

# Understanding Problems Encountered by Dyslexic Learners in Mathematics: A Qualitative Inquiry

Rajendra Kunwar<sup>1</sup>

## Abstract

Dyslexic learners often experience difficulties in mathematics, which can hurt their academic achievement and future success. This study aimed to understand the problems encountered by dyslexic learners in mathematics. The study involved five dyslexic learners in grades V and VI from public schools in the Kathmandu Valley. Data were collected through in-depth interviews and analyzed using thematic analysis. The analysis revealed five themes: difficulty applying mathematical concepts, the impact of dyslexia on mathematics achievement, challenges related to language, comprehension, and memory, math anxiety and self-esteem, and individual differences and support systems. The results of this study highlight the need for targeted support and interventions that address the specific needs of dyslexic learners in mathematics education to improve their overall academic performance. It is recommended that a multi-faceted approach be implemented to support dyslexic learners in mathematics education, which should support the learners to overcome their challenges and achieve success in mathematics.

**Keywords:** dyslexia, individual differences, learning difficulties, mathematical concepts, mathematical language, mathematical symbols

## Introduction

Dyslexia is a learning difficulty that affects an individual's ability to read, write, and spell. It is estimated that approximately 5-10% of the population is dyslexic (Shaywitz et al., 2021; Snowling & Melby-Lervåg, 2016). Dyslexia can significantly impact academic performance, particularly in subjects that require strong reading and writing skills, such as mathematics (Bodrova & Leong, 2017; Sharma et al., 2018). Dyslexic learners may encounter difficulties in understanding mathematical concepts, reading word problems, and recalling mathematical procedures (Sharma et al., 2018). As mathematics is a fundamental subject in education, the difficulties faced by dyslexic learners in this subject can significantly affect their academic success and future careers.

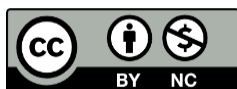
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A body of research has identified several challenges that dyslexic learners encounter in mathematics. These challenges include difficulties in understanding mathematical concepts, applying mathematical procedures, and solving word problems (Bodrova & Leong, 2017; Sharma et al., 2018). Dyslexic learners may also struggle with spatial reasoning, which is crucial for comprehending geometry and other mathematical concepts (Butterworth, 2010). Additionally, the standard mathematical language and symbols used in the subject can be challenging for dyslexic learners, who may have difficulty decoding and comprehending written texts (Kaufmann et al., 2013; Sharma et al., 2018).

Several studies have identified specific areas of difficulty that dyslexic learners may encounter in mathematics. For example, dyslexic learners may struggle with reading and comprehending word problems, which can make it challenging to identify relevant information and solve the problem (Kunwar & Sapkota, 2022; Koponen et al., 2020). Despite these challenges, dyslexic learners can still achieve success in mathematics with appropriate support and accommodations. However, there is a need for further research to understand the experiences and challenges of dyslexic learners in mathematics. Recent studies have emphasized the importance of using a qualitative approach to gain an in-depth understanding of the experiences and perspectives of dyslexic learners in mathematics (Dyslexia Foundation, 2021).

While there are studies conducted on dyslexia and mathematics, there is still a need for a deeper understanding of the challenges dyslexic learners face and how teachers can support them. Qualitative research methodologies, such as phenomenology, provide an opportunity to explore the unique experiences of dyslexic learners in mathematics. By gaining insights into the specific challenges faced by these learners, teachers can develop effective strategies for teaching mathematics to dyslexic learners and improving their academic outcomes.

The objectives of this qualitative inquiry are to gain a deeper understanding of the challenges dyslexic learners face in mathematics, explore the specific difficulties dyslexic learners encounter in mathematics, and how teachers can support dyslexic learners in learning mathematics.

### ***A Short Glimpse at the Literature***

Dyslexia is a common learning disorder that affects reading and writing skills, it can also have a significant impact on mathematics learning (Kunwar & Shapkota, 2022; Wilson et al., 2021). Dyslexic learners may struggle with mathematical language, symbols, and notation, making it difficult to understand concepts and solve problems (Bodrova & Leong, 2017). The spatial aspects of mathematics, such as geometry and spatial relationships, can also pose challenges for dyslexic learners (Butterworth, 2010). Dyslexia affects approximately 5-10% of individuals worldwide (Snowling & Melby-Lervåg, 2016).

The disorder is characterized by difficulties in accurate and fluent word recognition, poor spelling, and decoding abilities. Dyslexia has been found to have

a significant impact on mathematics achievement (Almahrag, 2021; Chinn & Ashcroft, 2017). Dyslexic learners may struggle with mathematical language and symbols, as well as with understanding and applying mathematical concepts. Research has identified several areas of difficulty that dyslexic learners may encounter in mathematics. Dyslexic learners may have difficulty with basic numerical processes such as counting, ordering, and comparing numbers (Geary et al., 2013; Kunwar & Sapkota, 2022). They may also struggle with mathematical reasoning, problem-solving, and spatial reasoning (Bartelet et al., 2014). Despite these challenges, dyslexic learners can still achieve success in mathematics with appropriate support and interventions. The success of interventions for dyslexic learners in mathematics depends on the individual's needs and strengths (Butterworth, 2014).

Research findings have consistently shown that dyslexia poses significant challenges for children, affecting their academic performance and social well-being. Difficulties in reading, a core characteristic of dyslexia, often lead to frustration and increased levels of reading anxiety (Carroll & Iles, 2006; Kunwar & Sapkota, 2022). The prevalence of dyslexia varies across different countries, reflecting differences in writing systems and cultural contexts. In the United States, estimates range from 5% to 17% of children, while in the United Kingdom, they range from 3% to 6% (Wajuihian & Naidoo, 2011). In Europe, the prevalence can be as high as 15% of the population (European Dyslexia Association, 2022). Non-English-speaking countries like China report prevalence rates ranging from 3.0% to 12.6% (Gu et al., 2018).

Gender differences also play a role in the prevalence of dyslexia, with males being more commonly affected than females, with a ratio of approximately 3.4 to 1 (Hawke et al., 2009; Jiménez et al., 2009). This disparity may be influenced by the tendency of teachers to perceive boys as more disruptive, leading to their referral for special assistance with reading problems (Shaywitz et al., 2021). The global prevalence of dyslexia is estimated to range from 5% to 10% of the population (Snowling & Melby-Lervåg, 2016). However, achieving early identification, intervention, and adequate support for students with dyslexia remains a challenge in many countries, including Nepal (Forrester et al., 2020; Kunwar & Sapkota, 2022).

Furthermore, dyslexia not only affects reading but also has implications for mathematical abilities. Students with dyslexia are at a higher risk of experiencing difficulties in mathematics, particularly in areas such as word problems, logic, and abstract reasoning (Lewis & Fisher, 2016). The prevalence of dyslexia in mathematics varies depending on the language and country, and discrepancies in diagnostic criteria and assessment tools contribute to the variation (Lin et al., 2020). Studies from different countries have reported prevalence rates ranging from 3.08% in India to 9.9% in China among students with dyslexia (Gu et al., 2018; Su et al., 2020). In English-speaking countries, the prevalence of dyslexia among outpatients ranges from approximately 5% to 10%, and among school-age children, it is around 17.5% (Cavalli et al., 2018).

In conclusion, dyslexia poses significant challenges for individuals and their families worldwide. The prevalence rates of dyslexia vary across countries and languages, influenced by factors such as writing systems and cultural contexts. Gender differences are also observed, with males being more commonly affected. It is crucial to raise awareness and provide appropriate support for individuals with dyslexia to address their academic and social difficulties effectively. The literature related to dyslexia and mathematics as well as language and dyslexia are discussed briefly in this section.

**Dyslexia and Mathematics.** Dyslexia and mathematics are closely related, as dyslexic learners often struggle with the language-based aspects of mathematics, such as reading and comprehending word problems or understanding mathematical symbols (Sharma et al., 2018). Research indicates that dyslexic learners may encounter difficulties in multiple areas of mathematics, including numerical processing, arithmetic, and problem-solving (Bodrova & Leong, 2017; Sharma et al., 2018). Recent studies have further elucidated the relationship between dyslexia and mathematics. For instance, Wilson and colleagues (2021) found that dyslexic learners have specific difficulties with processing and manipulating numerical quantities, which may contribute to their difficulties with mathematics. Similarly, dyslexic learners may have difficulty with the visual-spatial aspects of geometry, which may be related to their underlying difficulties with processing visual information (Lipowska et al., 2011). Thus, dyslexia can significantly impact a learner's ability to learn and succeed in mathematics. However, with appropriate support and intervention, dyslexic learners can still achieve success in this subject (Sharma et al., 2018).

Teachers and educators can play a crucial role in supporting dyslexic learners in mathematics by developing effective teaching strategies that take into account the unique challenges faced by these learners (Bodrova & Leong, 2017; Sharma et al., 2018). Additionally, potential strengths and compensatory mechanisms can be developed to address the challenges that dyslexic learners face in mathematics. For example, enhancing their abilities in visuospatial working memory can be beneficial for tasks such as mental rotation and spatial reasoning in mathematics (Fias et al., 2020). Dyslexic learners may also rely more on numerical magnitude processing, rather than symbolic processing, which could be advantageous for tasks such as estimation and approximation in mathematics (Delazer et al., 2019). This suggests that dyslexic learners may have unique cognitive strengths that can be leveraged to support their learning in mathematics. On the other hand, students with dyslexia may encounter challenges with the language and concepts of mathematics (Almahrag, 2021). This can include spatial and numerical relations, such as understanding concepts like "before," "after," "between," "one more than," and "one less." Additionally, math terms like "numerator" and "denominator," "prime numbers" and "prime factors," and the processes of "carrying" and "borrowing" can also be particularly complex for individuals with dyslexia (Sharma et al., 2018).

Despite these potential strengths, dyslexic learners still face significant challenges in mathematics, and it is important for educators to provide appropriate support and accommodations to help these learners succeed (Kunwar & Sapkota, 2022; Sharma et al., 2018). Strategies such as providing extra time for reading and writing tasks, using visual aids and manipulatives, and providing explicit instruction on mathematical language and symbols can all be helpful for dyslexic learners in mathematics (Koponen et al., 2020; Kunwar & Sapkota, 2022). Dyslexia can have significant effects on learning mathematics, and recent research has highlighted the specific areas of difficulty that dyslexic learners may experience in this subject, such as reading and comprehending word problems, understanding mathematical symbols, and grasping spatial concepts (Butterworth, 2010; Koponen et al., 2020; Sharma et al., 2018). Dyslexic learners may also have lower scores on tasks related to arithmetic, numeracy, and problem-solving compared to non-dyslexic learners (Wilson et al., 2021). The low scores in mathematics can affect student attitude, motivation, and their self-esteem. Self-esteem refers to a person's overall sense of satisfaction and comfort with themselves (Akinleke, 2012). It encompasses various factors, including self-confidence, feelings of security, self-respect, a sense of competence, and a feeling of belonging. As such, a person's self-esteem plays a critical role in their overall well-being, including their ability to stay motivated, maintain positivity, and feel inspired to learn mathematics (Kunwar & Sapkota, 2022). When a student has high self-esteem, it can boost their confidence and encourage them to strive for better performance and outcomes (Akinleke, 2012). This suggests that dyslexia can have a widespread impact on mathematical achievement, affecting multiple areas of mathematical competence.

The effects of dyslexia on learning mathematics can be significant and can impact multiple areas of mathematical competence. However, with appropriate support and accommodations, dyslexic learners can still achieve success in this subject (Kunwar & Sapkota, 2022; Sharma et al., 2018). Educators can use strategies such as providing extra time for reading and writing tasks, using visual aids and manipulatives, and providing explicit instruction on mathematical language and symbols to help dyslexic learners overcome these challenges (Koponen et al., 2020).

**Dyslexia and Language.** Dyslexia is one of the most common learning disabilities, with varying prevalence rates across different countries. The term "dyscalculia" was coined as a language-based disorder and was originally referred to as "word blindness" by German professor Adolph Kussmaul in 1877 (Kuerten et al., 2020). According to the International Dyslexia Association, dyslexia is a learning disability characterized by challenges with expressive or receptive language skills, whether oral or written (Almahrag, 2021). These challenges can manifest in difficulties with reading, spelling, writing, speaking, or listening. Students with dyslexia may also struggle with learning mathematics due to the subject's unique language and vocabulary (Almahrag, 2021).

Individuals with dyslexia often experience difficulty with accurate and fluent reading, spelling, and decoding abilities, which stems from deficits in the sound

component of language (Kunwar & Sapkota, 2022). This poor language competency also manifests in difficulties with phonological awareness and quick recall of items like colors, symbols, numbers, and other familiar objects (Kunwar & Sapkota, 2022; Roitsch, 2021).

Early signs of dyslexia in children may include difficulty in learning the alphabet, recognizing rhyming patterns, and pronouncing familiar words. As they progress to elementary school, dyslexia becomes more apparent, with slow and error-prone reading and writing, difficulty connecting letters with sounds, and struggles to understand sentences (Almahrag, 2021). Dyslexia can also affect other areas, such as short-term memory, attention deficits, and motor skills (Sharma, 2018), which can significantly impact academic achievement, particularly in tasks that require reading, spelling, or writing.

The prevalence rates of dyslexia vary across different countries, with orthographic complexity in the language being a significant contributing factor (Maunsell, 2020; Lyytinen et al., 2015). English, for instance, is more inconsistent in the relationship between letters and sounds, while non-alphabetic languages like Chinese and Japanese have fairly regular correspondences between letters and sounds (Wajuihian & Naidoo, 2011). As a result, the prevalence rates of dyslexia vary somewhat across cultures, rooted in the fundamental differences in writing systems. While limited research has explored the relationship between dyslexia, self-esteem, and academic achievement, low self-esteem resulting from academic failures can lead to resistance to learning and a lack of effort to improve academic performance.

However, more research is needed to gain an in-depth understanding of the experiences and challenges of dyslexic learners in mathematics and how to support them in achieving success. Therefore, the research questions for this study are: What are the specific difficulties that dyslexic learners encounter in mathematics? What are the effective interventions and accommodations for supporting dyslexic learners in mathematics? How do dyslexic learners experience mathematics education, and what can be done to improve their experiences and outcomes?

## **Methodology**

### ***Research Design***

This study uses a qualitative research design to investigate the experiences and challenges of dyslexic learners in mathematics. Specifically, the study employs an interpretive phenomenological approach, which seeks to uncover the meaning and essence of a particular phenomenon from the perspective of individuals who have experienced it (Smith et al., 2020).

### ***Participants***

In this study, dyslexic learners in grades VI and VII who were studying mathematics in schools located in the Kathmandu Valley were selected as the participants using purposive sampling. A total of five students, including three girls

and two boys, were chosen for the study. The sample size was determined based on the principle of theoretical saturation, which means that data collection can continue until data redundancy is achieved (Guest et al., 2020).

### ***Data Collection***

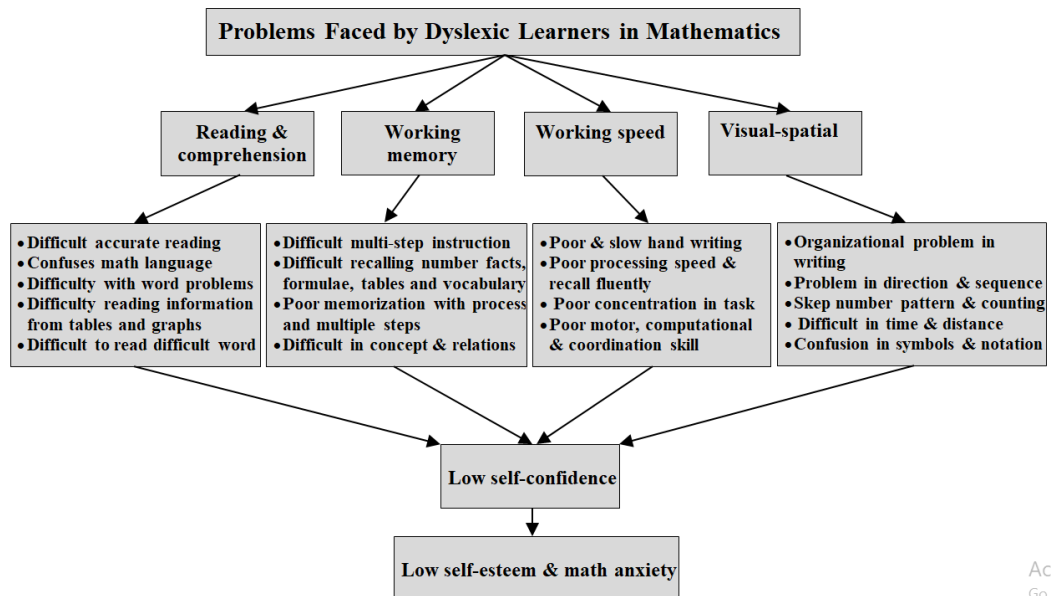
This study aims to understand complex phenomena and subjective experiences through the collection and analysis of non-numerical data (Creswell & Poth, 2018) using in-depth interviews with participants. The interviews were conducted one-on-one and audio-recorded with the participant's consent. An open-ended interview guide was used, which focused on the experiences and challenges of dyslexic learners in mathematics. The interviews were transcribed and analyzed using the thematic analysis method.

### ***Data Analysis***

The data collected from the participants were analyzed thematically. Initially, the data obtained from the interviews were coded and analyzed for themes and patterns that emerged from the data. To ensure consistency in the coding process, a coding manual was developed. The themes and patterns were refined through multiple trials and organized into categories, and the results were presented in a narrative format. The study adhered to ethical guidelines for research involving human participants, including obtaining informed consent, ensuring confidentiality and privacy, and minimizing potential harm or discomfort to participants.

### **Results**

The results of this study are based on the experiences and challenges of dyslexic learners in mathematics, which were explored through open-ended questions in the form of five themes. The interview guideline was developed on the basis of the thematic framework of the study as presented in Figure 1. The in-depth experiences and challenges faced by the dyslexic learners are presented below.

**Figure 1** *Thematic Framework of Problem Faced by Dyslexic Learner in Mathematics*Ac  
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### ***Difficulty Applying Mathematical Concepts***

In the theme, difficulty applying mathematical concepts, the questions related to difficulty in learning mathematics were asked to the participants. In this background, most of the participants viewed the same responses. They always face difficulties when it comes to applying mathematical concepts. The theme of difficulty applying mathematical concepts for dyslexic learners relates to the challenges that dyslexic students face in understanding and applying mathematical concepts. Dyslexic students often struggle with basic math concepts, such as number sense and arithmetic fluency, which can hinder their ability to apply more complex mathematical concepts (Fraga González et al., 2020). They struggle with understanding the language and symbols used in mathematical problems, which can make it difficult for them to apply mathematical concepts (Nelson et al., 2021). In this study, Participants reported struggling to apply mathematical concepts to real-world situations as well as problem-solving tasks. This difficulty was particularly evident in word problems, where dyslexic learners had difficulty reading and comprehending the problem and translating it into mathematical terms.

For example, one participant, who was a student of grade VI, stated that she had difficulty with word problems. She explained, "I have trouble understanding the words in the problem and then turning it into math. It's like I have to translate it twice or more." This participant also reported difficulty with fractions, saying, "I don't really understand fractions. I know that it's part of a whole, but I have trouble applying it to problems." She further added her views: "I remember a time when I was reading a word problem that involved fractions, and I couldn't understand



what the problem was asking me to do. I had to read it multiple times and ask my teacher for help before I could begin to solve it. Then, when it came time to solve the problem, I forgot one of the steps I had learned in class and had to start over. Another participant, who was a student of grade V, reported difficulty with algebra. Specifically, the participant stated, "I have trouble with algebra because I can't visualize it. It's like I'm trying to solve a puzzle without knowing what the picture is supposed to look like. I know the steps, but I don't really understand what I'm doing." Likewise, the answer of the other participant was "I find it difficult to read mathematical language and I cannot copy or write fast as others can do and I always left the problem copying half of the solution solved by the teacher on board". She further states "I cannot understand the multi-step instruction and I cannot recall the exact word when it is necessary for me. Sometimes later I can remember the word but the time has already gone out. So I cannot complete any task in the given time and I become always back to complete the task given by the teacher".

These examples illustrate the challenges that dyslexic learners face when it comes to applying mathematical concepts. The difficulty in applying mathematical concepts to real-world situations or problem-solving tasks can lead to frustration, confusion, and a lack of confidence in mathematics. To address this challenge, interventions that aim to improve dyslexic learners' ability to apply mathematical concepts to real-world situations or problem-solving tasks may be beneficial.

Despite these challenges, the participants also reported several strategies that they used to overcome their difficulties in mathematics. These strategies included seeking help from teachers and peers, using visual aids and manipulatives, and taking their time to understand the mathematical concepts. The findings suggest that dyslexic learners may benefit from interventions that focus on improving their understanding of mathematical language and symbols, as well as their ability to apply mathematical concepts to problem-solving tasks.

### ***Impact on Mathematics Achievement***

Another theme that emerged from the analysis was the impact of dyslexia on mathematics achievement. Participants reported experiencing challenges in mathematics due to their dyslexia, which had an impact on their mathematics achievement. Dyslexic students tend to have lower mathematics achievement than their non-dyslexic peers (Fraga González et al., 2020), and explicit instruction in math is considered particularly effective for dyslexic students who struggle with basic math skills, such as number sense and arithmetic fluency (Ryoo et al., 2021).

In this theme, the participants viewed their experiences. For example, one participant, who was a student in grade V, stated, "I struggle with math. I always have. Even when I study hard, I still get low grades. I feel like something is holding me back. Sometimes I am confused in similar types of terms or symbols like numerator and denominator, multiplication and division" This participant also

reported feeling anxious and stressed when it came to mathematics, which further impacted her achievement.

Another participant, who was a student from the same grade, reported that her slow reading and writing affected her ability to complete mathematics assignments and exams. She stated, "Most of the time, I don't finish math tests or assignments on time because I have to read the questions multiple times. It takes me longer to process the information, and it affects my grades."

In the same way, another participant expressed his feelings. "I used to get anxious before math tests or exams. When I get inside the exam hall, I cannot concentrate on the question paper. I tried to read and understand the question but sometimes I miss reading some words and it takes more time. I am always confused about solving problems, especially word problems."

These examples illustrate the impact that dyslexia can have on mathematics achievement. Dyslexic learners may experience challenges in mathematics due to their difficulties with mathematical language and symbols, applying mathematical concepts, and processing information. Dyslexia may also lead to anxiety and stress, which can further impact mathematics achievement. Interventions that aim to support dyslexic learners in mathematics may be beneficial in improving their mathematics achievement.

### ***Language, Comprehension and Memory***

The theme of language, comprehension, and memory for dyslexic learners is related to the challenges that these students face in these areas, which can impact their academic performance and overall learning. The problems faced by dyslexic students regarding language, comprehension, and memory are also common. Dyslexia can make it difficult for these students to read, write, and understand language, as well as to remember information. They frequently struggle with reading and understanding what they read, as well as with remembering information they learn in class. Dyslexic students often struggle with language skills, including vocabulary, grammar, and syntax, which can impact their comprehension of written material due to weaknesses in working memory that hinder their ability to understand and retain information (Fraga González et al., 2020). Similarly, they have difficulty with visual-spatial memory, which can impact their ability to learn and apply mathematical concepts. (Rello et al., 2021). They also have difficulty with spelling and writing things down. These students often struggle with reading and understanding what they read, as well as remembering information they have learned in class. They sometimes see words jumbled up or letters in the wrong order, making it difficult for them to keep track of what they are reading. Additionally, they may have trouble spelling and writing things down, which can impact their ability to express their thoughts and ideas.

Some notable problems faced by dyslexic students regarding language, comprehension, and memory in their views: One of the participants studying in grade VI expressed his views: "I have trouble reading and understanding what I'm

reading. Sometimes the words seem to jump around on the page, or I see letters in the wrong order. It can be hard for me to keep track of what I'm reading or remember what I've read." Another participant from grade V focuses on memory problems. "I have trouble remembering things I've learned in class. Sometimes I forget things right after I've learned them. A grade V participant viewed the problem regarding spelling and writing. She viewed: "I have trouble spelling and writing things down. Sometimes the words get jumbled up in my head and I can't remember how to spell them."

These shared views of the participants highlight some of the common challenges that dyslexic students in grades 5 and 6 are facing with language, comprehension, and memory. These problems can also hinder the overall student performance in mathematics.

### ***Math-anxiety and Self-esteem***

Dyslexic learners are at a higher risk of experiencing math anxiety and lower self-esteem in math due to various weaknesses in learning mathematics. According to a study by Fraga González et al. (2021), dyslexic learners are more likely to experience these challenges compared to their non-dyslexic peers. Therefore, it is crucial to provide social-emotional support to students with dyslexia to improve their math self-concept and reduce math anxiety, as found in a study by Dai and Rinn (2020).

Math problems can create a lot of tension, fear, and confusion for mathematics learners, as noted in a study by Kunwar et al. (2022). Therefore, it is essential to help students gain confidence and overcome their worries and fears. Some students with dyslexia may feel anxious because they have severe difficulty reading and are unable to comprehend word problems. Difficult math problems can also affect learners' self-esteem, making them feel insecure and nervous, leading to mistakes. To address these challenges, students should engage in preliminary activities and receive support to increase their confidence and reduce feelings of anxiety. In this study, the participants also emphasized the importance of recognizing and providing social-emotional support to improve learning mathematics and overcome these challenges.

A participant in grade V shared her views: "I don't really like math. It's hard for me to understand the problems, and I get really nervous when I have to do math in class." She further shared: "I think reading and writing is not so difficult for me but when I have to do math problems, I get really worried and I feel like I'm not as good at math as the other students, and it makes me feel bad about myself." Another participant expressed her views as frustrating that she never improves in mathematics and she feels like she can do and learn everything except mathematics. She further stated: "My teacher knows that I struggle with math, however, I have not got extra help or worked with a tutor, because I don't like to show my weakness to others and I feel really nervous about math and it makes me feel bad about myself."

Similarly, a participant of grade VI student expressed his view that he spends most of his study time in learning math although he is still backward in math. He shared his view: "All the time. I get really worried that I won't understand the problems, and then I feel really bad about myself. I don't want anyone to think I'm stupid or anything. Also, I'm too scared to ask my teacher."

Thus, the dyslexic students expressed similar views about math, including feeling anxious and struggling more with math compared to other subjects. They also described how math affects their self-esteem negatively. One student had talked to their teacher about their struggles but had not shared how it affected them emotionally. The other student had not yet talked to anyone about it due to fear of being perceived as stupid. Overall, the participants emphasized the importance of recognizing and addressing the emotional impact that math anxiety and low self-esteem can have on dyslexic learners.

### ***Individual Differences and Support System***

The theme of individual differences and support highlights the importance of considering the unique needs and characteristics of dyslexic learners when designing interventions to support their mathematics learning. Individualized support and accommodations can greatly benefit students with dyslexia and can improve reading comprehension and overall academic performance (Barnes, Kim, & Phillips, 2021). Similarly, explicit instruction in reading and writing skills, as well as individualized support and accommodations, can improve academic outcomes (Tayler et al., 2020). In this study, the participants express their views focusing on individual differences and support for the student.

For example, one participant, who was a grade VI student, reported that she preferred to learn mathematics through hands-on activities and visual aids. She stated, "I learn better when I can see and touch things. I like using manipulative materials and drawing pictures to help me understand mathematical concepts." This participant also expressed a preference for working independently rather than in groups. Another participant, who was a student of grade V, reported that she appreciated having extra time on mathematics exams. She stated, "When I have extra time, I can read the questions more carefully and process the information better, and also I do not feel the time pressure. It really helps me to do well on exams." This participant also reported that she liked having the option to use assistive technology, such as text-to-speech software, to help her with mathematics assignments. Another participant viewed that: "I cannot read and write as fast as another friend. Mostly, I cannot copy everything done by the teacher on the board. I usually copy them in break time from others."

Regarding the support system, participants reported using a variety of strategies to help them understand and solve mathematical problems. For example, one participant, who was a grade VI student, reported seeking help from her teacher and peers. She stated, "I always make sure to ask my teacher questions if I don't understand something. I also study with my classmates, and we work through

problems together. Sometimes, they explain things in a way that makes more sense to me." She further states that: " I feel more comfortable to ask questions with my classmates." This participant also reported using visual aids, such as graphs and charts, to help her understand mathematical concepts. Another participant, who was a grade V student, reported using manipulative materials, such as blocks and cubes, to help her understand fractions. She stated, "I find it easier to understand fractions when I can see them in front of me." This participant also reported taking her time to understand mathematical concepts, saying, "I don't rush through math problems. I take more time to make clear understanding."

These examples illustrate the importance of considering the individual needs and preferences of dyslexic learners when designing interventions to support their mathematics learning. Seeking help from teachers and peers, using visual aids and manipulative materials, and taking their time to understand mathematical concepts are some of the strategies that were reported. Dyslexic learners may have unique learning styles, preferences, and needs, and interventions that are tailored to their individual needs may be more effective in improving their mathematics learning.

Overall, the shared views of the dyslexic students regarding learning mathematics highlight the importance of addressing the specific needs of dyslexic learners in language, comprehension, memory, concept learning, and individualized support and instruction to improve their math achievement as well as overcome the challenges and achieve success in their academic pursuits.

## **Discussion**

The present study has investigated the problems encountered by dyslexic learners in mathematics, using a qualitative inquiry approach. The analysis revealed several themes, including difficulty in understanding and applying mathematical concepts, challenges with mathematical language and symbols, use of strategies to overcome difficulties, impact on mathematics achievement, and individual differences and needs. The research on dyslexic learners in mathematics education has highlighted based on five themes related to their specific needs and challenges. The first theme is difficulty applying mathematical concepts, which has been found to be a significant challenge for dyslexic students. The findings of this study are consistent with recent research literature on dyslexia and mathematics. Studies have shown that dyslexic learners may struggle with mathematical vocabulary and symbols, which can impact their ability to understand and solve mathematical problems (Ferrer et al., 2016; Krajewski & Schneider, 2019). The present study provides further evidence for the challenges that dyslexic learners face when it comes to mathematical language and symbols. Studies have shown that dyslexic learners may struggle with basic math concepts, working memory, processing speed, and executive functioning, which can hinder their ability to apply more complex mathematical concepts (Fraga González et al., 2020). Additionally, dyslexic students may have difficulty with visual-spatial memory, which can impact their ability to learn and apply mathematical concepts (Rello et

al., 2021). Similarly, it is found that dyslexic learners may have difficulty applying mathematical concepts to real-world situations or problem-solving tasks. This finding is consistent with previous research literature that has shown that dyslexic learners may struggle with problem-solving tasks in mathematics (Hornickel & Ransom, 2017; Willcutt et al., 2013). The use of manipulative and visual aids, as reported by some participants in the present study, has been shown to be an effective intervention for improving dyslexic learners' ability to apply mathematical concepts to real-world situations (Foster & Miller, 2018).

Regarding the second theme, the impact of dyslexia on mathematics achievement is lower for dyslexic students compared to their non-dyslexic peers. The study found that dyslexia may have a significant impact on mathematics achievement, which is consistent with previous research literature that has shown that dyslexic learners may have lower scores on mathematics assessments compared to their non-dyslexic peers (Willcutt et al., 2013). The findings of the present study highlight the need for interventions that aim to support dyslexic learners in mathematics, in order to improve their mathematics achievement. Dyslexic students tend to score significantly lower on standardized math tests and are more likely to fall behind in math compared to their non-dyslexic peers (Fraga González et al., 2020; Willcutt et al., 2013). However, dyslexic students who receive explicit instruction in math have been found to have significantly higher math achievement than those who do not receive this type of instruction (Ryoo et al., 2021). In the context of Nepal, the status of dyslexic students has not been found properly, and no special provision to intervene in the student and personalized instruction (Kunwar & Sapkota, 2022). So, all dyslexic students are getting equal treatment and support for learning mathematics.

The problems of language, comprehension, and memory are the areas where dyslexic learners may experience significant difficulties ((Kunwar & Sapkota, 2022). In this study, it is also found that most dyslexic learners are struggling with language, comprehension, and memory regarding learning mathematics. The findings are consistent with recent literature on dyslexia and mathematics, which has shown that dyslexic learners may experience difficulties with mathematical language and symbols, applying mathematical concepts, and processing information in mathematics (Ferrer et al., 2016; Hornickel & Ransom, 2017; Willcutt et al., 2013). Dyslexic learners may also experience anxiety and stress when it comes to mathematics, which can further impact their achievement (Jordan & Hanich, 2000). Dyslexic students often struggle with language skills, including vocabulary, grammar, and syntax, which can impact their comprehension of written material (Fraga González et al., 2020). Dyslexic students may also have difficulty with visual-spatial memory, which can impact their ability to learn and apply mathematical concepts (Rello et al., 2021).

Similarly, the themes of math anxiety and self-esteem, which are emotional factors that can impact dyslexic learners in mathematics education are also found impacted. Dyslexic students have been found to experience math anxiety and lower

self-esteem in relation to math, which can contribute to their difficulties in the subject (Fraga González et al., 2020). However, dyslexic students who receive targeted support and interventions have been found to improve their math skills and reduce feelings of anxiety and low self-esteem (Ryoo et al., 2021). Due to low achievement, problems of forgetting, language performance, and difficulty in conceptual understanding, most of the dyslexic learners found getting anxiety and low self-esteem. This ultimately caused a negative attitude and poor performance in mathematics.

The theme, individual differences, and support system, which emphasizes the importance of recognizing and addressing the unique needs of dyslexic learners in mathematics education also found significant and necessary. The study found that dyslexic learners may have individual differences and needs, which need to be taken into consideration when designing interventions to support their mathematics learning. This finding is consistent with previous research literature that has shown the importance of individualized interventions for dyslexic learners (Ferrer et al., 2016; Krajewski & Schneider, 2019). The result shows that the students who are getting proper interventions were found comparatively more positive than those not getting support in learning mathematics. Dyslexic learners may have different strengths and weaknesses and may require different types of support and interventions to succeed in math (Rello et al., 2021). The dyslexic students who are not getting support are likely to be anxious and frustrated in learning mathematics. Providing targeted support and interventions, such as explicit instruction in math and interventions that target visual-spatial memory, can help dyslexic students overcome their challenges and achieve success in math (Ryoo et al., 2021; Rello et al., 2021). Additionally, addressing emotional factors such as math anxiety and self-esteem can also contribute to improved math achievement for dyslexic students (Fraga González et al., 2020). Thus, the research on dyslexic learners in mathematics education focuses on considering proper support and interventions to address the specific needs and challenges of dyslexic learners get succeed in math and improve their overall academic performance. Also, explicit instruction and interventions in mathematics that target visual-spatial memory are also necessary to develop a positive attitude toward mathematics that can improve math achievement in dyslexic students (Ryoo et al., 2021; Rello et al., 2021).

Overall, the present study provides valuable insights into the problems encountered by dyslexic learners in mathematics and the strategies that they use to overcome their difficulties. The findings of this study have important implications for educators and researchers who aim to support dyslexic learners in mathematics. By considering the challenges and needs of dyslexic learners, interventions that are tailored to their individual needs may be more effective in improving their mathematics learning.

## Conclusion

The qualitative inquiry on the problems encountered by dyslexic learners in mathematics provides valuable insights into the unique challenges that these learners face in the subject. The research highlights the difficulties that dyslexic learners may have with mathematical language, comprehension, and memory, as well as understanding and applying mathematical concepts, and the impact on mathematics achievement. The research also emphasizes the emotional impact of mathematics anxiety and low self-esteem on dyslexic learners, which can further impede their progress in the subject. Additionally, the importance of individual differences is highlighted, with the findings indicating that dyslexic learners may have different strengths and weaknesses in mathematics. The study also emphasizes the importance of recognizing individual differences and providing support that is tailored to the unique needs of each student. The study suggests that early identification of dyslexic learners and proper intervention are necessary to support their success in mathematics. Early intervention can help address the specific needs and challenges of dyslexic learners before they fall behind their peers in math achievement (Fraga González et al., 2020). Moreover, the identification of dyslexic students provides timely support for educators to improve the overall academic performance of the students.

The study highlights challenges faced by dyslexic learners in math, informing educators, developers, and policymakers. It emphasizes targeted support, recognizing individual needs and strengths. A comprehensive support system involving teachers, parents, and peers is crucial. Collaborative efforts can provide the necessary support. Findings inform interventions and programs for dyslexic learners, enhancing math learning. However, limited generalizability due to the qualitative nature and small sample size calls for further research with larger, diverse samples.

## References

- Akinleke, O.W. (2012). An investigation of the relationship between test anxiety, self-esteem and academic performance among polytechnic students in Nigeria. *International Journal of Computer Applications* 51(1), 47-50.
- Almahrag, K. M. (2021). Effect dyslexia on early learning of mathematics the children. *Arts and Design Studies*, 95, 34-39. <https://doi.org/10.7176/ADS/95-05>
- Barnes, E. M., Kim, H., & Phillips, B. N. (2021). The effects of text-to-speech software on reading comprehension and academic performance for students with dyslexia. *Annals of Dyslexia*, 71(2), 181-193.
- Bartelet, D., Vaessen, A., Blomert, L., & Ansari, D. (2014). What basic number processing measures in kindergarten explain unique variability in first-grade arithmetic proficiency? *Journal of experimental child psychology*, 117, 12-28.



- Bodrova, E., & Leong, D. J. (2017). Dyslexia and Mathematics: A Review of the Literature. *Journal of Learning Disabilities*, 50(1), 3–18. <https://doi.org/10.1177/0022219415620804>
- Butterworth, B. (2010). Foundational numerical capacities and the origins of dyscalculia. Trends in cognitive sciences. *Trends in Neuroscience and Education*, 14(12), 534-541.
- Butterworth, B. (2014). *The dyscalculia toolkit: Supporting learning difficulties in maths*. SAGE Publications.
- Carroll, J. M., & Iles, J. E. (2006). An assessment of anxiety levels in dyslexic students in higher education. *British Journal of Educational Psychology*, 76, 651–662.
- Cavalli, E., Cole, P., Leloup, G., Poracchia-George, F., Sprenger-Charolles, L., El Ahmadi, A. (2018). Screening for dyslexia in French-Speaking university students: An evaluation of the detection accuracy of the Alouette Test. *Journal of Learning Disability*, 51, 268–282.
- Chinn, S., & Ashcroft, R. E. (2017). *Mathematics for dyslexics and dyscalculics: A teaching handbook*. John Wiley & Sons
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- Dai, D. Y., & Rinn, A. N. (2020). Social-emotional support for students with dyslexia: Associations with math self-concept and math anxiety. *Journal of Educational Psychology*, 112(4), 822-835.
- Delazer, M., Girelli, L., Semenza, C., & Denes, G. (2019). Calculation abilities in dyslexic adolescents: A study on the role of numerical and non-numerical factors. *Journal of Numerical Cognition*, 5(1), 1-22.
- Dyslexia Foundation. (2021). *Dyslexia and maths*. Retrieved from <https://dyslexiafoundation.org.nz/dyslexia-and-maths/>
- European Dyslexia Association (2022). *What is dyslexia*. Retrieved July 9, 2022, from <https://edainfo.eu/what-is-dyslexia>
- Ferrer, E., Shaywitz, B. A., Holahan, J. M., Marchione, K., Shaywitz, S. E., & Gabrieli, J. D. (2016). Achievement gap in reading is present as early as first grade and persists through adolescence. *Journal of Pediatrics*, 170, 256-261. <https://doi.org/10.1016/j.jpeds.2015.11.030>
- Fias, W., Vanbinst, K., Reynvoet, B., & Brysbaert, M. (2020). Enhanced visuospatial working memory in dyslexia: A cognitive neuroscience perspective. *Journal of Experimental Psychology: General*, 149(4), 620-635.
- Forrester, N. A., Katondo, L. K. & Griffiths, C. A. (2020). Dyslexia in Nepal: Policy and practice. *Dyslexia*, 26(4), 463-470.
- Foster, N. A., & Miller, H. E. (2018). A comparison of math achievement between elementary students with dyslexia and typically developing peers. *Focus on Autism and Other Developmental Disabilities*, 33(3), 137-145.

- Fraga-González, G., González-Fernández, Á., & García-Sánchez, J. N. (2020). Mathematics achievement of dyslexic students: A meta-analysis. *Journal of Learning Disabilities, 53*(4), 320-332.
- Fraga-González, G., González-Fernández, Á., & García-Sánchez, J. N. (2021). Math anxiety and self-esteem in dyslexic learners. *Journal of Learning Disabilities, 54*(3), 229-238.
- Geary, D. C., Hoard, M. K., Nugent, L., & Bailey, D. H. (2013). Adolescents' functional numeracy is predicted by their school entry number system knowledge. *PloS one, 8*(7), e67429.
- Gu, H., Hou, F., Liu, L., Luo, X., Nkomola, P. D., Xie, X., Li, X. & Song, R. (2018). Genetic variants in the CNTNAP2 gene are associated with gender differences among dyslexic children in China. *EBioMedicine, 34*, 165–170.
- Guest, G., Namey, E. E., & Mitchell, M. L. (2020). *Collecting qualitative data: A field manual for applied research*. Sage Publications.
- Hawke, J. L., Olson, R. K., & Willcutt, E. G. et al., (2009). Gender ratios for reading difficulties, *Dyslexia, 15*(3), 239–242. <https://doi.org/10.1002/dys.389>. 8.
- Hornickel, J., & Ransom, M. E. (2017). Auditory processing, speech perception, and reading skills in children with dyslexia. *Developmental Neuropsychology, 42*(8), 505-518.
- Jiménez, J. E. et al. (2009). Gender ratio and cognitive profiles in dyslexia: A cross-national study. *Reading and Writing, 24*(7), 729–747. <https://doi.org/10.1007/s11145-009-9222-6>.
- Jordan, N. C., & Hanich, L. B. (2000). Mathematical thinking in second-grade children with different forms of LD. *Journal of Learning Disabilities, 33*(6), 567-578.
- Kaufmann, L., Nuerk, H. C., & Willmes, K. (2013). Numerical development in children with dyslexia: Evidence from a longitudinal study. *Developmental science, 16*(6), 804-815.
- Koponen, T., Aro, M., & Viholainen, H. (2020). Supporting mathematics learning and problem solving in children with dyslexia. In S. Chinn & A. Deane (Eds.), *Handbook of dyscalculia and mathematical learning difficulties* (pp. 303-319). Routledge.
- Krajewski, K., & Schneider, W. (2019). Exploring the impact of phonological and numerical processing on mathematics in adulthood: Evidence from a case of developmental dyscalculia and dyslexia. *Journal of Learning Disabilities, 52*(5), 380-395.
- Kuerten, A. B., Mota, M. B., & Segaert, K. (2020). Developmental dyslexia: a condensed review of literature. *Journal of English Language, Literatures in English and Cultural Studies, 72*(3), 249– 270. <https://doi.org/10.5007/2175-8026.2019v72n3p249>

- Kunwar, R., & Sapkota, H. P. (2022). An overview of dyslexia: Some key issues and its effects on learning mathematics. *Turkish International Journal of Special Education and Guidance & Counselling (TIJSEG)*, 11(2), 82-98.
- Kunwar, R., & Sapkota, H. P. (2022). An overview of dyslexia: Some key issues and its effects on learning mathematics. *Turkish International Journal of Special Education and Guidance & Counselling (TIJSEG)*, 11(2), 82-98.
- Kunwar, R., Pokhrel, J. K., Sapkota, H. P., & Acharya, B. R. (2022). Mathematics learning: Misconceptions, problems and methods of making mathematics learning fun. *American Journal of Education and Learning, Online Science Publishing*, 7(2), 98-111. <https://doi.org/10.55284/ajel.v7i2.719>
- Lewis, K.E., & Fisher, S. (2016). Taking action: Using the universal design for learning framework to reach all learners in mathematics. *Mathematics Teaching in the Middle School*, 21(9), 532-537.
- Lin, Y., Zhang, X., Huang, Q., Lv, L., Huang, A., Li, A., Wu, K., & Huang, Y. (2020). The prevalence of dyslexia in primary school children and their Chinese literacy assessment in Shantou, China. *Int. J. Environ. Res. Public Health*, 17, 7140. <https://doi.org/10.3390/ijerph17197140>
- Lipowska, M., Czaplewska, E., & Wysocka, A. (2011). Visuospatial deficits of dyslexic children. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, 17(4), CR216–CR221. <https://doi.org/10.12659/msm.881718>
- Lyytinen, H., Erskine, J., Hämäläinen, J., Torppa, M., & Ronimus, M. (2015). Dyslexia-Early Identification and Prevention: Highlights from the Jyväskylä Longitudinal Study of Dyslexia. *Current Developmental Disorders Reports*, 2(4), 330–338. <https://doi.org/10.1007/s40474-015-0067-1>
- Maunsell, M.(2020). Dyslexia in a global context: A cross-linguistic, cross-cultural perspective, *Latin American Journal of Content, Language Integrated Learning*, 13(1), 92–113. <https://doi.org/10.5294/laclil.2020.13.1.6>.
- Rello, L., Ballesteros, S., Mayoral, P. S., & García-Sánchez, J. N. (2021). The impact of visual-spatial memory training on mathematical performance in children with dyslexia. *International Journal of Psychology*, 56(2), 226-235.
- Roitsch, J. (2021). Dyslexia and the Speech Pathologist. *IntechOpen*. <https://doi.org/10.5772/intechopen.93690>
- Ryoo, J. H., Lee, S. Y., & Lee, K. (2021). The effectiveness of explicit instruction in mathematics for students with dyslexia: A meta-analysis. *Journal of Educational Psychology*, 113(2), 297-313.
- Sharma, S., Sharma, R., & Sharma, A. (2018). Impact of Dyslexia on Mathematics Learning: A Study on Secondary School Students. *International Journal of Education and Management Studies*, 8(2), 127–133. <https://doi.org/10.31033/ijems.v8i2.122>

- Shaywitz, S. E., Shaywitz, J. E., & Shaywitz, B. A. (2021). Dyslexia in the 21st century. *Current Opinion in Psychiatry*, 34(2), 80–86. <https://doi.org/10.1097/YCO.0000000000000670>
- Shaywitz, S. E., Shaywitz, J. E., & Shaywitz, B. A. (2021). Dyslexia in the 21st century. *Current Opinion in Psychiatry*, 34(2), 80–86. <https://doi.org/10.1097/YCO.0000000000000670>
- Smith, J. A., Flowers, P., & Larkin, M. (2020). *Interpretative phenomenological analysis: Theory, method and research*. Sage Publications.
- Snowling, M. J., & Melby-Lervåg, M. (2016). Oral language deficits in familial dyslexia: A meta-analysis and review. *Psychological Bulletin*, 142(5), 498-545.
- Snowling, M. J., & Melby-Lervåg, M. (2016). Oral language deficits in familial dyslexia: A meta-analysis and review. *Psychological Bulletin*, 142(5), 498-545.
- Su, L.Y., Yan, X.F. & Lu, H. D. (2020). A comparative study of the component model and the discrepancy model in the diagnosis of reading dyslexia. *J. Mod. Spec. Educ.* 4, 72-77.
- Tayler, C., Martinussen, R., & Lundetræ, K. (2020). The effects of individualized support and explicit instruction in reading and writing for students with dyslexia. *Journal of Learning Disabilities*, 53(2), 152-166.
- Wajuihian, S. O. & Naidoo, K.S. (2011). Dyslexia: An overview. *African Vision and Eye Health*, 70(2), 89-98. <https://doi.org/10.4102/aveh.v70i2.102>.
- Wajuihian, S. O., Naidoo, K. S. (2011). Dyslexia: An overview. *African Vision and Eye Health*, 70(2), 89-98. <https://doi.org/10.4102/aveh.v70i2.102>.
- Willcutt, E. G., McGrath, L. M., Pennington, B. F., & Keenan, J. M. (2013). Epistemological dimensions of learning by students with reading and attentional disabilities. *Journal of Learning Disabilities*, 46(1), 3-13.
- Wilson, A. J., Revkin, S. K., Cohen, D., Cohen, L., & Dehaene, S. (2021). Dyslexia and numerical processing: A comprehensive investigation of the arithmetic abilities of young adults with dyslexia. *Journal of Educational Psychology*, 113(3), 398-416.