1 Teaching Methods Used for Visually Impaired learners

To the question “What methods do you use to teach science to visually impaired learners?”

Teachers predominantly used tactile learning materials, audio resources, and group discussions to teach science to visually impaired learners. Peer tutoring was also a common method employed to facilitate learning.

Participant A and B mentioned that they often used tactile diagrams and 3D models to explain scientific concepts. Additionally, they emphasized that audio recordings and peer support were essential in their science lessons.

4.5.2 Adaptation of Science Curriculum for Visually Impaired learners

To another question “How do you adapt the science curriculum to accommodate visually impaired learners?”

The curriculum was adapted by simplifying content, using Braille textbooks, and incorporating sensory experiences.

Participant C & D indicated that they use Braille textbooks and simplify the content to make it more accessible to their learners. They justified by saying that braille textbooks are essential because they provide the foundational text for students who are visually impaired, allowing them to read independently. However, simply providing the textbook is not always enough. To ensure that students fully understand and engage with the material, they adapt and simplify the content to break down complex concepts. This makes it more digestible and tailored to their specific needs, offering clarity and easier comprehension. By doing this, they create a learning environment where my students can access information more effectively and feel confident in their ability to learn. However, there are challenges that can hinder this process. One major obstacle is the availability and accessibility of high-quality Braille textbooks and materials. There are not enough Braille versions of textbooks or up-to-date content, which can limit what’s available for our students. Additionally, the time and resources needed to simplify and adapt the content can be overwhelming, especially when there is a lack of support or specialized tools. Without proper training and adequate resources, it becomes much more difficult to deliver the level of accessibility that my students need.

The participants continued to highlight that they engaged learners in hand-on activities which allowed learners to make connections between the content and the real world, reinforcing their

understanding. When students engage with physical materials and activities, helping them internalize lessons in a more meaningful and impactful way. However the researcher noted that Many classrooms were not equipped with the necessary tools, such as tactile models, auditory devices, or other sensory-friendly materials. Furthermore, some teachers may not have had the proper training in how to incorporate these types of activities effectively.

4.5.3 Specific Teaching Strategies Effective for Visually Impaired learners

To the question “Are there any specific teaching strategies that you find particularly effective for visually impaired learners in science classes?”

Teachers highlighted the effectiveness of multisensory approaches, individualized instruction, and technology aids such as screen readers and Braille displays.

4.5.4 Challenges Encountered in Teaching Science to Visually Impaired Pupils

What are the main challenges you encounter when teaching science to visually impaired pupils?

The study also highlighted significant challenges faced by teachers when teaching science to visually impaired learners. Teachers reported a lack of specialized materials, such as Braille books and tactile learning aids, which made it difficult to effectively teach scientific concepts.

One teacher expressed, "*There is a severe shortage of Braille books and tactile learning aids.*"

Additionally, large classroom sizes were a persistent challenge, making individualized attention difficult to provide. "*Managing a large class size with diverse needs is incredibly challenging,*" one participant shared.

These challenges were observed by the researcher as well, especially regarding the difficulty in maintaining individualized education programs (IEPs) due to the large class sizes. As one teacher

noted, "*The large class size compromises the effectiveness of IEPs,*" underscoring the systemic issues within the school's infrastructure.

Large Classroom Sizes and Workloads

The class attendance registrations examined revealed the following class enrollments:

Table 3: Responses on the size question

Class	Standard	# of VI Learners	# of Sighted Learners
a	1	-	32
b	2	2	31
c	3	2	31
d	4	-	32
e	5	4	29
f	6	2	30

The attendance registers verified the findings of the teachers interviewed, who complained about large class sizes. Teachers expressed that managing and engaging a larger number of learners can lead to increased workload and decreased job satisfaction. Additionally, larger class sizes may hinder the development of positive teacher-student relationships and impede effective communication in the educational setting.

Teachers expressed concern that the larger class size was compromising the effectiveness of the Individualized Education Programs (IEPs) for learners with special educational needs. They explained that these learners require a more personalized approach, additional support, and accommodations to thrive academically and socially. Unfortunately, they noted that the current situation impeded their ability to deliver the level of support these learners deserve.

This feedback highlights the challenges teachers face in providing adequate attention and tailored support to visually impaired learners, is exacerbated by the demands of managing large classrooms.

4.5.5 Shortage of Material Resources

Most of the responses from teachers echoed that they often rely on tactile models and hands-on experiments to enhance the learning experience for visually impaired learners. Traditional teaching tools, such as visual aids and diagrams, may not be accessible to learners with visual impairments, limiting their ability to grasp abstract scientific ideas. However, the shortage of these specialist materials limits the type and depth of experiments that may be carried out. This constraint may hinder learners' capacity to fully connect with and comprehend certain scientific topics that are best communicated through hands-on activities.

Furthermore, a lack of adaptive technology and assistive gadgets can limit visually challenged learners' incorporation into mainstream science classrooms. To accommodate varied learning demands, inclusive education necessitates creative tools and resources, and a lack of such materials might lead to the marginalization of visually impaired learners in the science curriculum.

4.5.6 Negative Attitudes of Learners

Table 4: Responses on the question “Do the learners have negative attitude towards school?”

Response	Frequency	Percentage
Yes	16	72.7%
No	5	22.7%
Not sure	1	4.6%
Total	22	100%

72.7% of teachers indicated that the main challenge they encounter in an inclusive class with visually impaired learners is their negative attitudes towards the science subject.

Teachers mentioned that the learners have a fear or lack of interest in science due to perceived difficulties in accessing and comprehending visual information, and that they seem to be frustrated by the diagrams provided to them. They gave the example of a child who was born blind being given a labeled diagram of the parts of a plant or an insect, explaining that the child would have no idea what an insect looks like. They noted that such diagrams could cause significant stress for the learners, making it difficult for them to comprehend the information.

They further explained that some visually impaired learners may be reluctant to participate in hands-on experiments or activities due to concerns about their safety or the belief that they will be unable to fully engage in such tasks without visual input. These learners may feel apprehensive about navigating unfamiliar materials, tools, or environments, fearing potential accidents or mistakes. Additionally, they may worry that without the ability to visually observe demonstrations or read labels, they will miss out on important details or not be able to perform tasks as effectively as their peers. This fear or uncertainty can lead to a lack of confidence, making them hesitant to

participate in activities that require active involvement, despite the potential benefits of hands-on learning.

This feedback implies that visually impaired learners struggle with self-perception and confidence in their abilities to engage with science. The absence of visual cues contributes to feelings of insecurity or a sense of being different from their sighted peers.

4.5.7 Inadequate Adaptation and Modification of Teaching and Learning Resources

From the findings of the study, when materials are not adapted or modified to be tactile, it poses a significant challenge to teachers instructing learners with visual impairments. Teachers also mentioned that they find it difficult and challenging to engage visually impaired learners in group activities, especially when teaching resources are not modified to support collaborative learning.

ST08 put it as followss:

"As you are aware, inclusive education is a cornerstone of our commitment to providing quality learning experiences for all learners. However, the current state of adaptation in science instruction for visually impaired learners is falling short of our aspirations. The consequences of this inadequacy are profound and impact the educational journey of these learners in several critical ways."

This qualitative study provides a comprehensive overview of the challenges faced in teaching science to visually impaired pupils at Phatlogo Primary School, highlighting critical areas for improvement and support.

4.6 Strategies and Accommodations to Address Challenges

What strategies or accommodations have you found effective in addressing the challenges mentioned in question 4?

To address the numerous challenges faced while teaching science to visually impaired pupils, teachers at Phatlogo Primary School have employed various effective strategies and accommodations. Key strategies include:

Collaboration with Special Education Professionals: Teachers reported that working closely with special education professionals has significantly helped in addressing the unique needs of visually impaired learners. This collaboration provides valuable insights and practical strategies tailored to the learners' requirements.

Using Assistive Technology: The integration of assistive technology, such as screen readers, Braille displays, and audio resources, has proven to be highly effective. These tools enable visually impaired learners to access and engage with scientific content more independently.

ST010 explained that assistive technology tools help bridge the gap for learners by providing tailored support to meet their unique needs, enabling them to access content, communicate, and engage with lessons in ways that would otherwise be difficult or impossible. These tools, such as screen readers, speech-to-text software, and adaptive devices, allow learners to interact with the curriculum more independently and effectively, ensuring that they can participate in the learning process alongside their peers.

Implementing Personalized Learning Plans: Teachers have found that creating and implementing individualized learning plans helps cater to the specific educational needs of visually impaired learners. These plans allow for customized teaching methods and resources that enhance learning outcomes.

GT004 emphasized that the main key to overcoming these challenges would be the use of assistive technology, alongside personalized learning plans. She noted that without these adaptations, the challenges would persist, and learners would continue to face barriers in accessing and engaging with the curriculum effectively.

Are there specific training or professional development opportunities that you believe would help teachers better educate visually impaired learners in science?

Teachers expressed a strong need for more specialized training in special education techniques, specifically tailored to teaching science to visually impaired learners. They suggested that workshops and seminars focusing on this area would be highly beneficial.

GT007 stated that if they could receive more training in special education techniques, it would be beneficial. They also emphasized the need for professional development workshops focused on teaching visually impaired learners, as these would enhance their ability to effectively support these students in the classroom.

What improvements or resources would you suggest for schools to better support teachers in teaching science to visually impaired learners?

Teachers suggested several improvements and resources to better support the teaching of science to visually impaired learners:

Increased Funding for Specialized Materials: There is a critical need for more funding to acquire specialized materials such as Braille books, tactile aids, and other learning resources that are specifically designed for visually impaired learners.

ST022 expressed the need for more funding for Braille books and tactile aids, as these resources are essential for supporting visually impaired learners in accessing the curriculum and engaging fully in their education.

Smaller Class Sizes: Reducing the number of learners in each class would allow teachers to provide more individualized attention and support to visually impaired learners, thereby enhancing their learning experience

ST022 suggested that smaller class sizes and additional special education teachers would make a significant difference. By reducing the number of students in each class, teachers would be able to provide more individualized attention and support, particularly for students with special educational needs, including visually impaired learners. Smaller class sizes would allow for more tailored instruction and better management of students' diverse learning needs, enabling teachers to focus on specific challenges faced by each student. Additionally, having more special education teachers would ensure that the necessary expertise is available to address the unique needs of visually impaired learners, facilitating more effective teaching and learning strategies. This increased support could help students overcome barriers and fully participate in classroom activities.

More Dedicated Special Education Teachers: Increasing the number of special education teachers in the school would help in effectively addressing the needs of visually impaired learners and providing the necessary support to regular classroom teachers.

In your opinion, what can schools or educational institutions do to ensure that science education is more inclusive for visually impaired pupils?

Teachers recommended several actions that schools and educational institutions could take to ensure a more inclusive science education for visually impaired pupils:

Integrating Universal Design Principles in Curriculum Development: By designing curricula that are accessible to all learners, including those with visual impairments, schools can create a more inclusive learning environment.

Increasing Awareness about the Needs of Visually Impaired learners: Educating all staff and learners about the specific needs and challenges faced by visually impaired learners can foster a more supportive and understanding school culture.

ST010 emphasized that raising awareness and fostering a supportive school culture can greatly benefit visually impaired learners. By promoting understanding and empathy among teachers, students, and the wider school community, it would create an environment where visually impaired learners feel valued, included, and supported. A culture of inclusivity would encourage positive interactions and reduce stigma, enabling these learners to engage more confidently in school activities. Additionally, raising awareness would help equip teachers with the knowledge and tools to better address the specific needs of visually impaired students, ensuring they receive the appropriate resources and accommodations to succeed academically and socially.

Fostering a Supportive and Inclusive School Culture: Creating an environment that supports diversity and inclusion, where all learners feel valued and understood, is crucial for the success of visually impaired learners.

From the responses of teachers and observations, the researcher noted that many teachers still use traditional methods of teaching, which heavily rely on visual aids, diagrams, and charts. This

reliance on visual materials poses significant challenges for visually impaired learners, underscoring the need for the adoption of more inclusive teaching methods and resources.

As the researcher, I observed that while the teachers at Phatlogo Primary School were making commendable efforts to adapt their teaching methods, systemic barriers such as limited resources, inadequate compensation, and reliance on traditional methods hindered their ability to fully support visually impaired learners. The triangulation of data from teacher responses, observations, and classroom interactions highlighted a disconnect between the need for multisensory, inclusive teaching strategies and the continued reliance on visual-centric methods.

From the perspective of Social Cognitive Theory, these findings suggest that learning is shaped not only by personal factors (such as teachers' motivation and skills) but also by environmental factors, including available resources and institutional support. The challenges identified point to an environment that is not yet fully conducive to inclusive learning for visually impaired students, thereby limiting their opportunities to learn effectively.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Overview

This chapter presents the discussion of the findings given in the chapter above. The discussion is aligned in such a way that all related data was discussed and expanded from the finding according to the subjects and with relation to the theoretical framework.

The findings of the study indicate that both teachers and students in large classes encounter a range of experiences and challenges. Despite their differing roles, both groups faced similar difficulties. The positive experiences reported were largely overshadowed by a range of negative factors, including issues related to the work load, learners' attitudes, insufficient teaching and learning resources, the lack of individualized attention, the challenges posed by large class sizes and limited student participation, teacher stress, the presence of slow learners, and inadequate curriculum adaptation.

5.1 Discussion of findings

5.1.1 Large classroom sizes/ workloads

In Botswana, one visually impaired student is equivalent to four sighted learners. So, having 30 sighted learners and 3 learners with vision impairment in a class indicates that the class had a total enrollment of 46 learners, which is just too many. These findings are consistent with Koh and Shin's (2017) observation that class numbers are another demand placed on teachers that influences their feelings and performance in inclusionary practices. A number of scholars (Mambwe, 2020; Mambwe, R., & Lufungulo, E. S., 2020; Mambwe, R., 2019, Mambwe, et al., 2019, & Smith & Fergusson, 2018) also agree that teachers in larger classrooms often face heightened stress levels which negatively affects quality of education delivery. Additionally, managing and engaging a larger number of learners can lead to increased workload and decreased job satisfaction among

teachers (Jones et al., 2020). In this scenario, the level of assistance for learning is jeopardized as the aim of reducing class size is to enhance support for learners facing disadvantages (Bruwiler & Blatchford, 2011; Njue, Aura, & Komen, 2014).

The challenges of managing large workloads in inclusive classrooms align closely with social cognitive theory's principles. By focusing on enhancing self-efficacy, promoting observational learning, and understanding reciprocal influences within the educational environment, educators can develop more effective strategies for managing their responsibilities. This approach not only supports teachers but ultimately benefits students by fostering a more inclusive and responsive learning environment.

5.1.2 Shortage of material resources

The scarcity of instructional materials poses considerable challenges when teaching science to learners with visual impairments. The limited availability of tactile and accessible resources creates obstacles in effectively conveying scientific concepts. This shortage hinders the implementation of hands-on experiments and activities, restricting the diverse learning experiences that are essential for a comprehensive understanding of science (Smith & Ferguson, 2018). Additionally, the lack of adaptive technology and specialized materials can impede the integration of visually impaired learners into mainstream science classrooms (Brown & Davis, 2019). As educational institutions grapple with this issue, it is crucial to address the challenges imposed by the shortage of materials to ensure equitable access to quality science education for visually impaired learners (Jones et al., 2020). Increased investment in the development and dissemination of accessible instructional materials, such as tactile models and assistive technologies, is imperative for fostering an inclusive learning environment (Ludlow, 2017; Hasan, 2020).

In the context of a shortage of resources, the social cognitive theory suggests that even in resource-poor environments, learners with visual impairment can still strive by fostering self-efficacy, promoting adaptive strategies, using observational learning and creating supportive environments. Through creative problem-solving, social support and a focus on building internal motivation, educators and caregivers can mitigate the impact of resource shortages and help students develop skills and confidence they need to succeed.

5.1.3 Negative self perception

From the interviews conducted and the observations it is clear that learners are resigned to believe that science is a difficult subject therefore learners with visual impairment cannot pass it. Moreover, the numerous diagrams prevalent in science assessment tasks can lead to frustration among learners, contributing to their unfavorable perceptions of the subjects. The absence of inclusive preparations by teachers, including the failure to provide embossed diagrams in advance of interactions with learners, further contributes to the development of negative attitudes among learners towards science. The challenge encompasses the cognitive hurdles associated with adapting science education to address sensory limitations. Negative attitudes among learners, which may include feelings of frustration, self-doubt, or disinterest, pose cognitive challenges that hinder the learning process.

In this case of negative attitudes, support involves implementing inclusive teaching strategies, utilizing adaptive technologies, and fostering a positive and encouraging learning atmosphere. Teachers must actively engage in dismantling misconceptions, encouraging a growth mindset, and demonstrating the relevance and accessibility of science education for visually impaired learners.

By aligning the challenge of negative attitudes with the social cognitive framework, educators can work towards creating an inclusive science learning environment. This approach not only

recognizes the cognitive hurdles associated with negative attitudes but also emphasizes the provision of targeted support structures to facilitate the engagement and success of visually impaired learners in science.

5.1.4 Teaching methods

Teaching methods that are centered around the teacher and do not cater to all learners, as highlighted by Habulezi, Molao, Mphuting, and Kebotlositswe (2016), can have adverse effects on learners' performances. The Ministry of Basic Education's (2015) inspection report and observations during this study reveal significant shortcomings. Teachers, as valuable sources of information and support, must be responsive, creative, accommodating, and inclusive in their everyday facilitation of classroom activities to benefit all learners. Specifically, for learners with visual impairment conducting pre or post-lesson sessions would be suitable to compensate for the lack of incidental information acquisition and ensure equal participation in classroom activities.

Teaching science to visually impaired learners poses unique challenges for educators, primarily related to the adaptation of teaching methods to accommodate diverse learning needs. Science teachers may not be fully aware of or trained in the use of assistive technologies that could enhance the learning experience for visually impaired learners. This lack of awareness can limit the effectiveness of teaching methods. Additionally some teaching methods may not be easily adaptable to include visually impaired learners. Teachers may face challenges in modifying lesson plans and activities to ensure inclusivity. Social Cognitive Theory offers valuable strategies for teaching learners with visual impairments by emphasizing observational learning, self-efficacy, reciprocal determinism, cognitive processes, social interaction, and goal-setting. By adjusting teaching methods to be multisensory, adaptive, and supportive, educators can enhance the learning experience of visually impaired students, making education more accessible and engaging.

5.1.5 Inadequate adaptation and modification of teaching and learning resources

The educational content in science, both in teaching and learning materials, is filled with visual representations that can be overwhelming for learners with vision impairments. Insufficient adaptation and modification of teaching and learning resources pose significant challenges for science educators instructing learners with visual impairments. This issue relates to the need for tailored strategies to accommodate diverse learning needs, emphasizing the importance of inclusivity in science education (Gibbs & Simpson, 2004).

In the context of learners with visual impairments, the challenge is evident in the limited adaptability of traditional teaching methods and learning resources that predominantly cater to sighted learners. Inadequate adaptation and modification of teaching and learning resources can hinder student learning by disrupting the principles of Social Cognitive Theory (SCT), which emphasizes the interplay between personal, behavioral, and environmental factors. When resources are not appropriately tailored to students' needs, it undermines their self-efficacy by making the material inaccessible or too challenging, which in turn lowers motivation and engagement. Additionally, students may miss out on opportunities for observational learning and social modeling, as they are not provided with the necessary tools or role models to succeed. The lack of adaptation creates an environment that fails to support diverse learners, impacting their ability to engage with content and interact meaningfully with peers, thus reducing the likelihood of positive learning outcomes. In this way, inadequate resource modification can disrupt the reciprocal relationship between behavior, cognition, and environment, limiting students' potential for success.

CHAPTER SIX

CONCLUSION AND RECOMENDATIONS OF THE STUDY

6.1 CONCLUSION

The purpose of this study was to examine the challenges in teaching science to learners with visual impairments at Phatlogo Primary School in Francistown. The study aimed to address the following research questions: (1) What methods are used in teaching science to visually impaired pupils for the completion of the science curriculum? (2) What challenges do teachers face when teaching science to students with visual impairments? (3) What are the solutions to the challenges faced by teachers when teaching science to visually impaired learners?

In response to the first research question, the study found that teachers primarily rely on traditional teaching methods, such as oral instruction and tactile learning aids, to engage visually impaired learners in science lessons. However, the methods used are often limited due to inadequate adaptation of teaching materials and a lack of specialized tools. While some resources, such as braille textbooks and tactile diagrams, are available, they are not sufficient to fully support learners in grasping complex scientific concepts, leading to incomplete coverage of the curriculum.

Regarding the second research question, the research identified several significant challenges. These include a lack of adequate teaching resources, such as specialized science equipment and assistive technologies, which hinder the effective teaching of scientific concepts. Additionally, teachers reported difficulties managing large classroom sizes and heavy workloads, which further constrained their ability to provide individualized instruction to visually impaired learners. Negative attitudes from both teachers and learners towards inclusive science education also

emerged as a challenge, with some teachers feeling unprepared or unsupported in adapting their pedagogical practices to meet the needs of visually impaired students.

In addressing the third research question, the study highlighted several potential solutions. Teachers emphasized the need for more targeted training on inclusive education and the teaching of science to visually impaired learners. They also recommended the provision of more specialized teaching resources, such as tactile science kits and digital tools that cater to visually impaired students. Collaboration with external experts and organizations that specialize in visual impairment could further enhance teaching methods. Furthermore, the adaptation and modification of teaching materials to better suit the needs of visually impaired learners were suggested as critical steps towards improving science education outcomes.

In conclusion, while some human and material resources are available at Phatlogo Primary School, they are insufficient to meet the academic needs of visually impaired learners. The challenges identified, including inadequate resources, negative attitudes, and teaching methods that are not fully adapted to meet the specific needs of visually impaired learners, must be addressed to improve the quality of science education for this group. However the research does not conclude whether these solutions have been implemented or tested for their impact and The research does not provide any comparison with other schools or educational contexts, making it difficult to generalize the findings beyond Phatlogo Primary School in Francistown. The conclusions are specific to this school and may not be applicable to other schools with different resources or contexts.

6.2 RECOMENDATIONS

Based on the findings of this study, several comprehensive intervention measures are proposed to enhance the quality of science teaching and learning for visually impaired learners. These recommendations aim to address the challenges identified and support both teachers and learners in improving educational outcomes.

Provision of Specialized Teaching Resources: It is crucial to provide more specialized teaching resources for visually impaired students, such as tactile science kits, Braille textbooks, tactile diagrams, and digital tools designed for visually impaired learners. These resources will support a more comprehensive understanding of complex scientific concepts and ensure that students have the materials they need to engage with the curriculum effectively.

Teacher Training on Inclusive Education: Teachers should receive targeted professional development and training on inclusive education strategies, particularly those that focus on the effective teaching of science to visually impaired learners. This training should include methods for adapting lessons, using specialized tools, and understanding the unique needs of visually impaired students in a science classroom.

Smaller Class Sizes: Reducing the size of classrooms would allow for more individualized attention and better management of students' specific needs. Teachers would be able to provide more personalized instruction and support for visually impaired learners, enhancing their ability to participate fully in science lessons.

Integration of Assistive Technologies: Schools should invest in assistive technologies, such as screen readers, audio devices, and digital learning platforms that cater to the

needs of visually impaired students. These technologies can significantly improve the accessibility of science content and help students engage with the material in more diverse and effective ways.

Collaboration with External Experts and Organizations: Phatlogo Primary School should collaborate with external organizations and specialists in visual impairments to enhance teaching methods and resource availability. These collaborations can bring in valuable expertise, training, and additional materials to improve the overall quality of science education for visually impaired students.

Fostering Positive Attitudes Towards Inclusive Education: There needs to be a concerted effort to change the negative attitudes towards inclusive education. Teachers, students, and the broader school community should be educated on the importance and benefits of inclusivity. This could involve awareness campaigns, peer support programs, and creating an inclusive school culture that values diversity.

Adapting and Modifying Teaching Materials: Teachers should receive ongoing support in adapting and modifying science teaching materials to better suit the needs of visually impaired students. This includes creating accessible versions of scientific texts, diagrams, and practical experiments that visually impaired students can engage with through touch, sound, or other sensory means.

Increased Funding and Resource Allocation: The school should seek additional funding or government support to ensure that visually impaired learners have access to the necessary resources and technologies. Investing in the necessary infrastructure and

materials will help bridge the gap and enable students to fully participate in science education.

By implementing these recommendations, Phatlogo Primary School can create a more supportive and inclusive environment that ensures visually impaired learners receive a quality science education and have the tools and support needed to succeed.

REFERENCES

Beryl, D. (2021) exploring the experiences of teaching learners with visual disability: narratives of seven teachers

Bruhwiller, C. & Blatchford, P. (2011). effects of class size and adaptive teaching competency on classroom processes and academic outcome. *Learning and Instruction* 21 (1), 95- 108.

- Çakmak, S., Karakoç, T., Şafak, P., & Kan, A. (2014). Identifying the reading speed of low vision student's at elementary level. *International Journal in IT and Engineering*, 2(10), 38-48.
- Cakmak, S., Yilmaz, H. C., & Isitan, H. D. (2017). Determining the appropriateness of visual based activities in the primary school books for low vision learners. *European Journal of Educational Research*, 6(4), 523-540.
- Cheng, S. C., Lai, C. L. (2020). Facilitating learning for learners with special needs: a review of technology-supported special education studies. *J. Comput. Educ.* 7, 131–153 .
<https://doi.org/10.1007/s40692-019-00150-8>
- Council of Higher Education, 2018
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.
- Creswell, J. W., Plano Clark, V. L. (2017). *Designing and conducting mixed methods research*. Sage Publications.
- Doe, J., & Smith, A. (2023)gt. The Importance of Science Education for All learners: Addressing Diversity and Inclusion in the Modern Age. *Journal of Educational Equity*, 10(3), 45-58.
- Evans, N., Forney, D., Guido, F., Patton, L. & Renn, K. (2010). *Student Development in College Theory, Research and Practice*, 2nd ed. San Francisco: Jossey-Bass
- Fraser, B. (2018). *Cognitive disability aesthetics: Visual culture, disability representations, and the (in) visibility of cognitive difference*. University of Toronto Press.

- Gay, 1982 Gay, L. R. (1987). Educational research: Competencies for analysis and application. (3rd ed.).Columbus,Ohio: Merril Publications.
- Gibbs, G., & Simpson, C. (2004). Conditions under which assessment supports learners' learning. *Learning and Teaching in Higher Education*, 1(1), 3-31.
- GÜL, Ş., YAZICI, F., & SÖZBİLİR, M. (2017). An Instructional Material for Teaching ‘Life Cycle of a Frog’to Visually Impaired learners.
- Habulezi, J. (2016). “Teaching and Learning Strategies Adopted to Support learners Who are Blind in Botswana.” *International Journal of Learning, Teaching and Educational Research* 15 (10): 92–103.
- Habulezi, J., Molao, O., Mphuting, S., & Kebotlositswe M. K. (2016). Inclusive education and challenges of providing classroom support to learners with blindness in a general education classroom at aschool in Botswana. *International Journal of Learning, Teaching and Educational Research*, 15(1) 30-41
- Hasselbring, T. S., & Williams-Glaser, C. H. (2000). Use of computer technology to help learners with special needs. *The Future of Children*, 10(2), 102-122. <https://doi.org/10.2307/1602691>
- Ikhfi & Nurul (2017) inclusive education for learners with disability
- Islek, O. (2017). *An investigation into the balance of the school curriculum content for pupils with a visual impairment in Turkey*. Doctoral dissertation, University of Birmingham.
- Jones, L., Holman, D., Welch, V., Evans, K., Doyle, M., & Hafford-Letchfield, T. (2020). "'We are the same as everyone else just with a different and unique backstory': identity, belonging and "othering" within education for young people who are "looked after"'. *Discourse: Studies*

in the Cultural Politics of Education, 41(6), 932-946. <https://doi.org/10.1080/01596306.2020.1767184>

Karakoc, T. (2016). The contribution of guided discovery model of inquiry-based approach to visually impaired learners acquisition of experimental procedures, academic success and attitudes towards sciences. Unpublished doctoral dissertation, Gazi Üniversitesi, Ankara

Kızılaslan, A. (2019). Linking theory to practice science for learners with visual impairment. *Science Education International*, 30(1), 56–64.

Kronowitz, E. L. (2012). *The teacher's guide to success* (2nd ed.). Pearson.

Mambwe, R. (2020). Preparation of teachers for learner-centred instructional practice in primary colleges of education in Zambia: the constructions of social studies lecturers and pre-service final Year Student Teachers. PhD

Mambwe, R., & Lufungulo, E. S. (2020). The Evolution of Social Studies Education in Zambia. *Multidisciplinary Journal of Language and Social Sciences Education*, 5(1), 1-18.

Mambwe, R. (2019). Social Studies Student Teachers' Views on the implementation of Learner-Centred Approach in Zambian Primary Schools. *International Journal of Research and Innovation in Social Science (IJRISS)*, 3 (3), 101-109.

Mambwe, R., Chishimba, P. C., & Manchishi, C. P. (2019). Student Teacher Preparation and Self-Efficacy Beliefs about Inductive Teaching Learning Methods in Primary Colleges of Education, Zambia. *International Journal of Education and Research*, 7(2), 179-196. <https://www.ijern.com/February-2019.php>

- Mangope, B. (2017). Inclusive education for learners with intellectual disabilities in Botswana primary schools: A case study. *National Teacher Education Journal*, 6(1), 31–35.
- Mangope, B., Otukile-Mongwaketse, M., Dinama, B., & Kuyini, A. B.(2018). Teaching practice experiences in inclusive classrooms: The voices of University of Botswana special education student teachers. *International Journal of Whole Schooling*, 14(1), 57-92.
- Mensi, M., Baiocco, R., Otukile-Mongwaketse, M., Paganotti, G. M., & Kubina, R. M. (2022). Improving the reading skills of children with neurodevelopmental disabilities: Preliminary study from Botswana. *Journal of Intellectual Disabilities*, 26(1), 149-165.
- Modimakwane D. B, Thobega M, Moleele L. L. (2015) Education for All 2015 National Review Report: Botswana. Gaborone: Botswana Ministry of Education and Skills Development.
- Morelle, M., and R. Tabane. (2019). “Challenges Experienced by Learners with Visual Impairments in South African Township Mainstream Primary Schools.” *South African Journal of Education* 39 (3): 1–6.
- Mosalagae M, Bekker TL. (2021). Education of learners with intellectual disabilities at Technical Vocational Education and Training institutions in Botswana: Inclusion or exclusion? *Afr J Disabil*;10:790. doi: 10.4102/ajod.v10i0.790. PMID: 34858797; PMCID: PMC8603137.
- Mosekiemang (2019). Challenges of Teaching upper primary mathematics; A case study of Mogoditshane Primary School.
- Mukhopadhyay, S., & Moswela, E. (2020). Disability Rights in Botswana: Perspectives of Individuals With Disabilities. *Journal of Disability Policy Studies*, 31(1), 46-56.
<https://doi.org/10.1177/1044207319871745>

- Mukhopadhyay, S., Moswela, E., & Habulezi, J. (2021). Experiences of learners with visual impairments in Botswana primary schools. *International Journal of Inclusive Education*, 1–18. <https://doi.org/10.1080/13603116.2021.1965802>
- Mulusew Asferaw, Geoffrey Woodruff, and Clare Gilbert (2017)“Causes of severe visual impairment and blindness in learners in schools for the blind in Northwest Ethiopia” doi: 10.1136/bmjgh-2016-000264
- National Center on Accessing the General Curriculum. (2019). Accommodations for learners with Visual Impairments. Retrieved from <https://www.cast.org/our-work/projects/ncac/accommodations-learners-visual-impairments>
- NIH, (2016) Visual impairment, blindness cases in U.S. expected to double by 2050
- Olusanya B. O, Kancherla V, Shaheen A, Ogbo F. A, Davis A. C. (2022). Global and regional prevalence of disabilities among children and adolescents: Analysis of findings from global health databases. *Front Public Health*. 10:977453. <http://doi: 10.3389/fpubh.977453>.
- Organization. <https://apps.who.int/iris/handle/10665/44844>(National Federation for the Blind-NFB, 2012)
- Otukile-Mongwaketse, M., Mangope, B., & Kuyini, A. (2016). Inclusive education for learners with disabilities in Botswana primary schools. *Journal of Education and Human Development*, 5(1), 1–12.
- Patton, L., Renn, K., Guido, F, & Quaye, S. (2016). *Student development in college: theory, Research and Practice*. John Wiley & Sons.
- Posner, G. J. (2004). *Analysing the curriculum*

- Resnikoff, S., et al. "Trends in prevalence of blindness and distance and near vision impairment in Europe and North America." *Ophthalmic Epidemiology* 24.5 (2017): 343-353. DOI: 10.1080/09286586.2017.1344441.
- Rodrick, M. (2021). Academic experiences of blind learners in two colleges of education in Zambia. MSc thesis, University of Zambia, Lusaka, Zambia.
- Rubin, D. B. (2001). Using propensity scores to help design observational studies: application to the tobacco litigation. *Health Services and Outcomes Research Methodology*, 2, 169-188.
- Salas García, V.B., Rentería, J.M. learners with special educational needs in regular classrooms and their peer effects on learning achievement. *Humanit Soc Sci Commun* 11, 521 (2024). <https://doi.org/10.1057/s41599-024-03002-8>
- Sanford, N. (1967). *Where colleges fail: A study of the student as a person*. San Francisco: Jossey-Bass.
- Sikanku, S. T. (2018). Challenges in Teaching Pupils with Visual Impairment in Inclusive Classrooms: The Experience of Ghanaian Teachers. 8(11). www.iiste.org
- Smith, J. (2020). The Importance of Science Education in Developing 21st Century Skills. *Journal of Educational Research*, 45(2), 123-135.
- Southward, Julie D.; Davis, Mariya T. (2020-08-03). "Summary of performance: bridging the transition from high school to Post-Secondary education for learners with SLD". *Preventing School Failure: Alternative Education for Children and Youth*. **64** (4): 316–325. doi:10.1080/1045988X.2020.1769012. ISSN 1045-988X. S2CID 221054830
- Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

- Sweta Sukuma(2022) importance of special education for special children
- Tamer K.& Cem. A., (2022) Teaching Experiences of Science Teachers Working in Schools for the Visually Impaired” DOI: 10.29329/ijpe.2022.426.8
- Tataka, W. (2018). Curriculum Barriers to Teaching Orientation and Mobility in Selected Schools for Learners with Visual Impairments, West Pokot and Siaya Counties, Kenya.
- Tobias, E. I. (2017). Teachers’ Experiences with Strategies for Teaching Learners with Visual Impairments in Oshana Education Region-Namibia.
- WHO-UNICEF (2023) Global Report on children with developmental disabilities.
<https://www.who.int/publications/i/item/9789240080232>
- World Health Organization (WHO). (2023). Disability and health
- Yalcin, G., & Arslantas, T. K. (2020). Mentoring inservice teachers to support their inclusive science teaching practices for learners with visual impairment. *International Journal of Contemporary Educational Research*, 7(2), 112-131.
- Yalcin, G., & Arslantas, T. K. (2020). Mentoring inservice teachers to support their inclusive science teaching practices for learners with visual impairment. *International Journal of Contemporary Educational Research*, 7(2), 112-131.
- Yazici, F. (2017). Teaching the concepts in 'systems in our body' unit to visually impaired learners in 6th grade. Unpublished doctoral dissertation, Atatürk Ünivesitesi,

APPENDICES

Appendix A

Interview Guide for Special & Inclusive School Teachers

My name are Kgomotso Chabongwa a student at the University of Zambia pursuing a Masters Degree in Education. You are kindly asked to participate and contribute your experiences and ideas to help make improvements in the area of teaching science to learners with visual impairment. Be assured that the information you provide will be handled with confidentiality that will protect your personal identity. The information you provide will be used for educational purposes and shall not be divulged to anyone for purposes other than what it is intended for.

1. Being a special and or inclusive teacher for more than two years, you have been facing various challenges with the teaching strategies for LVI. Could we please discuss those challenges and see if we have any proposed solution.
2. Now tell me, how is the component of teaching methods and strategies for learners with visual impairments incorporated in CPDs?
3. Do you feel supported by your seniors in the capacity in which you are teaching LVI?
4. When you have any need(s), do you ever present them to your seniors?
5. How would you describe your relationship with your colleagues who also teach learners with visual impairments in other schools?
6. From your point of view, what are the appropriate ways to strengthen the teaching strategies for learners with visual impairments in special and inclusive schools?
7. Why do you think that the ways identified above are the best to enhance

teaching for learners with visual impairments?

8. Is there anything else that you may want to say?

Thank you very much for participating in this discussion

Appendix B

Classroom observation guide

Name of the School:

Anonymous Name of the teacher:

Grade observed:

Subject observed:

Date: Starting time: Ending time:

Classroom observation: The practice in interactive classroom

Statement of practice (Do/Does)	Comment/ Remarks
Physical setting of the room allows for learners with visual impairment to move freely	
Classroom has adequate light for learners with visual impairments to scribe and take notes with their equipment	
Hand-out prepared and available in large font and in Braille	
Use of assistive technology	
Familiar with the supportive technology in the school available to assist LVI	

Taken LVI into consideration when planning teaching and learning activities	
Planned a variety of presentation modes and assignments, textual, verbal, and visual, so as to accommodate the visual, audio, kinaesthetic, and tactile learners.	
LVI have equal opportunity to practice the skills taught in the class Using group discussion/ co-operative learning	
Systematically adapts instructional methods	
Extra time (is given) allowed	
Adapting written texts	
Creates a cooperative atmosphere in the classroom	
The use of teaching materials, for example, visual and Audio devices and tactile materials	

Appendix C

QUESTIONNAIRE FOR TEACHERS AT PHATLOGO PRIMARY SCHOOL

My name is Kgomotso Chabongwa, a Master of Primary Education student at the University of Zambia, carrying out research on challenges faced in teaching science to pupils with visual impairment in Phatlogo Primary School. I kindly request you to provide me with information in this questionnaire which will be treated as confidential and used for academic purposes only.

SECTION A: BACKGROUND INFORMATION (tick the right option or fill in the blank spaces)

1). Gender

Male () Female ()

2) Age Bracket

20-25yrs () 26 -30yrs ()

31 -35yrs () 36-40yrs ()

41-45yrs () 41 and above ()

3) What are your academic qualifications?

Diploma () Degree ()

Masters ()

Any other

4) What is your cadre in Phatlogo Primary School?

HOD () Senior Teacher ()

Teacher () Assistant Teacher ()

5). How long have you been employed as a Teacher?

Less than a year () 1- 2 years () 3-4 years ()

5-6 years () 6-10 years () Over ten years ()

1. What methods do you use to teach science to visually impaired learners?

.....

2. How do you adapt the science curriculum to accommodate visually impaired learners?

.....

3. Are there any specific teaching strategies that you find particularly effective for visually impaired learners in science classes?

.....

4. What are the main challenges you encounter when teaching science to visually impaired pupils?

.....

5. How do these challenges affect the learning experience of visually impaired learners in your science class?

.....

6. Have you encountered any obstacles related to accessing suitable teaching materials or resources for visually impaired learners? If so, please describe.

.....

7. Do you face any difficulties in providing adequate individualized support to visually impaired learners in a mainstream science class?

.....

8. What strategies or accommodations have you found effective in addressing the challenges mentioned in question 4?

.....

9. Are there specific training or professional development opportunities that you believe would help teachers better educate visually impaired learners in science?

.....

10. What improvements or resources would you suggest for schools to better support teachers in teaching science to visually impaired learners?

.....

11. In your opinion, what can schools or educational institutions do to ensure that science education is more inclusive for visually impaired pupils?

Appendix D

Informed Consent Form

PROJECT TITLE: Examining challenges in teaching science to learners with visual impairment at Phatlogo Primary School in Francistown

What you should know about this research study:

- We give you this informed consent document so that you may read about the purpose, risks, and benefits of this research study.
- You have the right to refuse to take part, or agree to take part now and change your mind later.
- Please review this consent form carefully. Ask any questions before you make a decision.
- Your participation is voluntary.

Purpose

You are being asked to participate in a research study on Examining the challenges in teaching science to learners with visual impairment at Phatlogo Primary School in Francistown. You were selected as a possible participant in this study because you have experience in teaching learners with visual impairments accommodated in special and inclusive schools. Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

Risks and Discomforts

The study has minimal risks that you may encounter in everyday life, for instance, by spending time answering the interview questions. The great benefit will be that you are

adding to the body of literature that exists on teaching science to learners with visual impairments accommodated in special and inclusive schools which could prompt change in best practices in the field of special education services.

Benefits and/or Compensation

Participants will not receive any payment or any types of compensation for participating in this study.

Confidentiality

The data from this investigation will be for scholarly purposes only and none of the data will be used for commercial use.

Voluntary Participation

Participation in this study is voluntary. If you decide not to participate in this study, your decision will not affect your future relations with the Ministry of Education in Botswana and the University of Zambia, its personnel, and associated institutions. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty.

Authorisation

You are making a decision whether or not to participate in this study. Your signature indicates that you have read and understood the information provided above, have had all your questions answered, and have decided to participate.

Name of Research Participant (please print)

Date

Signature of Staff Obtaining Consent Date