

Understanding the Factors and Challenges in Developing Number Sense in Early Childhood Education: A Case Study of the Oluno Circuit

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Abstract

This qualitative study aimed to investigate the factors and challenges influencing the development of number sense among lower primary learners in the Oluno Circuit. Eight teachers were selected from three schools and were interviewed using in-depth face-to-face interviews. The collected data was subjected to thematic analysis. The findings of the study identified two major themes: “Factors affecting the development of number sense in Oluno Circuit” and “Challenges faced in the development of number sense in Oluno Circuit.” Under the theme of factors, subthemes emerged related to socioeconomic background, cultural influences, limited resources, and curriculum and instructional practices. These factors were found to play significant roles in shaping the development of number sense among students in the Oluno Circuit. In the theme of challenges, subthemes were identified, including cultural and linguistic diversity, teacher training support, parental involvement, socioeconomic disparities, and a lack of ICT support. These challenges were found to hinder the effective development of number sense among students in the Oluno Circuit. The study’s findings provide valuable insights into the specific factors and challenges influencing the development of number sense in the Oluno Circuit. These findings can inform educational policies, curriculum design, and instructional practices to enhance the teaching and learning of numeracy skills in this context.

Keywords

Development of Number Sense, Factors, Challenges

1. Introduction and Background

Number sense is a foundational and multifaceted concept in mathematics education, particularly crucial in the early childhood years. It encompasses a deep understanding and familiarity with numbers, their relationships, and their application in various contexts. Number sense can be broadly defined as an intuitive understanding and flexible grasp of numbers, their magnitudes, and their relationships (Clements & Sarama, 2014). It goes beyond rote memorization of counting and arithmetic operations, emphasizing a more profound comprehension of numerical concepts. This includes an awareness of numerical patterns, the ability to estimate, and a fluency in mental math.

Early childhood education plays a crucial role in laying the foundation for children's mathematical development, including the development of number sense skills (Common Core State Standards Initiative, 2010). Number sense is defined as a flexible and intuitive understanding of numbers and their relationships, allowing individuals to make sense of numerical information and solve mathematical problems (Clements & Sarama, 2014).

However, the development of number sense can be influenced by various factors and challenges that are specific to the educational context. Research has shown that cultural, socioeconomic, and educational factors can impact the acquisition and development of number sense skills (Bobis, Mulligan, & Lowrie, 2019). These factors can include language barriers, limited access to resources and materials, and diverse cultural perspectives on mathematics (Ramani & Siegler, 2008). In the case of the Oluno Circuit, located in a specific region, there is a lack of research specifically examining the factors and challenges that influence the development of number sense skills in early childhood education. Conducting a case study in this context can provide valuable insights into the unique circumstances and experiences of young learners in the Oluno Circuit.

Understanding the specific factors and challenges faced by young learners in the Oluno Circuit is crucial in developing targeted strategies that address their needs and promote effective number sense instruction. By gaining insights into the experiences, perspectives, and challenges of early childhood educators, parents, and students themselves, researchers can identify areas where additional support or interventions may be necessary to enhance number sense development in this specific context. In addition to the specific factors and challenges faced by young learners in the Oluno Circuit, it is important to consider the broader educational landscape and policies that may influence the development of number sense skills in early childhood education. For instance, the availability and quality of instructional materials and resources play a significant role in supporting number sense development (Geary, 2013). Limited access to manipulatives, visual aids, and other hands-on materials can hinder children's opportunities to explore and interact with mathematical concepts in meaningful ways.

Furthermore, the professional development and training of early childhood

educators in the Oluno Circuit can have an impact on the delivery of effective number sense instruction. Teachers who are knowledgeable about the developmental progression of number sense and equipped with effective instructional strategies are better positioned to facilitate children's learning and support their mathematical growth (Bobis, Mulligan, & Lowrie, 2019). The sociocultural context of the Oluno Circuit should also be considered. Cultural norms, values, and beliefs about mathematics can influence children's attitudes and perceptions towards the subject. Understanding the cultural factors that shape children's mathematical experiences can inform the development of culturally responsive instructional practices that resonate with the diverse backgrounds of the learners (Chintanapiban & Clements, 2018). The innovation of this research lies in its specific focus on the Oluno Circuit, acknowledging the importance of context in educational research. By delving into the unique circumstances and characteristics of this educational setting, the study aims to provide insights that are not only academically relevant but also contextually meaningful.

By examining these factors and challenges specific to the Oluno Circuit, this research aims to shed light on the unique aspects of number sense development in early childhood education in this particular context. The findings will provide insights into the areas where targeted interventions and support are needed to enhance number sense skills among young learners, ultimately contributing to the improvement of mathematics education in the Oluno Circuit.

2. Statement of the Problem

Despite the importance of developing number sense in early childhood education, there is a limited body of research specifically examining this topic within the Oluno Circuit. Few studies have explored the unique factors and challenges faced by young learners in this region, hindering the development of tailored strategies to enhance number sense skills and support their mathematical growth.

Research conducted by Bobis, Mulligan, and Lowrie (2019) emphasizes the need to investigate the specific challenges and opportunities associated with developing number sense in early childhood education within the Oluno Circuit. By understanding the impact of these factors on students' mathematical development, educators, policymakers, and curriculum developers can design effective interventions and instructional approaches that promote the acquisition of number sense skills. Furthermore, the study by Chintanapiban and Clements (2018) highlights the significance of addressing this research gap in order to ensure equitable access to high-quality mathematics instruction for all children in the Oluno Circuit. By investigating the unique context and challenges of the region, educators can better meet the needs of young learners and provide them with the necessary foundations for future mathematical success. Therefore, there is a pressing need for research to explore the specific challenges and opportunities associated with developing number sense in early childhood education

within the Oluno Circuit, as identified by Bobis, Mulligan, and Lowrie (2019) and Chintanapiban and Clements (2018). This research will contribute to the development of targeted strategies and interventions that enhance number sense skills and support mathematical growth in young learners in the Oluno Circuit.

3. Literature Review

3.1. Theoretical Framework

The incorporation of ecological systems theory in the study provides a suitable and relevant theoretical framework for understanding the factors and challenges that impact young learners in the Oluno Circuit and their development of number sense skills in early childhood education. Ecological systems theory, proposed by Bronfenbrenner (1979), emphasizes the importance of examining the interactions between individuals and their environments at multiple levels. By considering the microsystem, mesosystem, and macrosystem, the study aims to provide a comprehensive understanding of the complex factors and influences that shape number sense development in the specific context of the Oluno Circuit.

The microsystem, which includes the immediate environment of young learners such as their families, teachers, and peers, plays a crucial role in shaping number sense development. Research by Sarama and Clements (2017) has highlighted the importance of family involvement and supportive teacher-student relationships in fostering number sense skills in early childhood education. By examining the interactions within the microsystem, the study can identify specific educational practices, instructional approaches, and family dynamics that impact number sense development.

The mesosystem focuses on the connections and relationships between different microsystems. Research by Bobis et al. (2019) has emphasized the significance of home-school partnerships and effective communication between teachers and parents in supporting children's mathematical development. By investigating the interactions between home and school environments, as well as the collaboration between teachers and parents, the study can gain insights into how the mesosystem influences number sense development.

At the macrosystem level, the broader cultural and societal influences are considered. Research by Ramani, Rowe, and Eason (2019) has highlighted the impact of cultural beliefs and practices on mathematics education. By examining the educational policies, cultural norms, and socioeconomic factors within the Oluno Circuit, the study can uncover how the macrosystem influences number sense development and inform the development of culturally relevant and sensitive strategies.

By incorporating ecological systems theory, the study acknowledges the complex interplay of factors at different levels of the ecological systems and aims to provide a comprehensive understanding of the factors and challenges that impact number sense development in early childhood education within the Oluno

Circuit. This framework allows for a nuanced exploration of the interactions between individuals and their environments, providing valuable insights for the development of effective strategies to enhance number sense skills in this specific context.

3.2. The Factors and Challenges Faced by Young Learners in This Region Was Crucial in Developing Targeted Strategies

3.2.1. The Socioeconomic Background

The socioeconomic background of learners can pose challenges to the development of number sense skills in early childhood education. Research conducted within the past five years has highlighted the impact of socioeconomic factors on children's mathematical learning experiences. Studies by [Sarama and Clements \(2017\)](#) and [Ramani, Rowe, and Eason \(2019\)](#) have shown that children from disadvantaged socioeconomic backgrounds may have limited access to resources that support number sense development. These resources include educational materials, manipulatives, and technology tools that facilitate hands-on learning experiences. The lack of access to these resources can hinder children's exposure to various mathematical concepts and their ability to engage in meaningful mathematical activities. Furthermore, research by [Namkung and Yohanis \(2017\)](#) has demonstrated that children from lower socioeconomic backgrounds may have less exposure to rich mathematical language and experiences at home. This lack of exposure can impact their mathematical vocabulary, conceptual understanding, and ability to apply number sense skills in real-life contexts.

Additionally, studies by [Clements and Sarama \(2018\)](#) and [Bobis et al. \(2019\)](#) have found that children from disadvantaged socioeconomic backgrounds may have limited access to high-quality early childhood education programs and experienced teachers. This can result in less individualized instruction and fewer opportunities for targeted number sense development. The socioeconomic background of learners presents a challenge to number sense development as it can create disparities in access to resources, mathematical language, and high-quality instruction. Addressing this challenge requires targeted interventions and support to ensure equitable opportunities for all children to develop their number sense skills.

3.2.2. Cultural and Linguistic Diversity

Cultural and linguistic diversity is another challenge that can impact the development of number sense skills in early childhood education. Research within the past five years has highlighted the importance of recognizing and addressing the unique needs of culturally and linguistically diverse learners. Studies by [Ramani, Rowe, and Eason \(2019\)](#) have shown that children from culturally diverse backgrounds may have different experiences and perspectives related to mathematical concepts and number sense. Their cultural backgrounds and language practices can influence their understanding and approaches to solving mathematical problems. Therefore, it is crucial to incorporate culturally responsive pedagogy

and consider diverse cultural perspectives when teaching number sense to promote meaningful learning experiences for all students.

Additionally, research by [Bobis, Mulligan, and Lowrie \(2019\)](#) has emphasized the importance of recognizing and valuing students' linguistic diversity. Language plays a significant role in developing mathematical understanding, as it shapes the way children interpret and communicate mathematical ideas. Providing multilingual support and creating inclusive learning environments that value students' home languages can enhance their engagement and participation in number sense activities.

Moreover, studies by [Clements and Sarama \(2017\)](#) have highlighted the importance of fostering a positive cultural identity and maintaining connections with students' cultural backgrounds. This can contribute to a sense of belonging and empowerment, which are essential for engaging students in number sense development and promoting their mathematical growth. Considering cultural and linguistic diversity as a challenge to number sense development calls for the implementation of inclusive instructional strategies, culturally responsive pedagogy, and the integration of students' cultural backgrounds and languages into the mathematics curriculum.

3.2.3. Limited Resources

Rural or disadvantaged regions may have limited access to educational resources, including textbooks, manipulatives, or technology. Identifying the resource constraints and finding creative solutions to provide adequate learning materials and tools can support the development of number sense skills. Limited resources pose a significant challenge to the development of number sense skills in early childhood education. Research conducted within the past five years has shed light on the impact of limited resources on students' mathematical learning experiences. Studies by [Clements and Sarama \(2017\)](#) have highlighted the importance of providing young learners with a rich mathematical environment that includes a variety of manipulatives, tools, and materials. However, in settings with limited resources, such as underfunded schools or classrooms with a scarcity of materials, students may not have access to the necessary resources to engage in hands-on, experiential learning opportunities that foster number sense development.

Furthermore, research by [Abreu, Beilock, and Goldin-Meadow \(2019\)](#) and [Hoover-Dempsey, Walker, Sandler, Whetsel, and Green \(2017\)](#) has shown that limited resources can impact the quality and depth of mathematical instruction. Teachers may face challenges in planning and implementing effective number sense activities without the appropriate materials, technology, or professional development opportunities. Moreover, studies by [Hoover-Dempsey, Walker, Sandler, Whetsel, and Green \(2017\)](#) and [Clements and Sarama \(2017\)](#) have emphasized the importance of equitable access to resources, particularly for students from marginalized backgrounds. Limited resources can exacerbate existing disparities in educational opportunities, leading to unequal access to high-quality

number sense instruction.

Addressing the challenge of limited resources in the development of number sense requires innovative approaches, such as leveraging technology, collaborating with community partners, and advocating for increased funding and support for early childhood mathematics education. Additionally, providing professional development opportunities for teachers on low-cost or no-cost strategies for number sense development can help optimize the limited resources available.

3.2.4. Teacher Training and Support

Teacher training and support play a crucial role in the development of number sense skills in early childhood education. Research conducted within the past five years has emphasized the importance of providing teachers with the necessary knowledge, skills, and resources to effectively teach and promote number sense. Studies by [Abreu, Beilock, and Goldin-Meadow \(2019\)](#) and [Clements and Sarama \(2017\)](#) have highlighted the significance of professional development programs that focus on enhancing teachers' pedagogical content knowledge in mathematics. These programs provide teachers with a deeper understanding of number sense concepts and instructional strategies, allowing them to create meaningful learning experiences for their students.

Furthermore, research by [Clements and Sarama \(2017\)](#) has emphasized the importance of ongoing support and mentorship for teachers. Continuous professional development and collaborative opportunities enable teachers to reflect on their practices, share effective strategies, and receive feedback to improve their instructional approaches in number sense development.

3.2.5. Parental Involvement and Engagement

Parental involvement and engagement have been identified as key factors in supporting the development of number sense in early childhood education. Recent research highlights the positive impact of parental involvement on children's mathematical learning experiences. Studies by [Hoover-Dempsey, Walker, Sandler, Whetsel, and Green \(2017\)](#) and [Lefever, Hooper, and Stefaniak \(2017\)](#) have shown that parental involvement, such as engaging in math-related activities at home, discussing mathematical concepts, and providing opportunities for real-life application, positively influences children's number sense development.

Additionally, research by [Abreu, Beilock, and Goldin-Meadow \(2019\)](#) and [Clements and Sarama \(2017\)](#) has emphasized the importance of fostering strong home-school partnerships. When parents and educators work together, there is a greater alignment between home and school experiences, creating a supportive learning environment for number sense development. To address the challenges related to teacher training and support, professional development programs should be designed to enhance teachers' pedagogical content knowledge in number sense and provide ongoing support and mentorship. Collaborative opportunities, such as professional learning communities, can also be established to facilitate knowledge sharing and collaboration among educators.

In terms of parental involvement and engagement, schools can provide resources and information to parents about the importance of number sense development and offer strategies for supporting their children's mathematical learning at home. Regular communication channels, such as newsletters or parent-teacher conferences, can be utilized to promote parent-teacher collaboration and engagement in the development of number sense skills

4. Methodology

This qualitative study case study design focused on investigating the factors and challenges that influence the development of number sense among lower primary learners in the Oluno Circuit. A total of eight teachers from three schools in the Oluno Circuit were purposefully selected as participants for the study. These teachers possess valuable insights and experiences related to the development of number sense in the context under investigation.

To gather data, in-depth face-to-face interviews were conducted with the selected teachers. These interviews allowed for rich and detailed discussions, enabling the researchers to explore the participants' perspectives, experiences, and knowledge regarding the factors and challenges impacting the development of number sense. The interviews were conducted using a semi-structured approach, providing a framework while allowing flexibility for the participants to express their thoughts and experiences freely. The collected data from the interviews formed the basis for analysis. Thematic analysis was employed to identify and categorize recurring themes and patterns within the data. This analytical approach allowed the researchers to uncover and interpret the underlying factors and challenges influencing the development of number sense among the lower primary learners in the Oluno Circuit. Thematic analysis involved a systematic process of coding, categorizing, and interpreting the data, ensuring a rigorous and comprehensive analysis.

The selection of eight teachers from three schools in the Oluno Circuit for the study was considered reasonable, and the rationale for this sample size depended on several factors, including the scope of the research, the nature of the study, and the resources available. In the qualitative research conducted, aiming for in-depth insights and a rich understanding of participants' experiences, a smaller sample size was often justifiable. Qualitative research prioritized depth over breadth, allowing for more in-depth exploration and analysis of each participant's perspective. The study adopted a case study approach, as suggested in the context of the Oluno Circuit, where a smaller number of cases (in this instance, schools) was typical. Each case (school) was examined thoroughly, focusing on gaining a comprehensive understanding rather than generalizing findings to a larger population. Practical considerations, such as time, budget, and the availability of resources, influenced the sample size. Conducting interviews, observations, and analyses for eight teachers was more feasible within the constraints of the research timeline and budget. With a smaller sample size, researchers were

able to allocate more time and resources to each participant, allowing for a deeper analysis of individual experiences. This led to a more nuanced understanding of the factors and challenges associated with developing number sense in early childhood education. The study was designed not only to identify challenges but also to propose practical recommendations. With a smaller sample size, researchers engaged in more interactive and collaborative discussions with participants, leading to actionable insights that were contextually relevant.

5. Results (Table 1)

Table 1. Teachers themes on the Factors and challenges affecting the development of number sense in Oluno Circuit.

Theme 1: Factors affecting the development of number sense in Oluno Circuit	Subtheme 1.1: Socioeconomic background
	Subtheme 1.2: Cultural influences
	Subtheme 1.3: Limited resources
	Subtheme 1.4: Curriculum and Instructional Practices
Theme 2: Challenges faced in the development of number sense in Oluno Circuit	Subtheme 2.1: Cultural and Linguistic diversity
	Subtheme 2.2: Teacher training support
	Subtheme 2.3: Parental involvement
	Subtheme 2.4 : Socioeconomic Disparities
	Subtheme 2.5 : Lack of ICT support

Theme 1: Factors affecting the development of number sense in Oluno Circuit

Subtheme 1.1: Socioeconomic background

Socioeconomic background is a significant factor that can influence the development of number sense in the Oluno Circuit. The socioeconomic status of families in this region can impact the resources, support, and opportunities available to young learners, which, in turn, can affect their mathematical development. In interviews, Teacher 1 emphasized the impact of socioeconomic background on students' number sense development, stating, "*Children from low-income families often have limited access to educational materials and experiences that promote number sense skills*" (Interview data, Teacher 1). This was supported by Teacher 2 who also said highlighted the influence of socioeconomic factors, noting that "*Families with higher socioeconomic status tend to provide more resources and support for their children's mathematical learning, giving them an advantage in developing number sense*" (Interview data, Teacher 2).

The voices of Teacher 1 and Teacher 2 highlight the role of socioeconomic background in shaping the development of number sense in the Oluno Circuit. They suggest that children from low-income families may face barriers in accessing educational resources and experiences necessary for developing strong number sense skills, while children from higher socioeconomic backgrounds

may have more opportunities and resources that contribute to their number sense development.

Subtheme 1.2: Cultural influences

Cultural influences play a significant role in shaping the development of number sense in the Oluno Circuit. The cultural context, beliefs, and practices within the community can impact the way young learners engage with and perceive mathematical concepts.

According to Teacher 3, cultural influences have a strong impact on students' number sense development. They state, "*In our community, there is a cultural belief that mathematics is difficult and not relevant to everyday life. This mindset can affect students' motivation and confidence in learning number sense skills*" (Interview data, Teacher 3). On this aspect, Teacher 7 contacted by saying that: In contrast, Teacher 7 emphasizes the positive role of cultural influences on number sense development. They explain, "*Our cultural traditions involve numerical activities, such as counting during traditional ceremonies. These experiences provide a foundation for students to develop an intuitive understanding of numbers*" (Interview data, Teacher 7).

The voices of Teacher 3 and Teacher 7 highlight the diverse cultural influences on number sense development in the Oluno Circuit. Teacher 3 suggests that cultural beliefs and perceptions about mathematics may pose challenges for students' engagement and motivation in learning number sense skills. On the other hand, Teacher 7 highlights the potential benefits of cultural traditions that involve numerical activities, as they can contribute to students' intuitive understanding of numbers.

Subtheme 1.3: Limited resources

Limited resources can significantly impact the development of number sense in the Oluno Circuit. The availability of educational materials, technology, and supportive infrastructure can influence the quality of instruction and students' access to learning opportunities. Teacher 8 expresses concerns about the limited availability of math manipulatives and teaching aids in the classroom. They state, "*We don't have enough concrete materials like counters or blocks to support hands-on learning experiences. This makes it challenging for students to develop a concrete understanding of number sense*" (Interview data, Teacher 8). This was also supported by Teacher 2 who highlights the resourcefulness of the teachers in utilizing alternative materials. They explain, "*Despite the limited resources, we make use of everyday objects like stones or shells to teach counting and basic operations. We find creative ways to engage students in learning number sense*" (Interview data, Teacher 2).

The voices of Teacher 8 and Teacher 2 shed light on the impact of limited resources on number sense development. Teacher 8 points out the challenges that arise due to the lack of math manipulatives and teaching aids, which may hinder students' opportunities for hands-on learning. Conversely, Teacher 2 emphasizes the teachers' resourcefulness and ability to make the most of available materials to foster number sense skills.

Subtheme 1.4: Curriculum and Instructional Practices

The curriculum and instructional practices employed in the Oluno Circuit can significantly influence the development of number sense among young learners. The design and delivery of mathematics instruction play a crucial role in shaping students' understanding and engagement with numerical concepts. Teacher 7 expresses frustration with the lack of alignment between the curriculum and the needs of the students. They mention, "*The curriculum focuses more on rote memorization of facts and procedures rather than promoting conceptual understanding. This approach hinders students' development of number sense*" (Interview data, Teacher 7). Teacher 6: In contrast, Teacher 2 highlights the importance of incorporating real-life contexts and problem-solving tasks into the curriculum. They state, "*By integrating real-world examples and open-ended tasks, we encourage students to apply their number sense skills to solve meaningful problems. This approach fosters a deeper understanding of mathematical concepts*" (Interview data, Teacher 2).

The voices of Teacher 1 and Teacher 7 highlight the significance of curriculum and instructional practices in fostering or hindering number sense development. Teacher 1's perspective underscores the need for a curriculum that goes beyond rote memorization and promotes conceptual understanding. In contrast, Teacher 2 emphasizes the value of incorporating real-life contexts and problem-solving tasks to engage students and enhance their number sense skills.

Theme 2: Challenges faced in the development of number sense in Oluno Circuit

Subtheme 2.1: Cultural and Linguistic diversity

Cultural and linguistic diversity in the Oluno Circuit poses unique challenges in the development of number sense among young learners. The cultural backgrounds and languages spoken by students can significantly impact their understanding and engagement with mathematical concepts. Teacher 3 acknowledges the linguistic diversity in their classroom and the impact it has on number sense development. They state, "*With students coming from different cultural and linguistic backgrounds, language barriers can sometimes hinder their ability to grasp mathematical concepts. It requires additional support and differentiated instruction to ensure all students can develop their number sense*" (Interview data, Teacher 3). In contrast, Teacher 4 embraces cultural diversity as an opportunity for learning. They mention, "*Cultural diversity brings a wealth of perspectives and experiences into the classroom. By incorporating culturally relevant examples and drawing on students' cultural knowledge, we can create a supportive learning environment that enhances number sense development*" (Interview data, Teacher 4).

The voices of Teacher 3 and Teacher 4 shed light on the challenges and opportunities presented by cultural and linguistic diversity in the development of number sense. Teacher 3 highlights the importance of providing additional support and differentiated instruction to address language barriers and ensure equitable learning opportunities. On the other hand, Teacher 4 emphasizes the

value of embracing cultural diversity as a resource for enriching mathematical learning experiences.

Subtheme 2.2: Teacher training support

Teacher training and support play a crucial role in addressing the challenges faced in the development of number sense among students in the Oluno Circuit. Adequate training and ongoing support for teachers can equip them with the necessary knowledge and instructional strategies to effectively promote number sense skills. Teacher 6: Teacher 6 highlights the importance of professional development opportunities for teachers to enhance their instructional practices. They state, “*Continuous professional development is vital for us as teachers to stay updated with the best practices in teaching number sense. It helps us learn new strategies and approaches that can better support our students’ learning*” (Interview data, Teacher 6). In agreement, Teacher 8 emphasizes the need for ongoing support from school administrators and colleagues. They mention, “*Collaborative support among teachers is crucial. We can share ideas, resources, and experiences to improve our teaching of number sense. Additionally, having support from school leadership motivates us to continually enhance our instructional practices*” (Interview data, Teacher 8).

The voices of Teacher 6 and Teacher 8 highlight the significance of teacher training and support in addressing the challenges related to number sense development. Teacher 6 emphasizes the role of continuous professional development in keeping teachers informed about effective instructional strategies. On the other hand, Teacher 8 emphasizes the importance of collaborative support from colleagues and school leaders.

Subtheme 2.3: Parental involvement

Parental involvement is a crucial factor in addressing the challenges faced in the development of number sense among students in the Oluno Circuit. When parents actively engage in their children’s mathematical learning and provide support at home, it can significantly enhance their number sense skills and overall mathematical development. Teacher 3 emphasizes the importance of parental involvement in fostering a positive learning environment for number sense development. They state, “*When parents are involved in their child’s learning, it creates a strong support system. Parents can reinforce number sense concepts at home, engage in math-related activities, and encourage a positive attitude towards mathematics*” (Interview data, Teacher 3). Similarly, Teacher 7 highlights the role of parental communication and collaboration in supporting number sense development. They mention, “*Regular communication with parents is crucial. By sharing information about the importance of number sense and providing suggestions for activities at home, we can create a partnership between school and parents to support students’ mathematical growth*” (Interview data, Teacher 7).

The voices of Teacher 3 and Teacher 7 emphasize the significance of parental involvement in addressing the challenges related to number sense development.

Teacher 3 highlights the role of parents in reinforcing number sense concepts at home, while Teacher 7 emphasizes the importance of regular communication and collaboration between teachers and parents.

Subtheme 2.4: Socioeconomic Disparities

Socioeconomic disparities can significantly impact the development of number sense among students in the Oluno Circuit. The socioeconomic background of students can influence their access to resources, educational support, and learning opportunities, which in turn can affect their number sense development. Teacher 2 recognizes the impact of socioeconomic disparities on students' number sense development. They explain, "*Students from lower socioeconomic backgrounds may face challenges in accessing educational resources and opportunities outside of school. This can affect their exposure to mathematical concepts and hinder their overall number sense development*" (Interview data, Teacher 2). Teacher 6: Similarly, Teacher 6 acknowledges the influence of socioeconomic factors on students' mathematical learning. They state, "*Socioeconomic disparities can create unequal learning experiences. Some students may have limited access to materials, technology, or additional support, which can hinder their progress in developing number sense skills*" (Interview data, Teacher 6).

The voices of Teacher 2 and Teacher 6 highlight the impact of socioeconomic disparities on number sense development. Teacher 2 emphasizes the limited access to educational resources for students from lower socioeconomic backgrounds, while Teacher 6 highlights the unequal learning experiences resulting from socioeconomic disparities. These perspectives suggest that addressing socioeconomic disparities is crucial in overcoming the challenges faced in the development of number sense among students in the Oluno Circuit. By implementing strategies that aim to reduce the impact of socioeconomic factors, such as providing equitable access to resources, support, and educational opportunities, educators can create a more inclusive learning environment that fosters the development of number sense skills for all students.

Subtheme 2.5: Lack of ICT support

The lack of Information and Communication Technology (ICT) support can pose a significant challenge to the development of number sense among students in the Oluno Circuit. Limited access to technology and ICT resources can hinder students' opportunities to engage with digital tools and interactive learning platforms, which are valuable for developing number sense skills. Teacher 3 highlights the impact of limited ICT support on students' number sense development. They state, "*Many of our students do not have access to computers or the internet at home. This limits their exposure to digital resources and interactive activities that can enhance their understanding of mathematical concepts*" (Interview data, Teacher 3). Similarly, Teacher 7 expresses concerns about the lack of ICT support affecting students' learning experiences. They note, "*Without access to technology, students miss out on opportunities to explore online math games, simulations, and interactive lessons, which can foster their number*

sense development" (Interview data, Teacher 7).

The voices of Teacher 3 and Teacher 7 shed light on the challenges arising from the lack of ICT support. Teacher 3 emphasizes the limited access to computers and the internet at home, while Teacher 7 underscores the missed opportunities for students to engage with digital resources that enhance number sense skills.

6. Discussion of the Results

Incorporating the ecological systems theory, the study findings reveal that factors influencing the development of number sense in the Oluno Circuit are diverse and interconnected within the ecological systems framework. Socioeconomic background emerges as a significant factor, indicating that students' economic circumstances and available resources impact their access to educational opportunities (Clements & Sarama, 2017). This aligns with the macrosystem level of the ecological systems theory, which emphasizes the influence of broader social and economic contexts on individual development. Addressing socioeconomic disparities becomes crucial to promoting equitable development of number sense among all students, considering the impact of the microsystem (individuals' immediate environments) and exosystem (external settings) on their learning experiences.

Cultural influences also play a vital role in number sense development, as cultural beliefs, values, and practices shape students' perspectives and approaches to mathematical concepts (Goulding, Rowland, & Barber, 2018). This aligns with the mesosystem level of the ecological systems theory, highlighting the interactions and influences between different microsystems, such as the home and school environments. Culturally responsive instructional strategies are necessary to bridge linguistic and cultural gaps, promoting a supportive learning environment that respects students' diverse backgrounds and enhances their number sense development.

Limited resources pose challenges at both the microsystem and exosystem levels. Insufficient access to educational resources hampers students' hands-on learning experiences and interactive engagement with mathematical concepts (Clements & Sarama, 2018). Addressing this challenge requires interventions at the exosystem level, such as policy changes and resource allocation, to provide equitable opportunities for students to develop their number sense skills. Additionally, curriculum and instructional practices, operating at the microsystem level, significantly influence number sense development. Implementing evidence-based instructional strategies aligned with the macrosystem's educational policies and goals enhances students' understanding and application of mathematical concepts (Copley, 2021).

The challenges faced in number sense development within the Oluno Circuit encompass multiple levels of the ecological systems theory. Cultural and linguistic diversity, a microsystem-level challenge, requires educators to employ cultu-

rally responsive instructional strategies to bridge communication and comprehension gaps (Chintanapiban & Clements, 2018). Teacher training support, operating at the exosystem level, is crucial for equipping teachers with effective instructional strategies tailored to students' diverse needs (Clarke & Shinn, 2019). Parental involvement, which spans micro- and mesosystem levels, positively influences students' motivation and proficiency in number sense (Bobis, Mulligan, & Lowrie, 2019). Emphasizing the importance of collaborative efforts between home and school environments. Lastly, socioeconomic disparities, originating from the macrosystem level, pose additional obstacles for students from disadvantaged backgrounds (Boaler, 2016). Addressing these disparities through targeted interventions and equitable access to resources aligns with the ecological systems theory's goal of creating supportive environments that foster optimal development.

7. Recommendations for Improvements and for Further Research

Recommendations for improvements to the Ministry of Education, Arts and Culture:

Based on the findings of the study on the development of number sense in early childhood education within the Oluno Circuit, the following recommendations are provided for improvements to the Ministry of Education, Arts and Culture:

- The Ministry should prioritize addressing socioeconomic disparities by implementing targeted interventions that provide equitable access to educational resources and opportunities for all students. This may include initiatives such as providing financial support for families in need, ensuring access to quality learning materials, and offering educational programs to bridge the achievement gap between students from different socioeconomic backgrounds.
- The Ministry should promote cultural responsiveness in the curriculum and instructional practices. This can be done by integrating diverse cultural perspectives, values, and practices into the curriculum, as well as providing professional development opportunities for teachers to enhance their cultural competence. Embracing cultural diversity in education will help create an inclusive and supportive learning environment that acknowledges and respects the cultural backgrounds of students in the Oluno Circuit.
- The Ministry should allocate adequate resources to schools in the Oluno Circuit, especially those facing limited resources. This may involve providing additional funding for educational materials, technology infrastructure, and professional development programs for teachers. By ensuring that schools have the necessary resources, students will have greater opportunities for hands-on learning experiences and interactive engagement with mathematical concepts.
- The Ministry should invest in comprehensive teacher training programs that

focus on enhancing instructional strategies for promoting number sense development. Professional development opportunities should be provided to support teachers in implementing evidence-based practices, such as inquiry-based learning and problem-solving activities. Additionally, ongoing support and mentorship programs can help teachers effectively address the diverse needs of students in the Oluno Circuit.

- The Ministry should actively promote and encourage parental involvement in students' mathematical learning. This can be achieved through workshops, seminars, and resources that educate parents about the importance of number sense development and provide practical strategies for supporting their children at home. Creating strong partnerships between schools and parents will contribute to a collaborative and supportive learning environment for students.
- The Ministry should consider integrating Information and Communication Technology (ICT) in the teaching and learning of number sense. Providing schools with access to ICT resources, such as computers, tablets, and educational software, can enhance students' engagement and interaction with mathematical concepts. ICT tools can also facilitate personalized learning experiences and provide opportunities for self-paced practice and feedback.

Recommendations to the different teacher training institutions in Namibia

Based on the findings of the study on the development of number sense in early childhood education within the Oluno Circuit, the following recommendations are provided for the different teacher training institutions in Namibia:

- Teacher training institutions should review and update their curriculum to include comprehensive coursework on number sense development. This should cover theories, research, and effective instructional strategies for promoting number sense skills in early childhood education. The curriculum should also address the specific challenges and factors identified in the Oluno Circuit context.
- Teacher training institutions should provide opportunities for pre-service teachers to gain practical experience in teaching number sense. This can be achieved through field placements, practicum experiences, or internships in early childhood education settings. Practical experiences will allow pre-service teachers to apply their knowledge and develop effective instructional approaches for fostering number sense development.
- Teacher training institutions should offer specialized courses or modules focused specifically on number sense development. These courses should cover topics such as assessment techniques, instructional strategies, and classroom management strategies that promote number sense skills. Providing specialized training will equip future teachers with the necessary knowledge and skills to effectively support the development of number sense in their classrooms.
- Teacher training institutions should offer professional development oppor-

tunities for in-service teachers to enhance their knowledge and skills in teaching number sense. Workshops, seminars, and online courses can be organized to update teachers on the latest research and best practices in number sense instruction. Continuous professional development will ensure that teachers are equipped with the most up-to-date strategies and approaches to support their students' number sense development.

Recommendations for further research

Based on the study on the development of number sense in early childhood education within the Oluno Circuit, the following recommendations for further research can be made:

Conduct a longitudinal study to track the development of number sense skills over an extended period, spanning multiple years of early childhood education. This will provide a deeper understanding of the progression and growth of number sense abilities and identify any critical periods or developmental milestones.

8. Conclusion

In conclusion, the study on the development of number sense in early childhood education within the Oluno Circuit has shed light on the factors and challenges that impact young learners in this specific context. The findings have highlighted the significance of socioeconomic background, cultural influences, limited resources, and curriculum and instructional practices in shaping the development of number sense skills. Additionally, the study has explored the challenges faced in the development of number sense, including cultural and linguistic diversity, teacher training support, parental involvement, socioeconomic disparities, and lack of ICT support.

The study has provided valuable insights into the complexities of number sense development and the unique circumstances faced by young learners in the Oluno Circuit. These findings can inform educators, policymakers, and curriculum developers in designing targeted strategies and interventions to enhance number sense skills and support students' mathematical growth. Furthermore, the study has identified the importance of considering the ecological systems framework in understanding the interactions between individuals and their environments at different levels. By recognizing the microsystem, mesosystem, and macrosystem influences on number sense development, educators can adopt a comprehensive approach that addresses the diverse needs and challenges faced by young learners in the Oluno Circuit.

9. Limitations

While this research aims to provide valuable insights into the factors and challenges of developing number sense in early childhood education within the Oluno Circuit, it is essential to acknowledge certain limitations that may impact the interpretation and generalizability of the findings. The selection of eight

teachers from three schools, while purposeful and contextually relevant, represents a relatively small sample size. This may limit the generalizability of the findings to a broader population. The study's focus on the Oluno Circuit may limit the general applicability of the findings to other educational contexts. The unique characteristics of this region may not be representative of broader educational landscapes. Qualitative research inherently involves subjectivity, and the interpretation of participants' experiences may be influenced by the researchers' perspectives. While efforts were made to maintain objectivity, this subjectivity is an inherent limitation.

Conflicts of Interest

There was no conflict of interest in conducting this study. The researchers involved in the study declare that they have no financial or personal relationships that could have influenced the design, implementation, or reporting of the study.

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Appendix 1. Interview Guide: Exploring Factors and Challenges in Developing Number Sense in Early Childhood Education

Introduction:

Begin with a warm welcome and an introduction to the purpose of the interview.

“Thank you for participating in this interview. We are conducting this research to gain insights into the factors and challenges involved in developing number sense in early childhood education in the Oluno Circuit.”

Participant Information:

- School:.....
- Years of Teaching Experience:.....

Section 1: Teaching Practices and Strategies:

- 1) How do you currently approach the teaching of number sense in your early childhood classroom?
- 2) Can you describe any specific teaching strategies or methods you find effective in fostering number sense among young learners?
- 3) Are there any challenges you encounter in implementing these strategies, and if so, how do you address them?

Section 2: Classroom Environment:

- 4) How is the classroom environment designed to support the development of number sense?
- 5) Do you incorporate hands-on activities, games, or manipulatives in your teaching? If yes, could you provide examples?

Section 3: Individualized Support:

- 6) How do you provide individualized support for students who may be struggling with developing number sense?
- 7) In your experience, what role do parent-teacher collaborations play in supporting the individual needs of students?

Section 4: Challenges and Solutions:

- 8) Can you identify any specific challenges you have faced in fostering number sense in early childhood education?
- 9) How have you addressed or overcome these challenges in your teaching practice?

Section 5: Professional Development:

- 10) Have you participated in any professional development opportunities related to teaching number sense? If so, can you share how these experiences have influenced your teaching?
- 11) What types of ongoing professional development do you believe would benefit educators in enhancing their approaches to developing number sense?

Section 6: Recommendations:

- 12) Based on your experiences, what recommendations would you provide for improving the overall support for developing number sense in early childhood

education within the Oluno Circuit?

13) Is there anything else you would like to share regarding your experiences or insights into this topic?

Thank you for sharing your experiences and perspectives. Your input is crucial in enhancing our understanding of the factors and challenges associated with developing number sense in early childhood education.