

Teaching Competence of Mathematics Teachers for Inclusive Primary School Education: A Systematic Literature Review

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Abstract: *This Systematic Literature Review (SLR) was produced using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) with the aim of analyzing the teaching competency skills of Mathematics teachers for inclusive education in primary schools. An extended search was conducted using two highly indexed databases, Scopus and Web of Science (WoS), to obtain articles from the year 2020 to 2024. A total of 255 articles containing the keywords teacher competence, mathematics, and inclusive were found, but only 10 articles were identified as meeting the criteria for this study. There are 2 research questions in this study, namely what are the characteristics of empirical studies to identify the competencies needed by a teacher and what competencies are required by a Mathematics teacher for inclusive education in primary schools. There are 9 countries that have studied the teaching competencies of teachers and the teaching of Mathematics teachers for inclusive education in the past 5 years of research. The main themes of Mathematics teachers' teaching competencies in inclusive education for this SLR are pedagogical skills, knowledge levels, and classroom management in an inclusive environment. The results of this study can help researchers identify the teaching competencies required by Mathematics teachers in inclusive education at the primary school level.*

Keywords: Teacher Competence, Mathematics, Inclusive Education, Primary School

1. Introduction

A teacher's teaching competence is a critical element that must be fulfilled by a teacher, especially for one involved in the world of inclusive education (Vantieghem et al., 2023). Competence is the key to a comprehensive educational environment. It is defined as a framework that encompasses skills, abilities, attitudes, and knowledge towards effective teaching (Mihić et al., 2022). The skills possessed by a teacher serve as evidence of success in producing effective teaching, especially in the field of mathematics. Inclusive education, especially in Malaysia, is increasingly developing well where more and more teachers are paying attention to special education needs students (SENs) who are eligible to be in the Inclusive Education Program (IEP). Teaching involving students with special needs requires different and specific teaching strategies based on the unique needs of the students (Saini et al., 2024). The acceptance and adjustment of the needs of students with different backgrounds must

be taken seriously by teachers. The diversity of these needs has led to various studies and findings that focus on teacher instruction, especially for this IEP.

The elements of collaboration and support in the classroom are essential skills for a teacher. Collaboration with various parties such as the community, parents, administrators, colleagues, and students can shape the implementation of effective strategies for students. The characteristic of an effective teacher is the ability to encourage active student involvement and participation. The Salamanca Statement (1994) explains that children with special educational needs should still be given the opportunity to receive the same education as typical students in Malaysia Ministry of Education's Blueprint Pelan Pembangunan Pendidikan Malaysia (2013-2025). Support through differentiated pedagogy, high levels of knowledge, and inclusive classroom management enables students to access Mathematics learning effectively and apply it in their daily lives.

The ability to foster a supportive and collaborative classroom environment is also a characteristic of the competence required by an effective teacher (Niu et al., 2021). Mathematics, often seen as a challenging subject, requires teachers to use creative and adaptive teaching methods that meet diverse learning styles and needs (Khasawneh 2024). In inclusive education, these methods must be further refined to ensure that students with special needs can access, understand, and effectively use mathematical concepts. The quality of teaching mathematical skills can be achieved through the success of teachers in solving mathematical problems and related elements of professionalism (Podkhodova et al. 2020).

2. Problem Statement

Inclusive education is increasingly developing as the foundation of education for all individuals and serves as a medium for advocating for SENs to obtain equal rights with typical students. The integration of SENs learning with typical students in the main classroom is the foundation of inclusive education. From the Salamanca Statement 1994, inclusive education has developed over 30 years, yet there are still issues regarding effective implementation (Magnússon, 2019).

Throughout the years, there have been various studies on inclusive education, Mathematics teachers who teach inclusive education face challenges in the effective implementation of inclusive education. There are still teachers who lack pedagogical knowledge to teach Mathematics in an inclusive classroom. (Mahmud, 2023). There are teachers who believe that classroom management for inclusive education is the same as managing a typical classroom. A teacher should view adaptations based on the needs of the SENs present in the class. Support from various parties also affects the teaching competence of teachers as a challenge for teachers in the implementation of an optimal classroom. The role of resource teachers collaborating with subject teachers can reduce the gap in problems faced by inclusive teachers. (Salleh & Che Omar, 2018).

The aim of this study is to analyze previous research that highlights the characteristics of empirical studies and the competencies required for teaching Mathematics in inclusive education. This is addressed through the following research questions:

- i. What are the characteristics of empirical studies that identify the competencies required by Mathematics teachers in inclusive education at the primary school level?
- ii. What specific competencies are required by Mathematics teachers in primary school inclusive education?

3. Methodology

There are four phases conducted for the selection of articles in this systematic literature review (SLR), namely identification, screening, eligibility, and inclusion. This study uses the PRISMA model as a step for researchers to analyze information through a step-by-step process in producing a quality literature review (Shaffril et al. 2020). According to Page et al. (2021), the PRISMA model is used to complete reporting that can be assessed by readers regarding the appropriateness of the methods and the reliability of the study findings.

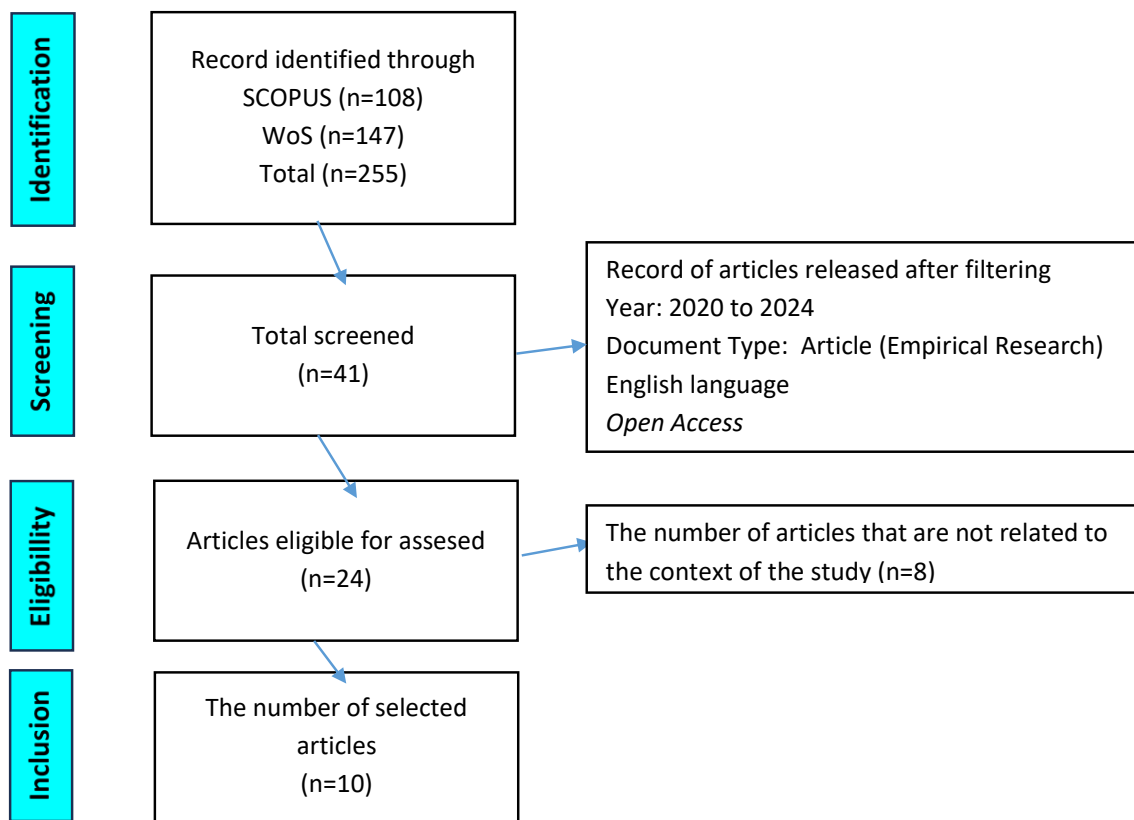


Figure 1: Model PRISMA (Paige et al. 2021)

3.1 Identification Phase

The process is divided into four main phases for the selection of past studies that are relevant to this SLR. The first phase of identification is carried out by identifying keywords and searching for related terms using thesauruses, dictionaries, and past studies. The selection of keywords using database search engines, namely Scopus and Web of Science (WoS), is listed in Figure 1 below. Based on the focus on the teaching competencies of Mathematics teachers for inclusive education, the final search of the study conducted on 24 November, 2024, revealed a total of 255 studies at the first stage of this SLR process.

3.1.1 Data Source

The main data source for this study is electronic media research articles using high-indexed databases such as Scopus and WoS. The selection of databases is based on articles cited in the field of education, particularly in the areas of special education and inclusive education. Gaona and Arévalo-Meneses (2024) state that Scopus and WoS are major databases for high-indexed research searches.

3.1.2 Search

The terms of this study use the search for each database as (teacher*) AND (competenc* OR ability) AND (mathematic*) AND ("inclusive education" OR "special education"). The Scopus database uses Boolean Operators techniques while WoS uses Truncation. All article searches are based on the title and keywords in the research abstract. There are limitations on the research search based on the established selection criteria. However, the total number of studies related to teacher teaching competence is not limited. Table 1 shows the results of this study.

Table 1: Preliminary search results

Database	Search Item	Findings
Scopus	<i>TITLE-ABS-KEY ((teacher*) AND (competenc* OR ability) AND (mathematic*) AND ("inclusive education" OR "special education"))</i>	108
WoS	<i>TS= ((teacher*) AND (competenc* OR ability) AND (mathematic*) AND ("inclusive education" OR "special education"))</i>	147

3.2 Screening Phase

The selected articles for screening are from published journals. The researcher has established, based on inclusion and exclusion criteria, that 195 articles were removed. This study does not include publications in the form of books, chapters, reviews, meta-analyses, meta-synthesis, concept papers, and conference proceedings because the selection of this study is limited to empirical studies only. The selection of articles for this study is limited to English only. The selected study period is the most recent 5 years, from 2020 to 2024. There were 9 studies rejected because they were duplicated between 2 databases. A total of 41 publications were selected at this stage.

Table 2: Criteria set in the filtering phase

Criteria	Kemasukan	Pengecualian
Types of literature	Journal (Study article)	Books, Concept Paper, Proceedings
Language	English	Other than English
Year of publication	2020-2024	Less than Year 2020
Index	Scopus & WoS	Apart from Scopus & WoS
Country	The whole world	No specific country
Access type	<i>Open Access</i>	<i>Early Access</i>

3.3 Eligible Phases

The eligible phase is the evaluation phase of 24 articles that meet the criteria using qualitative research methods. According to Petticrew and Roberts (2006), qualitative assessment has three levels: low, moderate, and high. The assessment was conducted to identify articles that serve as benchmarks for each level. There are two abstract assessments that can answer the research questions and 24 identified articles. Out of the 24 articles, a second assessment was conducted to review the entire reading of the articles, focusing on empirical characteristics and addressing

the research questions. After both assessments were conducted, 10 articles were selected as references for the SLR of this study.

3.4 Inclusion Phases

255 articles have been identified from two databases, Scopus and WoS. All articles were screened based on the criteria set by the researcher. A total of 10 articles were accepted and brought to the final phase, which is the inclusion phase. Refer to Figure 1 for the PRISMA flow.

4. Data Analysis

Based on the selected articles, 50% of the studies are quantitative studies (n=5). Qualitative studies constitute 30% of the total literature review (n=3) and there are 20% mixed-methods studies (n=2). The studies conducted are related to the teaching competencies of Mathematics teachers and inclusive education. The data obtained from this study were analyzed using qualitative thematic analysis. According to Braun and Clarke (2006), thematic analysis has six phases: reading articles, coding, theme determination, data review and collection, theme establishment, and reporting. Several themes have been found in the full reading of this study. A detailed analysis of all articles is presented in Table 3 below.

Table 3: Analysis of study findings

Researchers	Location	Teacher's Competence	Findings
Elisabet Mellroth (2020)	Sweden	Pedagogical knowledge through professional programs for high-ability students (gifted)	Teachers stated that they have competency awareness regarding gifted students, but they require collaboration from fellow teachers and support from the administration.
Emad M. Alghazo & Yazan M. Alghazo (2020)	Bahrain	Lack of adequate training to teach Mathematics in an inclusive classroom for SENs	There is a significant competency gap between pre-service teachers and in-service teachers. Pre-service teachers still lack experience and development as Mathematics teachers teaching in inclusive classrooms.
Moser Opitz et al. (2020)	Switzerland	Professional knowledge in the field of mathematics, attitudes towards inclusive education, classroom management, and teacher presence influence student learning.	The teaching resources of special education teachers can have a positive impact on students' achievement in Mathematics. The longer the interaction between the teacher and the student, the higher the student's achievement in learning.
Podkhodova et al. (2020)	Russia	Assessment of Mathematics teachers' competencies for inclusive education through the ability to address teaching and learning issues, reducing the gap in professional training, and planning programs to enhance teachers' skills.	Improvement in the quality of Mathematics teaching through the integration of content knowledge, teaching and learning strategies, and optimally meeting the needs of SENs. The difficulty in applying teaching can be improved through skill training provided to teachers.
Chinhara Henry &	Zimbabwe	The need to enhance effective training and coaching as well as	Administrators and inclusive early childhood education teachers undergo

Sotuku Namhla (2020)		professional development programs	competency training and professional development programs, informally but without showing effective results. The school is facing issues with funding for formal professional development programs.
Eklund et al. (2021)	Finland	Collaboration, self-directed learning, and experience can form strong support for special education teachers in developing their self-efficacy.	The role of teachers in forming support in three stages, namely identifying, supporting, and differentiated teaching for SENs. Among the challenges faced by teachers are time management, lack of resources and facilities, as well as collaboration with various parties such as parents and professionals.
Phua et al. (2022)	Malaysia	Highly knowledgeable teachers demonstrate greater readiness and focus with more inclusive classes.	Research findings indicate that strong internet access, ICT proficiency among teachers and parents, and government support contribute to the success of online classes for inclusive education.
Ravichandran Rajesh & Zeanath Cariena Joseph (2023)	India	3 competencies required by a teacher; knowledge of student needs and interventions, a positive attitude, and practices to implement effective classroom management strategies.	The competency training module is effective in enhancing knowledge, attitude transformation, and skill development for managing learning problems.
Petra Scherer & Jennifer Bertram (2024)	Germany	Understanding the different paradigms of inclusive education, exposure to practical experience and self-reflection.	Understanding the different paradigms of inclusive education, exposure to practical experiences, and self-reflection.
Susanne Prediger & Raffaele Buró (2024)	Germany	Basic mathematical knowledge, language proficiency, working memory, and metacognitive regulation	Various approaches and the need for professional development can enhance teachers' awareness and skills regarding inclusive classroom management.

5. Findings

5.1 Characteristics of Empirical Research

Table 4 shows the publication years of articles from 2020 to 2024. The trend of research on the teaching competence of Mathematics teachers for inclusive education has been declining between the years 2020 and 2024. There are 5 articles from the year 2020, 1 article in 2021, 1 article in 2022, and 1 article in 2023. The increase in the number of articles in 2024 is by 2 articles. The trend of this article shows that the highest number of studies was in 2020, which has not yet been surpassed in the following years. This study shows an increase in research on the competencies of Mathematics teachers in inclusive education in 2024.

Table 4: Year of publication of the study

Year of Publication	Total	Researcher
2020	5	Elisabet Mellroth; Emad M. Alghazo & Yazan M. Alghazo; Moser Opitz et al.; Podkhodova et al.; Chinhara Henry & Sotuku Namhla
2021	1	Eklund et al.
2022	1	Phua et al.
2023	1	Rajesh R. & Joseph Z. C.
2024	2	Scherer P. & Bertram J.; Prediger S.& Buró R.

5.2 Study Location by Country

Table 5 shows that a total of 9 countries are involved in this study. The country that has conducted the most research on the teaching competencies of Mathematics teachers for inclusive education is Germany. The research is mainly in European countries and not many to be discovered in Asia countries or East Asia countries.

Table 5: Country by study location

Country	Total	Researcher
Sweden	1	Elisabet Mellroth
Bahrain	1	Emad M. Alghazo & Yazan M. Alghazo
Switzerland	1	Moser Opitz <i>et al.</i>
Rusia	1	Podkhodova <i>et al.</i>
Zimbabwe	1	Chinhara Henry & Sotuku Namhla
Finland	1	Eklund <i>et al.</i>
Malaysia	1	Phua <i>et al.</i>
India	1	Rajesh R. & Joseph Z. C.
Germany	2	Scherer P. & Bertram J.; Prediger S.& Buró R.

5.3 Competence of Mathematics Teachers for Inclusive Education

The teaching competence of Mathematics teachers for inclusive primary education not only plays a role for the teachers but also impacts the learning development of special education students. Based on the findings of the provided study, teachers possess teaching competencies, but not all focus on the subject of Mathematics for inclusive primary school education. They have awareness but require support from administrators and collaboration from various parties such as colleagues and the community (Mellroth, 2020).

Good inclusive teaching environments encompass awareness of diverse student needs, understanding of pedagogy, and a positive attitude. Rajesh and Joseph (2023) emphasize that

the development of effective competency training modules can enhance knowledge, attitude transformation, and skill development to manage learning problems. Teacher expertise can promote optimal inclusive education teaching. Moser Opitz et al. (2020) argue that good teacher teaching resources can have a positive impact on students. The amount of interaction and two-way communication also has a significant impact.

The focus on the need for educators to enhance their basic mathematical knowledge, linguistic competence, and metacognitive abilities to effectively manage inclusive classrooms, Prediger and Buró (2024); Henry and Sotuku Namhla (2020).

Adequate theoretical and practical education and training programs for teaching Mathematics in inclusive classrooms impact the development of inclusive class programs. Practical experience in inclusive classrooms can shape the confidence and self-efficacy of teachers Emad M. Alghazo and Yazan M. Alghazo (2020); Podkhodova et al.(2020); Scherer and Bertram (2024).

Eklund et al. (2021) state that collaboration, self-directed learning, and experience can form robust support for special education teachers in developing their self-efficacy. Highly knowledgeable teachers demonstrate greater readiness and focus with inclusive classes Phua et al. (2022).

6. Discussion

The findings show that there are various competencies required for the Mathematics teacher in inclusive education for primary school. Teachers should be able to deliver the learning for the SENs a very well through and solid pedagogical knowledge and classroom management (Mellroth, 2020); Moser Opitz et al., (2020); Phua et al. (2022).

Henry and Namhla (2020) explained that the education system of a country has conducted courses for teachers, but the need to improve continuous training and courses as effective professional development programs can improve teacher competence and reduce the problem gap. This lack of training needs to be addressed during a teacher's pre-service preparation process and in-service (Alghazo and Alghazo, 2020). This is to ensure that the gap in professionalism training can be reduced and the planning of teacher efficiency improvement programs is improved Podkhodova et al., (2020).

The teacher's self-efficacy also has an impact on the teacher's behavior as a positive person who is able to recognize and do self-reflection stated by the study of Eklund et al. (2021); Rajesh and Joseph (2023); Scherer and Bertram (2024). In contrast, Prediger and Buró (2024) argue that language competence, working memory and metacognitive rules can improve the efficiency of inclusive classroom management of mathematics teachers.

Findings of recurring themes point to the need for increased pedagogical knowledge, training and courses and professionalism support. Teaching competencies such as stable classroom management and a positive attitude can increase the effectiveness of the implementation of inclusive education. But the gap that can be detected is the absence of studies that focus on primary school teachers who teach Mathematics subjects in inclusive education. The findings of this SLR study are general to inclusive education and not specific to Mathematics subjects.

7. Conclusion

Through this SLR, the collection of studies related to the issue of teacher teaching competence can be coordinated and provide answers to the research questions of Mengista et al. (2020). The competency of Mathematics teachers in inclusive education shows that teachers possess skills and competencies derived from high knowledge, pedagogical skills, positive attitudes, and teaching experience. Although these teachers have received various competency training, courses, and continuous training are still needed because teachers still face challenges such as insufficient training, limited resources, and inadequate support from various parties. Continuous efforts can create an inclusive environment conducive to both students and teachers, enabling effective teaching and learning.

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