

The Readiness of Mathematics Teachers to Implement Teaching and Learning Strategies for Students with Characteristics of Dysgraphia and Dyscalculia

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Abstract

The implementation of Inclusive Education in Malaysia with the concept of access to education for all encourages the inclusion of students with dysgraphia and dyscalculia in mainstream classes. However, studies show that teachers are less prepared to make Inclusive Education a success among students with special needs. The objective of this study is to identify the level of preparedness of primary school mathematics teachers (mainstream) in teaching and learning for students with dysgraphia and dyscalculia. In addition, this study also aims to determine the difference in the level of readiness of mathematics teachers to implement teaching and learning for students with dysgraphia and dyscalculia based on gender. A quantitative study in the form of a survey was conducted involving 104 mathematics teachers from a district in the state of Johor as a study sample. Instrument used in the study is questionnaire generated by Google Form. Through this study, it can be concluded that mathematics teachers have a high level of readiness. There is no difference for mathematics teachers to implement teaching and learning for students with dysgraphia and dyscalculia based on gender. As a suggestion, a deeper scope on this issue can be studied by diversifying instruments for example through questionnaires. In conclusion, the high level of readiness of mathematics teachers to succeed in teaching and learning among students with dysgraphia and dyscalculia gives confidence to the government and the community so that the objectives of Inclusive Education can be achieved.

Keywords: Readiness, Mathematics Teacher, Teaching and Learning, Dysgraphia, Dyscalculia

Introduction

With the advent of the Fourth Industrial Revolution (IR 4.0), educational transformation is underway, enabling individuals not only to achieve personal well-being but also to solve problems creatively on a global scale (George Fomunyam, 2020). IR 4.0 introduces major changes and advancements that restructure human life and work due to technologies such as robotics, the Internet of Things, 3D printing, artificial intelligence and more. These changes

extend beyond industry and business, impacting the field of education as well. Following this shift, the Malaysian Ministry of Education (KPM) introduced the revised Primary School Standard Curriculum (KSSR) 2017 for primary education. Mathematics subject in KSSR aims to develop mathematically-minded individuals, capable of applying mathematical knowledge and skills in life, grounded in correct values to face life's challenges (Ministry of Education Malaysia, 2017). Students must be equipped with 21st-century skills, knowledge, and moral values to avoid obsolescence by modern technology and to remain competitive globally through mathematics education.

Currently, mathematics teachers bear a significant responsibility in expanding their teaching strategies to unlock students' potential and develop skills essential for leading in a future driven by modern technology (Ayanwale et al., 2022). Teachers serve as facilitators in the classroom, encouraging students to inquire and engage in self-directed learning through guided support. At the same time, the concept of educational accessibility for all is consistently promoted by the KPM to ensure maximum enrollment across all levels of education. Aligned with this concept, Inclusive Education involves special needs students learning alongside other students in the same classes within government or government-aided schools. According to Ministry of Education Malaysia (2016), this program aims to enhance engagement and provide opportunities for special needs students to participate in curricular and extracurricular activities with mainstream students. This program also aspires to raise public awareness of the importance of recognizing special needs students as integral members of society. Students with characteristics of dysgraphia and dyscalculia are also categorized as special needs students. UNICEF (2017) defines Inclusive Education as an educational system that embraces all students, supporting and welcoming them to learn, regardless of who they are or what abilities and needs they may have.

Dysgraphia is the inability to write correctly due to damage to certain areas of the brain (Chung et al., 2020). Tampubolon (2019) found that the primary cause of dysgraphia is internal disruptions in children, particularly a lack of writing and auditory activity due to impairments in tissues, eye and ear organs, and memory. The learning outcomes of students are also impacted. For example, they struggle to differentiate symbols such as \times from $+$, the number 1 from 7, or the letter M from W. They also fail to draw two- or three-dimensional objects, such as straight lines and circles. Furthermore, children with dysgraphia cannot identify two objects in specific dimensions, such as distinguishing a circle from an ellipse. Dyscalculia, on the other hand, refers to difficulty in acquiring basic arithmetic skills and understanding mathematical concepts (Price & Ansari, 2013). Bird (2017) identified six characteristics of children with dyscalculia. These children continue to use their fingers for counting, even after their peers are able to perform arithmetic mentally; they struggle to recall math facts; and they find it difficult to relate numbers and symbols. Additionally, they have trouble reading time, organizing from left to right, recognizing patterns, and sequencing numbers. Jeya & Albina (2019) found that, out of a sample of 100 students, 9 were inclined to exhibit characteristics of dyscalculia, which affected their numeracy skills, sequential ability, motor skills, cognitive skills, and capacity for multitasking.

Students exhibiting characteristics of dysgraphia and dyscalculia are also recognized as special needs students and can be placed in mainstream classrooms. Those with dysgraphia, who experience difficulties with writing, are also prone to having dyscalculia,

which involves challenges in mastering arithmetic skills. According to the findings of (Ashraf & Najam, 2020), 36% of students with dysgraphia were also found to exhibit traits of dyscalculia, with female students showing a higher likelihood of having both conditions. This phenomenon suggests that dysgraphia and dyscalculia may be comorbid, potentially due to cognitive and neurological dysfunctions. The American Psychiatric Association (2013) further asserts that children with dysgraphia typically read slowly, struggle to understand what they read, and face difficulties with spelling and writing. They also have trouble mastering numerical facts, performing calculations and engaging in mathematical reasoning.

To effectively manage teaching and learning activities for students with dysgraphia and dyscalculia, teachers require specific knowledge and skills to ensure that special needs students (MBK) have the same learning opportunities as their peers. Teachers with a high level of commitment to develop their professionalism will strive to enhance their abilities in order to adapt to the demands of the IR 4.0 era (Lestari & Rahmawati, 2020). Teachers must be prepared to evolve over time to improve the quality of teaching and learning, particularly when it involves MBK, who have distinct needs compared to mainstream students. Previous studies consistently indicate that a teacher's readiness to implement Inclusive Education is a determining factor in the success of MBK when integrated into mainstream classrooms.

Problem Statement

Through interviews with mathematics teachers and special needs students, Vodičková et al. (2023) identified several factors influencing inclusive mathematics education. These include recognizing students' internal resources in mathematics education, the responsive approaches of mathematics teachers to special needs students, modifications and accommodations in mathematics instruction for special needs students, collaboration between schools and families, and the support mechanisms for schools as crucial institutions in the context of inclusive mathematics education. Kovacova et al. (2020) further emphasized that the difficulties faced by MBK could be exacerbated by low professional competence among teachers or administrators. Teachers who are open-minded and capable of understanding the needs of special needs students play a critical role in promoting Inclusive Education in mainstream classrooms (Hugo & Hadegaard, 2021). This is because teachers who understand special needs students are better equipped to provide explanations that are easy to comprehend, which in turn has a positive impact on the students.

(Kızılelma et al., 2023) found that teachers' understanding of learning concepts for special needs students varies based on their teaching experience. The study revealed that majority of Mathematics teachers lacked knowledge and had not received specific training to handle teaching and learning activities involving special needs students. Similarly, (Kharisma Prathama et al., 2022) found that teachers had only limited knowledge and skills to provide teaching and learning for special needs students, and that school infrastructure and environments were still not fully accessible to these students. Additionally, there was an absence of intensive supervision and guidance for Inclusive Education in schools by local authorities. Teachers in the study by (Ali et al., 2021) also indicated that they used the same teaching methods and techniques for both special needs students and mainstream students due to insufficient knowledge.

(Lin et al., 2021) highlighted that teachers exhibit a positive attitude toward Inclusive Education. However, they require a deeper understanding of its implementation. Teachers' perspectives on the presence of students with special educational needs in classrooms are influenced by various factors, including sociocultural attitudes toward special needs students, inefficient teaching and learning (T&L) resources, inadequate school facilities, and teachers' lack of knowledge and skills (Rosmalily & Woollard, 2021). According to Pershina et al. (2018), teachers' readiness to work in inclusive classrooms can be evaluated based on two main indicators: professional readiness and psychological readiness. Teachers must be prepared in terms of knowledge, skills, and attitudes to effectively conduct mathematics teaching and learning activities involving special needs students in the classroom.

Previous studies indicate that teachers are generally less prepared, particularly in terms of knowledge and skills, to conduct teaching and learning (T&L) activities for students with special educational needs (SEN). In this context, the readiness of mathematics teachers to implement T&L activities for students with characteristics of dysgraphia and dyscalculia has not yet been thoroughly examined. Inclusive Education (IE) places SEN in mainstream classrooms, requiring them to actively participate in the curriculum and mathematics learning alongside their peers. Mathematics teachers are responsible for ensuring that SEN learn the same primary content as their classmates (Ediyanto et al., 2023). Consequently, examining the readiness of mathematics teachers to conduct T&L activities for students with dysgraphia and dyscalculia is essential to determine whether policy changes or professional development initiatives are necessary.

Research Objectives

The objective of this study is to identify the readiness level of mainstream primary school mathematics teachers in implementing teaching and learning strategies for students with characteristics of dysgraphia and dyscalculia. Furthermore, this study aims to determine the differences in readiness levels among mathematics teachers in teaching students with dysgraphia and dyscalculia characteristics based on gender.

Hypothesis of Research

H_0 : There is no difference in the level of readiness of Mathematics teachers to implement teaching and learning for students with dysgraphia and dyscalculia based on gender.

Research Methodology

This study uses a quantitative method in the form of a survey. Quantitative research is a formal, objective, and systematic process in which numerical data are used to gain information about the world (Patton, 2002). The aim of this study is to collect information on the level of readiness of Mathematics teachers to conduct teaching and learning activities for students with characteristics of dysgraphia and dyscalculia. Therefore, this method is appropriate to achieve the study's objectives. A survey method is employed because this study gathers information about characteristics, actions, or opinions from a large group of people (Kraemer, 1991). The study population consists of Mathematics teachers serving in mainstream schools within a district in Johor state. Based on the Krejcie and Morgan (1970) table, a sample of 103 teachers was selected from a total population of 145.

The research instrument is a questionnaire administered using Google Forms. It consists of two sections: Section A, which relates to the demographic information of the respondents and Section B, which assesses the level of readiness of Mathematics teachers to conduct teaching and learning for students with characteristics of dysgraphia and dyscalculia. The items for the instrument were developed based on the items used in the study by Hishamuddin Ahmad et al. (2024). These items were modified to align with the context of this study, specifically focusing on the level of readiness of Mathematics teachers. The validity and reliability of the instrument were established in the study by Hishamuddin Ahmad et al. (2024), where the items recorded a reliability value of 0.91, based on Cronbach's Alpha. The validity of the instrument was also assessed by six experts. The data collected through Google Forms were analyzed using descriptive and inferential statistics.

Research Finding

Respondent Demographics

Table 1

Respondent Demographics

Item	Respondent	Frequency	Percentage (%)
Gender	Male	39	37.9
	Female	64	62.1
Age	21-30 years old	31	30.1
	31-40 years old	40	38.8
	41-50 years old	21	20.4
	More than 50 years old	11	10.7
	1-10 years	21	20.4
Experience in teaching Mathematics	11-20 years	60	58.3
	More than 20 years	22	21.4
	1-10 years	21	20.4
Academic qualifications	STPM	31	30.1
	Diploma	28	27.2
	Bachelor's degree	25	24.3
	Master	19	18.4
	Ph.D.	0	0.0

In Table 1, the number of male Mathematics teachers is 39 (37.9%), while the number of female Mathematics teachers is 64 (62.1%), totalling 103 as targeted in the methodology section. In terms of age, the largest group of respondents falls within the age range of 31 to 40 years, with 40 respondents (38.8%). Only 11 respondents (20.4%) are aged over 50 years. A total of 60 respondents (58.3%) have teaching experience in Mathematics for 11-20 years. Based on the academic qualifications of the respondents, 31 have an STPM qualification (30.1%), 28 have a diploma (27.2%), 25 hold a Bachelor's degree (24.3%), and 19 have a Master's degree (18.4%). No respondents in this study hold a Ph.D. qualification.

Descriptive Analysis

Table 2

Item analysis

Bil	Item	Percentage (%)				
		SD	D	SD	A	SA
1	I have experience managing the teaching and learning process (PdP) of Mathematics for students with dysgraphia and dyscalculia.	- (0%)	- (0%)	11 (10.7%)	43 (41.7%)	49 (47.6%)
2	I can easily and accurately identify students with dysgraphia and dyscalculia.	- (0%)	- (0%)	10 (9.7%)	44 (42.7%)	49 (47.6%)
3	I face challenges or obstacles in managing the Mathematics teaching and learning process for students with dysgraphia and dyscalculia.	- (0%)	- (0%)	11 (10.7%)	50 (48.5%)	42 (40.8%)
4	Students with dysgraphia and dyscalculia will disrupt teachers in managing the Mathematics teaching and learning process.	- (0%)	- (0%)	16 (15.5%)	46 (44.7%)	41 (39.8%)
5	Students with dysgraphia and dyscalculia should be placed in Special Remedial Classes.	- (0%)	- (0%)	4 (3.9%)	54 (52.4%)	45 (43.7%)
6	Students with dysgraphia and dyscalculia do not need to be separated from mainstream students to promote social integration.	- (0%)	- (0%)	10 (9.7%)	42 (40.8%)	51 (49.5%)
7	I feel confident in providing Mathematics guidance to students with dysgraphia and dyscalculia.	- (0%)	- (0%)	9 (8.7%)	47 (45.6%)	47 (45.6%)
8	I do not feel burdened when teaching students with dysgraphia and dyscalculia in Mathematics.	- (0%)	- (0%)	10 (9.7%)	55 (53.4%)	38 (36.9%)
9	I diversify teaching methods and information delivery to ensure students with dysgraphia and dyscalculia receive input at an optimal level, similar to mainstream students.	- (0%)	- (0%)	9 (8.7%)	55 (53.4%)	39 (37.9%)
10	Students with dysgraphia and dyscalculia can be helped.	- (0%)	- (0%)	4 (3.9%)	50 (48.5%)	49 (47.6%)

Based on the data presented in Table 2, it was found that the sixth item, which states that students with dysgraphia and dyscalculia do not need to be separated from mainstream students to promote social integration, recorded the highest percentage (49.5%) for the strongly agree option. The teacher respondents in this study strongly agreed that students with dysgraphia and dyscalculia should be included in mainstream education. Additionally, 47.6% of respondents indicated that they had previously conducted mathematics teaching and learning (PdP) with students exhibiting dysgraphia and dyscalculia characteristics. A similar percentage (47.6%) of respondents reported being able to identify students with dysgraphia and dyscalculia. The same percentage was also recorded for the tenth item, where

47.6% of respondents strongly agreed that students with dysgraphia and dyscalculia can be supported. However, only 36.9% of respondents strongly agreed that they do not feel burdened when conducting Mathematics PdP with students exhibiting dysgraphia and dyscalculia characteristics.

To determine the level of Mathematics teachers' readiness to implement PdP for students with dysgraphia and dyscalculia, the mean score was analyzed. Referring to the mean score interpretation by Mohd Najib (1994) in Table 3, the readiness level of Mathematics teachers was found to be high ($M = 4.4$) for implementing PdP for students with dysgraphia and dyscalculia.

Table 3

Mean score interpretation

Mean score	Interpretation
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

Inferential Analysis

A normally distributed sample is a fundamental requirement for conducting inferential statistics (Chua, 2013). A normality test was performed to ensure that the data were normally distributed before proceeding with inferential analysis. The collected data were confirmed to meet normality assumptions, as the Skewness and Kurtosis values were recorded at 0.238 and 0.472, respectively (Table 4). Both values fall within the acceptable range of ± 1.96 (Chua, 2013). Therefore, the data collected are normally distributed and suitable for further inferential analysis.

Table 4

Skewness and Kurtosis Test

Aspect	Method	Statistic	Std. Error
Readiness level	Skewness	.115	.238
	Kurtosis	-.270	.472

To determine the readiness level of mathematics teachers in implementing teaching and learning (PdP) for students with dysgraphia and dyscalculia based on gender, an inferential statistical analysis using an independent samples t-test was conducted. The independent t-test is used to identify significant differences between the means of two independent samples (Choudhary, 2017). Since the objective of this study was to determine whether there is a difference in the mean readiness level of mathematics teachers based on two independent samples—male and female teachers—this test aligns with the study's objectives. Referring to Table 5, $t(101) = 0.60$, $p > 0.05$, indicating no significant difference in the mean scores for the readiness level of Mathematics teachers to implement PdP activities for students with dysgraphia and dyscalculia based on gender.

Table 5

Analyse of Independent T-test

Levene's Test for Equality of Variances						
		F	Sig.	t	df	Sig. (2-tailed)
Readiness level	Equal variances assumed	.014	.906	.602	-.270	.472
	Equal variances not assumed			.611	84.285	.543

Research Discussion

The findings of the study indicate that Mathematics teachers demonstrate a high level of readiness to conduct teaching and learning (PdP) for students with dysgraphia and dyscalculia. This result aligns with the findings of Dolgova et al. (2017), who reported that 75% of teachers were adequately prepared, particularly in terms of professional competencies and personal attributes, to implement inclusive education in mainstream classrooms. However, this contrasts with the discussion presented by participants in Kalenjuk et al. (2024) study, where colleagues generally lacked specific knowledge about the characteristics of dysgraphia due to limited awareness of this issue among students. Nevertheless, Mathematics teachers in Yoong and Fu (2022) study exhibited high self-efficacy in teaching students with learning difficulties in Mathematics, including those with dyscalculia. In other words, awareness regarding the presence of students with dyscalculia in Mathematics has improved. Furthermore, no significant differences were found in teachers' effectiveness in teaching students with learning difficulties in Mathematics based on age group and years of teaching experience. However, there was a significant difference in the effectiveness of Mathematics teachers based on academic qualifications.

An inclusive culture promotes the concept of teachers recognizing their individual capabilities to facilitate learning and reduce barriers, thereby supporting the engagement of all students in the classroom. However, most teachers in schools report feeling inadequate in terms of knowledge to effectively handle students with Mathematics learning difficulties (Kunwar et al., 2021). In the study by Adams et al. (2021), teachers demonstrated a moderate level of readiness in terms of knowledge, understanding, skills, and abilities related to the implementation of inclusive education. They emphasized the importance of providing training and professional development programs for teachers to enhance their knowledge and understanding of inclusive practices. Only 7% of teachers were found to be highly prepared to conduct teaching and learning (PdP) activities involving students with special educational needs (MBK) alongside mainstream students (Ketrish et al., 2019). This is primarily due to their lack of confidence in organizing interactions between MBK and mainstream students, as well as the insufficient availability of specialized tools or equipment for MBK.

Sullivan (2015) emphasizes a mathematics teaching model that requires teachers to be clear about their intentions and sequential tasks to create a classroom environment adaptable to diverse student needs. Mathematics teachers who are attentive, knowledgeable, and proficient in decision-making can establish a conducive learning environment for both mainstream students and students with special educational needs (MBK). Mastery of specific subject content is crucial for teachers, as content knowledge and the skills to effectively deliver it enhance their confidence in conducting teaching and learning (PdP) when working with inclusive students (Hasel-Weide et al., 2021). When mathematics

teachers are prepared to accommodate MBK, they are more likely to continuously strive to improve their competencies over time. This is supported by a study by Baykaldi et al. (2024), which found that although mathematics teachers recognize their lack of readiness to implement inclusive education (PI), they believe they possess sufficient teaching efficacy to instruct visually impaired students effectively.

This study reveals no significant difference in the readiness levels of male and female mathematics teachers to conduct teaching and learning (PdP) for students exhibiting characteristics of dysgraphia and dyscalculia. Similar to the findings of Kunwar et al. (2021), there is no observed difference in teachers' awareness levels regarding students with mathematical learning difficulties based on teacher gender. Trivino-Amigo et al. (2022) also found no significant difference between male and female teachers concerning their readiness to address diversity among students with special educational needs (MBK). However, female teachers tend to demonstrate greater confidence in their ability to promote inclusive education (PI). In contrast, Adams et al. (2024) reported a significant difference in teachers' readiness for inclusive education based on gender.

Research Implications

The effectiveness of implementing teaching and learning (PdP) activities in mathematics for students with dysgraphia and dyscalculia relies heavily on teachers' readiness. Beyond teacher preparedness, factors such as support from school administrators, government agencies, and the local community, as well as adequate facilities and infrastructure that are inclusive of students with special needs (MBK), play a pivotal role in fostering effective learning experiences. Collaboration between families and schools is equally essential in stimulating the mathematical learning process for MBK students. This study provides an initial overview of the current realities faced by mathematics teachers in implementing inclusive education (PI). The high level of readiness demonstrated by mathematics teachers instils confidence in both the government and the local community, highlighting the feasibility of achieving education for all. The classroom serves as a learning space for students with diverse backgrounds, abilities, and experiences. Therefore, more targeted research is needed to examine specific practices employed by mathematics teachers in inclusive classrooms when addressing the unique needs of students with varying abilities (Faragher et al., 2016).

Conclusion

This survey study aims to identify the readiness level of primary school mathematics teachers (mainstream education) in implementing teaching and learning (PdP) for students with characteristics of dysgraphia and dyscalculia. The findings indicate that mathematics teachers in this study exhibit a high level of readiness to effectively carry out PdP activities for students with dysgraphia and dyscalculia. Furthermore, the null hypothesis was rejected, showing no significant difference in the readiness levels of mathematics teachers to implement teaching and learning for students with dysgraphia and dyscalculia based on gender. Teachers, as key stakeholders, play a crucial role in translating the objectives of inclusive education into reality through quality PdP activities. It is hoped that the findings of this study will serve as a valuable reference for all stakeholders to further intensify efforts in providing quality education for all students with special educational needs, including those with characteristics of dysgraphia and dyscalculia.

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