



Supporting Students with Specific Learning Needs in Mathematics Teaching and Learning: A Case Study of Five Secondary Schools in the OR Tambo Coastal District, Eastern Cape, South Africa

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ABSTRACT

Supporting students with specific learning needs in mathematics requires a multifaceted approach. Research has shown that students with learning disabilities, including those at risk or low-achieving, benefit from tailored interventions in mathematics. This paper provided a comprehensive overview of how students with specific learning needs in mathematics were supported. This paper was underpinned by the Constructivist Learning Theory. A sample of five secondary schools was selected for this study, focusing on the experiences, behaviours, and social interactions of 15 teachers. Based on the study's interpretive paradigm, it was discovered that certain teachers lack professional training to support students with specific learning needs. The findings also revealed a lack of parental involvement in their children's schooling. The study recommends encouraging teachers to acquire new skills to avoid stagnation. It was further recommended that all the school stakeholders should meet and provide workshops for teachers and parents to equip them with skills to support students with specific learning needs. This study offers evidence-supported techniques and perspectives for enhancing teaching practices in math education for students with particular learning requirements. Moreover, the study reveals shortcomings in current approaches, leading to more investigation and creativity in adaptive teaching and learning methods and materials tailored for students facing difficulties in mathematics. The findings could inform education policymakers by highlighting the specific resources, training, and support systems needed to better cater to students with learning difficulties in mathematics, particularly in underserved areas to influence future educational policies in the Eastern Cape and beyond.

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INTRODUCTION

The integration of electronic support tools, such as hint requests, has been demonstrated to significantly impact on students' mathematical reasoning and learning outcomes.¹ Furthermore, family support is vital in nurturing students' conceptual understanding and readiness for mathematical

¹ Irina Higgins et al., "Early Visual Concept Learning with Unsupervised Deep Learning," *ArXiv Preprint ArXiv:1606.05579*, 2016.

learning.² Nevertheless, parental involvement in aiding children's mathematics learning may sometimes lack specific strategies.³ It is particularly critical to comprehend the factors that promote or impede mathematics learning, especially for students with special needs, such as those with autism.⁴ Inclusive classrooms necessitate educators to possess the essential skills and competencies to cater to students with diverse learning needs, such as mathematics learning disabilities. Additional support from home and tutorial services can significantly enhance students' mathematical achievements.⁵ Establishing a nurturing learning environment that caters to individual learning needs is crucial in fostering students' success in mathematics. Assisting students with specific learning needs in mathematics demands a comprehensive approach that considers various instructional components.

Supporting students with specific learning needs in mathematics requires a multifaceted approach that considers several factors. Research indicates that peer instruction can be effective for students with moderate and severe disabilities.⁶ Teachers play a crucial role in diagnosing students' learning difficulties in mathematics, highlighting the need for continuous support and training to enhance their competencies in this area. Students with specific learning needs in mathematics may encounter challenges distinct from cognitive ability and reading achievement, indicating the presence of a moderate learning disability in mathematics. Acknowledging the crucial role of family support in students' mathematical learning is essential. Educators have integrated various strategies to tackle these challenges, including differentiated instruction, manipulatives, visual aids, technology, and collaboration with exceptional education professionals. Additionally, widely adopted frameworks such as Universal Design for Learning (UDL) and Response to Intervention (RTI) aim to foster more inclusive and supportive learning environments. Furthermore, using frameworks like Universal Design for Learning (UDL) can aid in planning inclusive mathematics teaching that benefits all students, including those with extensive support needs.

Despite these efforts, students with specific learning needs in mathematics often continue to lag behind their peers, indicating that there is still much work to be done to ensure all students succeed in mathematics. One significant gap in the current approach to supporting students with specific learning needs in mathematics is the lack of targeted, evidence-based interventions tailored to meet individual needs of these students. While differentiated instruction and UDL provide broad frameworks for inclusivity, they may not always address the specific cognitive or processing challenges some students face in mathematics. Additionally, technology and support tools, such as hint requests, have been proven to improve students' mathematical learning.⁷ Implementing differentiated instruction in mathematics classes can effectively address students' varying needs, providing valuable support to future educators exploring differentiation strategies.

Supporting learners with specific needs in mathematics is crucial for their success. Teachers can create an environment where all students excel by using a collaborative and inclusive approach. This paper thus investigates effective strategies and best practices for assisting students with specific learning needs in mathematics. It will explore the significance of collaboration among educators, the role of personalized instruction, and the utilization of technology and manipulatives. These resources offer valuable support to educators in addressing the distinct requirements of their students. Additionally, the paper will examine adopting a growth mindset to instil resilience and a positive

² Rosa María Toala-Bailón and Francisca Margarita Ávila-Rosales, "Family Support for the Mathematical Learning of the Students of the Middle Basic Sublevel," *International Research Journal of Management, IT and Social Sciences* 9, no. 4 (July 7, 2022): 621–30, <https://doi.org/10.21744/irjmis.v9n4.2128>.

³ Tim Jay, Jo Rose, and Ben Simmons, "Why Is Parental Involvement in Children's Mathematics Learning Hard? Parental Perspectives on Their Role Supporting Children's Learning," *Sage Open* 8, no. 2 (April 9, 2018), <https://doi.org/10.1177/2158244018775466>.

⁴ Sabaruddin Sabaruddin et al., "Student with Special Needs and Mathematics Learning: A Case Study of an Autistic Student," *JRAMathEdu (Journal of Research and Advances in Mathematics Education)* 5, no. 3 (August 30, 2020): 317–30, <https://doi.org/10.23917/jramathedu.v5i3.11192>.

⁵ Dirgha Joshi, Bishnu Khanal, and Shashidhar Belbase, "Teachers' Perceptions toward Student Support in Using Information and Communication Technology in Mathematics Learning," *The International Journal of Technologies in Learning* 29, no. 2 (2022): 57–73, <https://doi.org/10.18848/2327-0144/CGP/v29i02/57-73>.

⁶ Fred Spooner et al., "An Updated Evidence-Based Practice Review on Teaching Mathematics to Students With Moderate and Severe Developmental Disabilities," *Remedial and Special Education* 40, no. 3 (June 28, 2019): 150–65, <https://doi.org/10.1177/0741932517751055>.

⁷ Angela Urbina and Drew Polly, "Examining Elementary School Teachers' Integration of Technology and Enactment of TPACK in Mathematics," *The International Journal of Information and Learning Technology* 34, no. 5 (November 6, 2017): 439–51, <https://doi.org/10.1108/IJILT-06-2017-0054>.

approach toward mathematics. Through these measures, educators can ensure that each student realizes their full mathematics potential.

LITERATURE REVIEW

Inclusive mathematics education is increasingly emphasized in educational research and practice. It highlights the need to ensure fair access, facilitate meaningful learning, and support all students, including those with special needs. This literature review explores critical studies, theories, and strategies that influence the assistance provided to special needs learners in mathematics education.

Challenges faced by Teachers in Inclusive Mathematics Classroom

Inclusive classrooms are designed to offer equal opportunities for all students, including those with special needs. Nevertheless, teachers encounter several challenges in effectively supporting learners with special needs in such environments. Research suggests that teachers' attitudes toward inclusive education are shaped by their knowledge and understanding of accommodating students with special.⁸ Despite their positive intentions, teachers often require extensive training in inclusive education, which hampers their ability to adequately support learners with special educational needs (SENs).⁹ Teachers need help teaching subjects like science to students with special needs because their competencies in learning assessment, differentiated instruction, classroom management, and collaboration skills need further development. Inclusive classrooms benefit from practical strategies, but teachers' perceptions of essential competencies for supporting children with special needs vary.¹⁰ This variance underscores the necessity of standardized training and support for teachers in inclusive settings. Moreover, challenges such as inadequate orientation for head teachers and teachers, a shortage of teaching and learning materials for special needs learners, a lack of specialist teachers, and insufficient infrastructure create significant barriers to successful inclusive education implementation.¹¹ Identifying learners with learning barriers remains a challenge for teachers despite receiving training, as they may need more experience in this area.¹² Additionally, teachers' attitudes, self-efficacy, and preparedness are essential to effectively integrating students with special needs into mainstream classrooms.¹³ Challenges faced by teachers in supporting learners with special needs include the need for more necessary knowledge and skills in inclusive education, negative attitudes, inadequate training, and limited resources.

Professional Development

The professional development workshop is designed to equip teachers with strategies and tools to support students with specific learning needs in mathematics. The focus will be on understanding diverse learning needs, differentiating instruction, and using various resources to foster an inclusive learning environment. In supporting students with specific learning needs in mathematics teaching, effective teacher professional development plays a crucial role. Research emphasizes the significance of teachers' content knowledge and pedagogical content knowledge for high-quality instruction and student progress in mathematics.¹⁴ Professional development on specific mathematics content and how students learn such content is particularly beneficial for improving students' conceptual

⁸ Anke de Boer, Sip Jan Pijl, and Alexander Minnaert, "Regular Primary Schoolteachers' Attitudes towards Inclusive Education: A Review of the Literature," *International Journal of Inclusive Education* 15, no. 3 (April 2011): 331–53, <https://doi.org/10.1080/13603110903030089>.

⁹ Sifiso L Zwane and Matome M Malale, "Investigating Barriers Teachers Face in the Implementation of Inclusive Education in High Schools in Gege Branch, Swaziland," *African Journal of Disability* 7, no. 1 (2018): 1–12.

¹⁰ Tawanda Majoko, "Teacher Key Competencies for Inclusive Education: Tapping Pragmatic Realities of Zimbabwean Special Needs Education Teachers," *Sage Open* 9, no. 1 (January 8, 2019), <https://doi.org/10.1177/2158244018823455>.

¹¹ P.W. Chirwa et al., "The Impacts of COVID-19 on the Sustainable Management of the Forestry Sector in Southern Africa," *International Forestry Review* 23, no. 3 (September 1, 2021): 298–308, <https://doi.org/10.1505/146554821833992785>.

¹² Leetwane Anna Ntlhare and Kananga Robert Mukuna, "Professional Development Needs of Foundation Phase Teachers in Identifying Learners with Learning Barriers at Primary Schools," in *Education and New Developments 2022 – Volume I* (in Science Press, 2022), 447–51, <https://doi.org/10.36315/2022v1end101>.

¹³ Timo Saloviita, "How Common Are Inclusive Educational Practices among Finnish Teachers?," *International Journal of Inclusive Education* 22, no. 5 (May 4, 2018): 560–75, <https://doi.org/10.1080/13603116.2017.1390001>.

¹⁴ Jürgen Baumert et al., "Teachers' Mathematical Knowledge, Cognitive Activation in the Classroom, and Student Progress," *American Educational Research Journal* 47, no. 1 (March 5, 2010): 133–80, <https://doi.org/10.3102/0002831209345157>.

understanding.¹⁵ Teachers need to participate in informal learning experiences to make connections to mathematical concepts themselves, as this understanding is key to incorporating real-world connections into teaching.¹⁶ Furthermore, mathematical education of teachers is vital for enhancing students' mathematics learning outcomes.¹⁷ Teachers must continuously update their educational concepts, ensure student-centred teaching approaches, and employ various teaching methods to stimulate students' interest in mathematics.¹⁸ Additionally, professional development programmes can provide opportunities for mathematics teachers to increase their knowledge and confidence in the subject, ultimately improving mathematics teaching. To address the diverse learning needs of students, teachers should provide various learning opportunities in mathematics classes.¹⁹ Integrating culturally relevant pedagogy in science and mathematics education can foster stronger connections between students, faculty, and the community, thereby enriching the learning experience.²⁰ Furthermore, incorporating STEM education in elementary classrooms through model-eliciting activities and responsive professional development has improved mathematics teaching practices.²¹

Importance of Parental Involvement

Parental involvement plays a critical role in developing and implementing inclusive assessment practices for students with special needs in mathematics. As the field of education shifts towards more inclusive and equitable assessment strategies, the participation of parents is essential in ensuring that assessments truly reflect each student's abilities, progress, and learning needs. Inclusive assessment practices aim to accommodate the diverse learning profiles of students, particularly those with special needs. These methods are designed to provide a more comprehensive and accurate picture of a student's mathematical understanding and skills, beyond what traditional standardized tests offer. Parental involvement is tremendously significant in education.²² Parental involvement is fundamental for a child's academic success, and schools, staff members, state authorities, and lawmakers play some vital roles in the success of a child.²³ When all the stakeholders come together to assist learners, there is remarkable longevity in the learners' schooling and the adoration that the learners have for their education.²⁴ It should be noted that the time and effort the parents invest in their child's education have a positive relationship with academic performance.²⁵ Parental involvement in the educational process can significantly impact learner achievement/or success. Learners are more likely to finish school when parents are involved in their child's education.

Strategies to be used in inclusive mathematics classroom

In an inclusive mathematics classroom, strategies are vital to providing fair learning opportunities for all students. One auspicious approach is mixed-ability grouping, as Boaler highlighted.²⁶ This method not only promotes equitable treatment but also fosters solid mathematical achievement. It creates a

¹⁵ Laura M Desimone et al., "Effects of Professional Development on Teachers' Instruction: Results from a Three-Year Longitudinal Study," *Educational Evaluation and Policy Analysis* 24, no. 2 (June 1, 2002): 81–112, <https://doi.org/10.3102/01623737024002081>.

¹⁶ Alfred Hall and Danielle Miro, "A Study of Student Engagement in Project-Based Learning Across Multiple Approaches to STEM Education Programs," *School Science and Mathematics* 116, no. 6 (October 19, 2016): 310–19, <https://doi.org/10.1111/ssm.12182>.

¹⁷ Mark Hoover et al., "Conceptions of Teaching and Justice as Pivotal to Mathematics Teacher Educators' Thinking about Mathematical Knowledge for Teaching," *Journal of Mathematics Teacher Education*, December 10, 2023, <https://doi.org/10.1007/s10857-023-09609-z>.

¹⁸ Xiaofan Ma and Zezhong Yang, "Research on Implementation of Application Consciousness Literacy in Junior High School Mathematics Classroom Instruction," *Asian Journal of Education and Social Studies* 49, no. 3 (2023): 191–98.

¹⁹ Bishnu Khanal, "Approaches for Enhancing Mathematics Learning of Students with Learning Difficulties," *The Educator Journal* 10, no. 1 (2022): 88–92.

²⁰ Bryan A. Brown et al., "Moving Culturally Relevant Pedagogy From Theory to Practice: Exploring Teachers' Application of Culturally Relevant Education in Science and Mathematics," *Urban Education* 54, no. 6 (July 29, 2019): 775–803, <https://doi.org/10.1177/0042085918794802>.

²¹ Courtney K. Baker and Terrie M. Galanti, "Integrating STEM in Elementary Classrooms Using Model-Eliciting Activities: Responsive Professional Development for Mathematics Coaches and Teachers," *International Journal of STEM Education* 4, no. 1 (December 5, 2017): 10, <https://doi.org/10.1186/s40594-017-0066-3>.

²² Sebrina Patton, "Parents' and Teachers' Perceptions of Parental Involvement" (Walden University, 2019).

²³ Ruth Berkowitz, "Students' Physical Victimization in Schools: The Role of Gender, Grade Level, Socioeconomic Background and Ethnocultural Affiliation," *Children and Youth Services Review* 114 (July 2020): 105048, <https://doi.org/10.1016/j.childyouth.2020.105048>.

²⁴ Jacqueline Flemmings, "Parental Involvement: A Study of Parents' and Teachers' Experiences and Perceptions in an Urban Charter Elementary School," 2013.

²⁵ Nermeen E El Nokali, Heather J Bachman, and Elizabeth Votruba-Drzal, "Parent Involvement and Children's Academic and Social Development in Elementary School," *Child Development* 81, no. 3 (2010): 988–1005.

²⁶ Jo Boaler, "Promoting 'Relational Equity' and High Mathematics Achievement through an Innovative Mixed-ability Approach," *British Educational Research Journal* 34, no. 2 (April 2, 2008): 167–94, <https://doi.org/10.1080/01411920701532145>.

supportive learning atmosphere where students with different abilities can work together, learn from one another, and thrive. Furthermore, implementing Social and Emotional Learning (SEL) practices, as described by Griggs et. al, can improve students' self-confidence in mathematics.²⁷ By addressing math and science anxiety through SEL practices, educators can cultivate a positive classroom environment that enhances students' mathematical self-assurance. Yueying recommend that using visual aids such as number lines can be beneficial in teaching mathematical concepts to students with autism.²⁸ Visual tools like number lines offer a tangible representation of abstract mathematical concepts, increasing accessibility for students with diverse learning requirements. Inclusive mathematics classrooms can significantly benefit from the promotion of Mathematically Productive Relationships (MPRs), as proposed by Liu.²⁹ Teachers can foster a supportive learning environment by cultivating strong relationships through positive communication, community building, and genuine care, leading to increased student engagement and improved learning outcomes. In addition, using assistive technology in mathematics education, as noted by Akpan and Beard, can offer valuable assistance to students facing challenges.³⁰

THEORETICAL FRAMEWORK

The foundation of this study is rooted in the Constructivist Learning Theory.³¹ According to Piaget's theory, learners actively engage in constructing knowledge and understanding through interactions with their environment, exploration of new experiences, assimilation of new information into existing cognitive structures (schemas), accommodation of these structures to incorporate new information, and achieving equilibrium between assimilation and accommodation. This theory underscores the importance of experiences and interactions in the learning process, making it an engaging and interactive journey for learners.³² This theory challenges traditional teaching methods by emphasizing that knowledge is not merely imparted but constructed by the learner through exploration and discovery. Constructivism proposes that learners use their existing knowledge and beliefs to develop new understandings.³³ This dynamic process is shaped by the learners' interactions with their environment.³⁴ According to Piaget, learners actively participate in the cognitive processes of understanding the world around them.³⁵ This active engagement fosters deeper understanding and long-term retention of knowledge. In a constructivist classroom, teachers serve as facilitators who guide students in constructing their knowledge.³⁶ By creating opportunities for hands-on experiences, problem-solving, and collaboration, teachers can support students in developing critical thinking skills and conceptual understanding.³⁷ Constructivist teaching methods encourage students to explore, question, and reflect on their learning, promoting a deeper and more meaningful grasp of concepts.³⁸ Overall, Piaget's constructivist learning theory underscores the importance of active engagement, social interaction, and meaningful experiences in the learning process.

²⁷ David Griggs et al., "Sustainable Development Goals for People and Planet," *Nature* 495, no. 7441 (March 20, 2013): 305–7, <https://doi.org/10.1038/495305a>.

²⁸ Yueying Liu, "A Comparison Study of Using Origami as a Teaching Tool in Middle-School Mathematics Class in North America and China," 2019.

²⁹ Liu, "A Comparison Study of Using Origami as a Teaching Tool in Middle-School Mathematics Class in North America and China."

³⁰ Joseph P. Akpan and Lawrence A. Beard, "Assistive Technology and Mathematics Education," *Universal Journal of Educational Research* 2, no. 3 (March 2014): 219–22, <https://doi.org/10.13189/ujer.2014.020303>.

³¹ Jean Piaget, *Piaget's Theory* (Springer, 1976), 11–23.

³² Dianne S. Anderson and Jenny A. Piazza, "Changing Beliefs: Teaching and Learning Mathematics in Constructivist Preservice Classrooms," *Action in Teacher Education* 18, no. 2 (July 1996): 51–62, <https://doi.org/10.1080/01626620.1996.10462833>.

³³ Joan Garfield and Dani Ben-Zvi, "Helping Students Develop Statistical Reasoning: Implementing a Statistical Reasoning Learning Environment," *Teaching Statistics* 31, no. 3 (September 12, 2009): 72–77, <https://doi.org/10.1111/j.1467-9639.2009.00363.x>.

³⁴ Farooq Mughal and Aneesa Zafar, "Experiential Learning from a Constructivist Perspective: Reconceptualizing the Kolbian Cycle," *International Journal of Learning and Development* 1, no. 2 (December 19, 2011): 27, <https://doi.org/10.5296/ijld.v1i2.1179>.

³⁵ Helena Gaunt et al., "Supporting Conservatoire Students towards Professional Integration: One-to-One Tuition and the Potential of Mentoring," *Music Education Research* 14, no. 1 (March 2012): 25–43, <https://doi.org/10.1080/14613808.2012.657166>.

³⁶ Virginia Richardson, "Constructivist Pedagogy," *Teachers College Record* 105, no. 9 (2003): 1623–40.

³⁷ Gershen Kaufman, *The Psychology of Shame: Theory and Treatment of Shame-Based Syndromes* (Springer Publishing Company, 2004).

³⁸ Michael J. Prince and Richard M. Felder, "Inductive Teaching and Learning Methods: Definitions, Comparisons, and Research Bases," *Journal of Engineering Education* 95, no. 2 (April 2006): 123–38, <https://doi.org/10.1002/j.2168-9830.2006.tb00884.x>.

METHODOLOGY

A research methodology is a systematic framework guiding the entire research process, from formulating research questions to data collection, analysis, interpretation, and conclusion.³⁹ It encompasses the principles, procedures, and techniques used to conduct research and is crucial for ensuring the study's validity, reliability, and rigor.⁴⁰

Research Paradigm

The research paradigm comprises beliefs, values, and assumptions that influence the research process and shape the researcher's perspective, inquiries, methodologies, and interpretations.⁴¹ The researcher used an interpretivism paradigm. This paradigm also enables researchers to delve into the subjective experiences of individuals and analyse the meanings they attribute to their actions and interactions. One of the fundamental principles of interpretivism is its focus on the context in which social phenomena occur. Interpretivist researchers argue that understanding human behaviour requires an appreciation of the social, cultural, and historical contexts that shape individuals' perceptions and actions.⁴²

Research Approach

The study employed a qualitative research approach known for its versatility and ability to provide an in-depth understanding of phenomena, challenge conventional representations, and contribute to theory construction and evaluation. Unlike quantitative research, qualitative research requires a more structured, open-ended, and flexible methodological approach.⁴³ It involves an iterative process that generates new significant distinctions in understanding.⁴⁴ This type of research often relies on case studies and small-N designs rather than solely on qualitative evidence or methods.

Research Design

A research design is a critical component of the research process, outlining the plan for addressing research questions or testing hypotheses.⁴⁵ It serves as a roadmap, aiding researchers in selecting appropriate methods, procedures, and techniques for the effective collection and analysis of data. This study used a case study research design. The rigor of case study research is also a significant concern. Hoorani et al. argue that clarity regarding non-focal constructs is essential for establishing the validity of theoretical insights in qualitative research.⁴⁶ This trend reflects the method's versatility in addressing diverse research questions across various disciplines. Additionally, Yazan provides a comparative analysis of different case study methodologies, emphasizing the lack of consensus among researchers regarding the best practices for case study design and implementation.⁴⁷

Population

The population can be broad, encompassing all individuals within a certain demographic, or be more narrowly defined based on specific characteristics relevant to the research question. For instance, in

³⁹ Sawсан Abutabenjeh and Raed Jaradat, "Clarification of Research Design, Research Methods, and Research Methodology," *Teaching Public Administration* 36, no. 3 (October 24, 2018): 237–58, <https://doi.org/10.1177/0144739418775787>.

⁴⁰ Åsa Engström et al., "The Meaning of Critical Illness for People Suffering From COVID-19: When a Frightening Unreality Becomes Reality," *Qualitative Health Research* 32, no. 1 (January 27, 2022): 135–44, <https://doi.org/10.1177/10497323211050048>.

⁴¹ Pranas Žukauskas, Jolita Vveinhardt, and Regina Andriukaitienė, "Philosophy and Paradigm of Scientific Research," *Management Culture and Corporate Social Responsibility* 121, no. 13 (2018): 506–18.

⁴² Krishna Prasad Pathak and Samjhana Thapaliya, "Some Philosophical Paradigms and Their Implications in Health Research: A Critical Analysis," *International Research Journal of MMC* 3, no. 3 (2022): 9–17.

⁴³ Amusan Lekan, Aigbavboa Clinton, and James Owolabi, "The Disruptive Adaptations of Construction 4.0 and Industry 4.0 as a Pathway to a Sustainable Innovation and Inclusive Industrial Technological Development," *Buildings* 11, no. 3 (February 24, 2021): 79, <https://doi.org/10.3390/buildings11030079>.

⁴⁴ Andrea Teti and Pamela Abbott, "Scholarship on the Middle East in Political Science and International Relations: A Reassessment," *PS: Political Science & Politics* 56, no. 2 (April 15, 2023): 259–64, <https://doi.org/10.1017/S1049096522001378>.

⁴⁵ Kolawole Akinjide Aramide, "Investigation into the Reading Culture of Undergraduates in Nigerian Universities: A Qualitative Approach," *Library And Information Perspectives And Research* 5, no. 1 (2023): 62–72, <https://doi.org/10.47524/lipr.v5i1.64>.

⁴⁶ Bareerah Hafeez Hoorani, Emmanuella Plakoyiannaki, and Michael Gibbert, "Understanding Time in Qualitative International Business Research: Towards Four Styles of Temporal Theorizing," *Journal of World Business* 58, no. 1 (2023): 101369.

⁴⁷ Bedrettin Yazan and Ivar Vasconcelos, "Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake," *Meta: Avaliacao* 8 (January 1, 2016): 149–82.

clinical trials, the population might include all adults with a particular health condition while the target population would be a subset that meets additional criteria, such as age or severity.⁴⁸ It denotes the entire group of individuals or instances that share common characteristics and are the primary focus of a study. In this research, five schools in the Eastern Cape was selected from the OR Tambo Coastal District to represent the targeted demographic. The study specifically focused on teachers in the OR Tambo Coastal District using interviews.

Sampling

A sample in research is a smaller group selected from a bigger population to reflect and offer understanding of the population's trait.⁴⁹ Research depends on sampling to establish the extent to which results can be applied to a larger group of people.⁵⁰ This study used a purposeful sampling method to gather data from a sample of six. Fifteen teachers in the OR Tambo Coastal District in the Eastern Cape will be specifically chosen. The study used fifteen teachers as participants. To ensure a representative sample, the researcher used purposeful sampling where the aim is to gain in-depth insights into phenomena rather than to generalize findings across a larger population. Purposeful sampling aims to identify and select individuals or groups with specific knowledge or experience related to the phenomenon under investigation. For instance, Putri and Rati describe purposeful sampling as a technique aimed at obtaining in-depth and specific information by considering the research objectives.⁵¹

Data Collection

Semi-structured interviews were used as the data collection tools for this study. Semi-structured interviews are useful for exploring the phenomenon more thoroughly in research. This research explored the perspectives of participants in assisting students with specific learning needs in Mathematics education. Thematic analysis was used to identify themes from the unprocessed data. The researchers searched for comparable reactions within the data and clustered them to create patterns. Procedures for collecting data must incorporate a strategy for managing and analysing data. This includes arranging the gathered data in a structured manner, making sure it is prepared for examination. For example, Miles and Huberman highlight the significance of data reduction, presentation, and retrieval as essential stages in the data collection process.⁵²

Data Analysis

Thematic analysis involves recognizing, examining, and understanding trends and themes in qualitative data. It is a commonly used and adaptable method in research, especially in areas such as education, psychology, and sociology. The researcher reviewed all the information to gain a preliminary understanding of the material. Start encoding the information by highlighting significant or fascinating components relevant to research inquiry. This popular method consists of recognizing, scrutinizing, and documenting patterns (themes) in qualitative data. Braun and Clarke detailed a six-part procedure for carrying out thematic analysis: becoming familiar, coding, developing themes, reviewing, defining and naming themes, and writing up.⁵³

Ethical Considerations

This study complied with ethical clearance as prescribed by Walter Sisulu University. Researchers acknowledged that ethical considerations are more important in qualitative research as qualitative

⁴⁸ M. M. Willie, "Benefits Paid to Optometrists by Medical Schemes, South Africa," *Ann Clin Med Res.* 2022; 3 (1) 1058 (2022).

⁴⁹ Lawrence A Palinkas et al., "Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research," *Administration and Policy in Mental Health and Mental Health Services Research* 42 (2015): 533–44.

⁵⁰ Oliver C Robinson, "Sampling in Interview-Based Qualitative Research: A Theoretical and Practical Guide," *Qualitative Research in Psychology* 11, no. 1 (2014): 25–41.

⁵¹ Gusti Ayu Teristalya Merata Putri and Ni Wayan Rati, "Reading Problems in Grade II Elementary School Students," *Jurnal Ilmiah Sekolah Dasar* 6, no. 2 (June 4, 2022): 244–52, <https://doi.org/10.23887/jisd.v6i2.42584>.

⁵² Widya Dhea Aqtari and Nursapia Harahap, "Analysis of Children's Communication Education on the YouTube Series of Nussa and Rarra," *WACANA: Jurnal Ilmiah Ilmu Komunikasi* 22, no. 1 (June 20, 2023): 11–20, <https://doi.org/10.32509/wacana.v22i1.2649>.

⁵³ Aqtari and Harahap, "Analysis of Children's Communication Education on the YouTube Series of Nussa and Rarra."

researcher intrudes on people's lives. Turner and Fozdar highlighted the crucial importance of ethical responsibility in research. Their study includes senior secondary teachers and the researcher seeks permission from the Department of Education by sending a letter.⁵⁴ According to Mertens, ethical considerations in research involve various important factors that researchers need to consider to maintain the integrity and ethical requirements of their studies.⁵⁵ The issues to think about are:

Informed consent: Informed consent involves ensuring participants are fully informed about the study's purpose, data collection, usage, and potential risks or benefits before participating. They will willingly consent to take part.⁵⁶ The researcher prepared a concise consent form that clearly explains the extent of data collection. Participants are made aware that they could leave the study at any point without facing any consequences.

Privacy and Confidentiality: Participants were allowed to exercise control over personal information. The participants were not to be subjected to any unusual stress, embarrassment or loss of self-esteem. Researchers must protect the personal and academic data of participants. Rather than using personal names, unique codes or anonymized IDs will be used to store and analyse data. Nurmi highlighted the significance of maintaining confidentiality in the connection between the researcher and participant, which includes legal and ethical obligations related to handling personal data.⁵⁷

Transparency: Participants should understand how their data will impact the results of the research. One of the main reasons for advocating for transparency in research is to enhance the reproducibility of scientific results. Studies have indicated that a lack of openness can result in problems like selective reporting and manipulation of data, which erode the credibility of scientific publications.⁵⁸

Harm to participants: The researcher guaranteed that the study does not result in any psychological, emotional, or academic damage to the participants. AI tools in educational analytics must not harm students' learning journeys or lead to unnecessary stress.

PRESENTATION OF FINDINGS

Teachers' Views

Challenges encountered in a mathematical classroom with special needs

Teachers shared similar views on the challenges faced by teachers in supporting students with specific learning needs. A participant said, "*Some parents may be difficult to reach or may not actively engage in their child's education due to work schedules, language barriers, or other personal challenges.*" At another site, one participant said, "*Some parents may feel uncomfortable or lack confidence in their own math skills, making it difficult for them to support their child.*" A participant in another school responded by saying, "*When I organize workshops focused on basic mathematical skills and strategies, helping parents build their confidence in supporting their child, parents didn't show up.*" At a different site, one participant said, "*I found out that some students may not receive consistent support at home due to various factors, such as parents' work commitments, family dynamics, or lack of resources.*" A participant had this to say in conclusion, "*I approach these parents with empathy, acknowledging the challenges they face and offering support without adding pressure.*"

Professional Training

The section below presents feedback from participants on four key themes related to supporting students with special learning needs in mathematics teaching and learning. It outlines challenges and

⁵⁴ Marianne Turner and Farida Fozdar, "Dependency, Partiality and the Generation of Research Questions in Refugee Education," *Issues in Educational Research* 20, no. 2 (2010): 183.

⁵⁵ Mertens, Donna M. "What comes first? The paradigm or the approach." *Journal of mixed methods research* 6, no. 4 (2012): 255-257.

⁵⁶ Jackie Street et al., "Developing Best Practice in Linking and Sharing Administrative Data—A Comparison of Views in Health and Higher Education," *International Journal of Population Data Science* 5, no. 5 (2020).

⁵⁷ Sanna-Maria Nurmi, "Ethically Conducted Clinical Research in Hospitals: Views of the Stakeholders," 2018.

⁵⁸ Morton Ann Gernsbacher, "Rewarding Research Transparency," *Trends in Cognitive Sciences* 22, no. 11 (2018): 953–56.

the necessity for specialized training and development to address diverse learning styles, cognitive challenges, and specific needs.

During interviews, teachers were asked various questions about the professional training sessions that they attended which were organised by the Department of Education. Different participants gave their responses to each question. A Participant from another site responded, *“Training on how to tailor instruction to meet the varied needs of learners, including those with learning disabilities, is minimal.”* Another participant from another site said, *“Courses or workshops on understanding specific learning disabilities (e.g., dyscalculia) and their impact on mathematics teaching and learning are very few.”* Another participant said, *“Training on co-teaching models where general and special education teachers try means to collaborate to support students with learning needs.”* At a different site, a participant answered by the following response *“There is a lack of training on how to conduct formative and summative assessment techniques tailored to students with learning needs.”*

Technology in the Classroom

During the interviews, teachers were asked about technology in the classroom, The following were their responses: At a site, one participant responded, *“We are struggling to get a software that tracks student progress and adjusts the difficulty of tasks based on their performance which will help us to ensure that students are working at an appropriate level.”* In responding to the question asked them, one participant said, *“For students with difficulties in writing or reading, it is essential to get speech-to-text tools that can help them articulate their mathematical reasoning. Text-to-speech tools can read word problems aloud, and these could assist students with visual impairments, enabling them to interact with digital math content more effectively.”* The participant from a different site said, *“If there were enough resources in our schools, platforms like YouTube or Maths TV offer video tutorials that can be paused, replayed, and viewed at the student's own pace, which is beneficial for reinforcing concepts.”* Another participant said, *“Due to the lack of resources in our areas and the issue of loadshedding it is difficult to use platforms like Google Classroom or Microsoft Teams which will allow students to collaborate on mathematics problems, ask questions, and receive feedback from both peers and teachers in real time. Although technology can facilitate peer tutoring through platforms that allow students to work together virtually, lack of resources is a burning issue in our schools.”*

Parental Involvement

According to parental involvement in supporting students with specific learning difficulties in mathematics teaching and learning, teachers gave the following responses, *“Due to the illiterate level of parents in these rural areas, it is difficult to provide regular updates on their child's progress in mathematics through emails and phones band, also there is poor attendance of parents when they are called by the school in parents' meetings.”* Another participant at a different site said, *“Although I encourage parents to share their observations, concerns, and any strategies that work at home, which helps to create a consistent approach between school and home, parents are reluctant to involve themselves in their children's schoolwork.”* A participant teacher responded, *“During IEP (Individualized Education Program) meetings, I involve parents in setting specific, measurable goals related to their child's mathematics learning, however, only a few parents attend those meetings.”* Another participant concluded, *“Although I provide parents with simple, engaging math activities or games they can do at home, parents did not show any interest in their children's work.”*

Strategies to build confidence in students with learning needs

In supporting students with specific learning needs, the teachers responded, *“I break down complex math problems into smaller, more manageable steps. For example, if a student is struggling with multi-step word problems, I guide them through each step individually (e.g., understanding the problem, identifying relevant information, performing operations).”* Another participant said, *“I emphasize mastering one specific skill or concept before moving on to the next.”* Another participant added, *“I demonstrate how to solve a problem, thinking aloud to show my reasoning process. This gives students*

a clear example to follow.” A participant made this submission, “I consistently praise students for their effort and the progress they make, even if it is small. I ask students to reflect on how they solved a problem or what strategies helped them succeed, reinforcing their ability to tackle similar problems in the future.” A strategy came from a participant, “I sometimes pair students with a peer tutor or encourage small group work, where they can receive support and encouragement from classmates.”

DISCUSSION OF FINDINGS

In mathematics education, supporting students with specific learning needs presents unique challenges and valuable opportunities. Various strategies and approaches have brought to light vital findings that contribute to the effectiveness of teaching and learning in this area. It has been noted that additional professional development for teachers is crucial. The research underscores the significance of enriching teachers' professional knowledge of mathematics, ensuring the application of research-based instructional practices for positive student outcomes, and fostering skills to adapt classroom programs to aid students with learning difficulties in mathematics.⁵⁹ Studies indicate that teachers often feel unequipped to address the needs of students with developmental disabilities, highlighting the essential need for training to support students with mathematics learning disabilities.⁶⁰ In addition, teachers need to receive ongoing professional development in subject matter expertise and effectively supporting students with diverse learning needs by linking their everyday experiences with mathematical concepts.⁶¹ Teachers play a crucial role in fostering students' mathematical learning, and their professional proficiency entails mastering mathematical content and presenting it to capture students' engagement.⁶²

This study also emphasizes the necessity for more resources to aid students with special needs. Studies have indicated that students with specific difficulties in learning mathematics, such as dyscalculia, often encounter challenges in comprehending number-related concepts, recalling mathematical facts, and applying their knowledge to solve mathematical problems.⁶³ The challenges mentioned often result in a dislike for mathematics and can affect students' academic performance.⁶⁴ Teachers play a crucial role in supporting students with learning difficulties in mathematics. Nonetheless, studies have suggested that teachers may require assistance in identifying and addressing students' specific learning needs in mathematics due to a lack of training and resources.⁶⁵ Hence, there is a need to develop innovative and captivating learning materials that link mathematical concepts to students' daily lives to enhance comprehension and retention.⁶⁶ It has been observed that there needs to be more parental involvement in their children's education. Parental involvement plays a vital role in supporting students with specific learning needs in mathematics. Research has indicated that active parental support positively impacts students' attitudes toward mathematics, resulting in improved grades, test scores, and participation in advanced programs. Conversely, a lack of parental involvement has been recognized as a factor that can adversely affect learners' performance in mathematics.⁶⁷ Teaching professionals consistently emphasize the importance of parental support in enhancing students' academic performance, particularly in mathematics.⁶⁸

⁵⁹ Linda Evans, *Inclusion* (Routledge, 2007), <https://doi.org/10.4324/9780203962671>.

⁶⁰ Emad M Alghazo and Yazan M Alghazo, “In-Service and Pre-Service Special Education Teachers’ Perception of NCTM Standards: Implications for Professional Development,” *International Journal of Education and Practice* 8, no. 4 (2020): 686–94.

⁶¹ Wanyi Fang et al., “The Role of NO in COVID-19 and Potential Therapeutic Strategies,” *Free Radical Biology and Medicine* 163 (February 2021): 153–62, <https://doi.org/10.1016/j.freeradbiomed.2020.12.008>.

⁶² Kurnia Dirgantoro and Robert Soesanto, “The Impact of Pandemic Dynamics in Differential Calculus Course: An Overview of Students’ Self-Regulated Learning Based on Motivation,” 2021, <https://doi.org/10.2991/assehr.k.210508.043>.

⁶³ Anna Vintere, Eve Aruvee, and Daiva Rimkuviene, “Challenges and Benefits of Remote Learning in Context of Competence Development of Engineering Students during Covid-19 Pandemic,” 2021, <https://doi.org/10.22616/ERDev.2021.20.TF360>.

⁶⁴ Fakhira Aulia Hanifah, M Nurhalim Shahib, and Eva Rianti Indrasari, “Karakteristik Remaja Pada Siswa SMA Negeri 2 Bandung Tahun Ajaran 2022-2023,” in *Bandung Conference Series: Medical Science*, vol. 4, 2024.

⁶⁵ Hendi Wijaya, *Inspirasi Kalbu*, vol. 3 (Yogyakarta: Leutikaprio, 2019).

⁶⁶ Rinoanus E. Jenaman, Kadek A. Wibawa, and I G. A. P. A. Wulandari, “Developing a Realistic Mathematics Education Based Learning Module on Sets Subject in Junior High School,” 2022, <https://doi.org/10.2991/assehr.k.211229.042>.

⁶⁷ Renate O Shikwaya and Bhekumusa Khuzwayo, “An Investigation of Teachers’ Perceptions on Parental Involvement in Teaching and Learning Mathematics,” *International Journal for Multidisciplinary Research* 6, no. 1 (2024).

⁶⁸ Tommy Tanu Wijaya et al., “Factors Affecting the Use of Digital Mathematics Textbooks in Indonesia,” *Mathematics* 10, no. 11 (May 25, 2022): 1808, <https://doi.org/10.3390/math10111808>.

RECOMMENDATIONS

To tackle these challenges, the Department of Basic Education should offer opportunities to teachers to enhance their specialized mathematical knowledge and support their professional growth in mathematics education. It is recommended that teachers be equipped with specific strategies to assist students in overcoming their mathematical errors and difficulties, which is indispensable for providing adequate support. For quality education, the Department of Basic Education and school principals, should develop suitable teaching materials and resources vital for improving students' mathematical learning experiences. Current resources such as textbooks and worksheets may not effectively meet the diverse learning needs of students with specific mathematical difficulties. Effective parental involvement entails supporting, guiding, and encouraging children in their mathematics education. Teachers should work with parents to create a supportive learning environment for students with specific learning needs in mathematics. Teachers can benefit from training on effectively involving parents in the learning process to boost students' mathematical achievement. The school management teams should establish strong communication channels between teachers and parents, which facilitate parental involvement and enrich students' learning experiences in mathematics.

CONCLUSION

This paper has provided an overview of how students with specific learning needs in mathematics are supported. The study's findings recommend additional professional development for teachers to better support students with specific learning needs in mathematics. The challenges identified include the need for more teacher training, issues with network connectivity due to power outages, parental involvement, and integrating technology in the classroom. Practical support for students with specific learning needs in mathematics demands a multifaceted approach of differentiation, collaboration, technology integration, and fostering a growth mindset. By implementing these strategies and creating a nurturing learning environment, teachers can help students overcome obstacles, boost their confidence, and excel in mathematics. These findings underscore the significance of flexibility, empathy, and creativity in addressing the varied needs of learners.

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