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Teachers' knowledge about teaching mathematics to learning disabilities students

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Abstract

Teaching students with LD requires an arduous effort from special education (SE) teachers. Mathematics may seem to be a difficult subject,however, students with learning disabilities (LD) face more challenges in learning the subject. Even though teachers' knowledge has been widely studied, there is few research focusing on SE teachers who teach mathematics specifically. This systematic literature review attempts to critically present what kind of knowledge that SE teachers need to teach mathematics effectively. Nineteen papers were selected from Scopus as the leading database and few supporting databases such as Sage and Science Direct. This study identified subject matter knowledge and pedagogical content knowledge as the core expertise for SE teachers with knowledge about students with LD characteristics as the supporting knowledge. This study's contribution is the identification of these teachers' knowledge generally and mathematically to create a specific teaching model for learning disabilities students.

Keywords: learning disabilities; mathematics ; special education teachers; teachers' knowledge

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1. Introduction

Learning mathematics has never been separated by the words 'difficult', 'hard', 'complex', and 'tough' (Refugio et al., 2020). Compared to mainstream students, students with learning disabilities (LD) face more challenges due to their deficits that affect their abilities in learning mathematics (Adeniyi & Kuku, 2020). They reportedly did not master the mathematics learning standards. This situation needs the urgency of looking back to the related factors that cause unachievable learning outcomes. Hence, the center of attention would be the special education teachers. Teachers are always a concern when it involves students because of the impact on students' learning had been proved in many studies (Campbell et al., 2014; Ekstam et al., 2017[a,] Bishara, 2021). For mathematics education, Ball et al. (2008) introduced a significant model named mathematical knowledge for teaching (MKT) as an extensive and comprehensive version of knowledge from Lee Shulman's research in 1987. This framework had gained so much attention from the researchers, focusing to enhance teacher with mathematics option's knowledge.

Despite the number of researches conducted, only a few have focused on non-optionist teachers like special education (SE) teachers who teach mathematics. Other situations remain unknown, especially the SE teachers' knowledge of teaching mathematics to LD students. Teachers should possess profound knowledge to teach mathematics effectively. Thus, in getting insight into the knowledge base of teachers, a systematic literature review (SLR) needs to be done. A SLR synthesizes previous and related articles using a specific resource like review protocol, publication standard, and established guidelines. Previous studies will be chosen carefully through a transparent process to answer the research question designated. This paper reviews all the relevant articles systematically, aiming for SE teachers' knowledge to teach mathematics effectually towards students with LD. We hope to raise the attention and extend the special education teachers' research field in academic areas with this SLR. The development tool for the research question is PICo (population, interest and context) that brought us to this question, "What is the essential knowledge for teaching mathematics to students with learning disabilities effectively?".

2. Methodology

This part explained the method, the process of getting articles and data analysis for this study.

2.1 Publication standard

The present study used Scopus as the leading database. Due to the limited articles, we expanded the searching process using diverse established sources such as Science Direct, Sage, Google Scholar, Research Gate and Semantic Scholar to gain more pertinent papers.

We apply a publication standard named PRISMA, known as Preferred Reporting Items for Systematic Reviews and Meta-Analyses, to lead the systematic literature review. The advantage of using PRISMA is that it allows inclusion and exclusion criteria in the screening phase to elucidate the research question.

2.2 Searching process for relevant articles.

The systematic searching process consisted of three phases, which are identification, screening and eligibility.

2.2.1 Phase 1: Identification

We used keywords, related terms, synonyms, suggestion by databases and expert opinion regarding our topic of interest during the identification phase. By using dictionaries, thesaurus and

preceding studies, the final search string that we used is TITLE-ABS-KEY (("teachers' knowledge" OR "teachers' perception" OR "teachers' proficiency" OR "teachers' skills") AND ("mathematics")). With that, we succeeded in discovering 1287 articles from Scopus. Manual searching from Science Direct, Sage, Google Scholar, Research Gate and Semantic Scholar added up to 15 academic articles that make 1302 papers for review at this first phase.

2.2.2 Phase 2: Screening

Next, the screening phase comprised of the elimination of redundant articles based on the specified criteria. First, we only eliminated three duplicate articles. Then, we disqualified articles based on several inclusion and exclusion criteria: publication timeline, type of publication, and preference language (Table 1). We considered fifteen years of previous publication (2005-2020) and accepted journal, conference paper and thesis. We also preferred documents in the English medium. Other than that, we extended our search for articles in various fields such as social science and psychology. A sum of 408 research articles were excluded based on these criteria.

Table 1. The inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Timeline	Year 2005 – 2020	< year 2005
Type of publication	Journal, conference and thesis	Chapter in book, article, review and editorial
Preferred language	English	Non-English
Subject area	Mathematics, social science and psychology	Other field than mathematics, social science and psychology

We carefully looked for more details from the title, abstract and primary content to ensure that the articles met the research objective through the first phase. Thus, another 872 articles were eliminated since the articles did not focus on SE teachers. We finalized 19 articles ready to be analyzed at the end of the screening process.

2.3 Data analysis

This study conducted an integrative review, which explores and synthesizes quantitative, qualitative and mixed methods designs into either qualitizing quantitative data or quantifying qualitative data. In this study, we chose to qualitizing relevant aspects of data. The theme development process starts with compiling data covering 19 articles to excerpt related data units to answer the research question. Next, we transform the data (raw data) into themes, ideas, or concepts to make it more meaningful and useable. We used three themes: subject matter knowledge, pedagogical content knowledge and knowledge of students with LD. Under these themes, seven sub-themes emerged related to SE teachers: mathematics content knowledge (MCK), horizontal content knowledge (HCK), knowledge of content and teaching (KCT), knowledge of content and students (KCS), knowledge of content and curriculum (KCC), students' learning deficit (SLD) and mathematics learner behaviour (MLB). Three experts reviewed these themes to validate the themes and ensure the relevance of each theme derived.

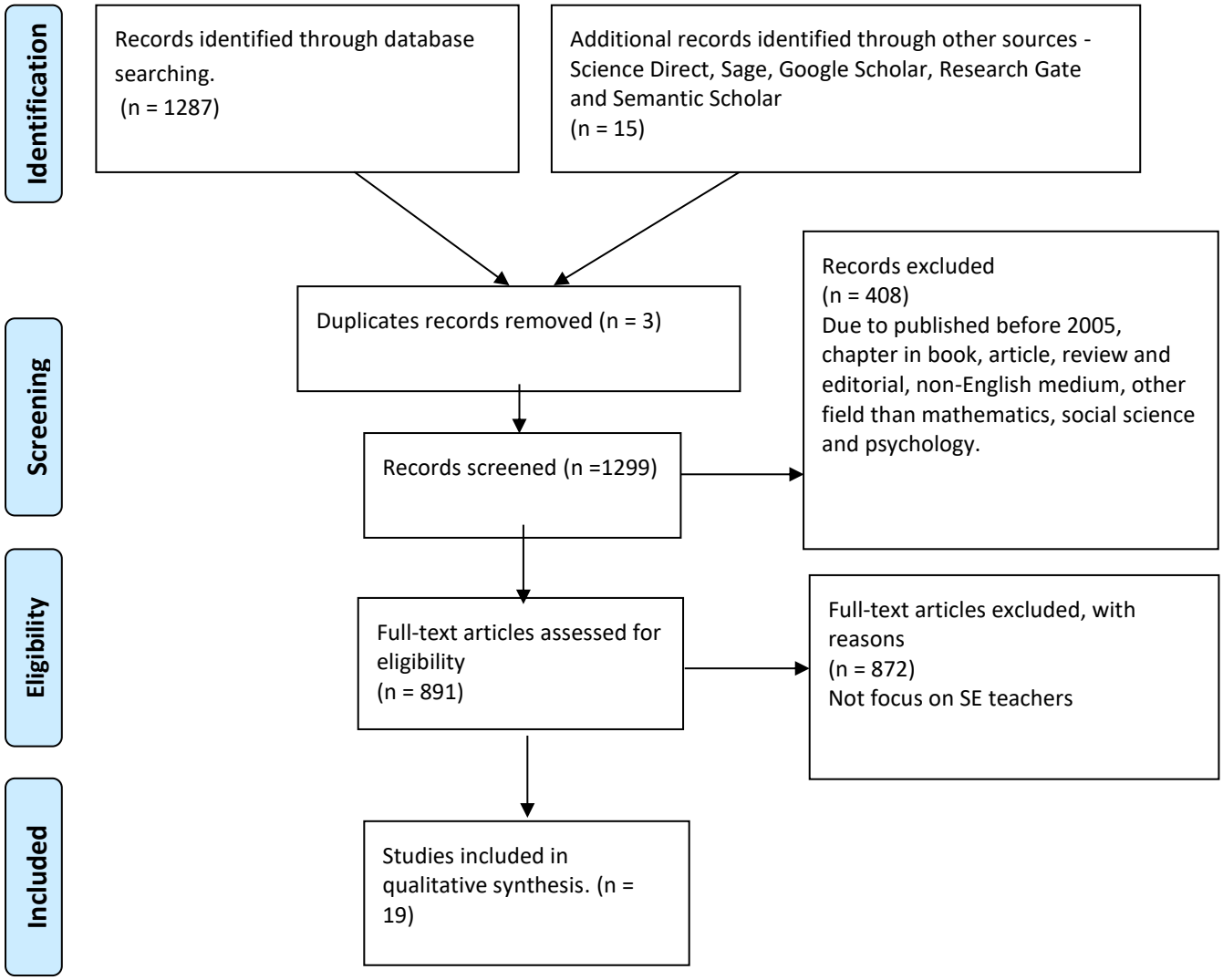

Fig. 1. PRISMA flow diagram (adapted from Moher et al., 2009)

3. Results

The data analysis generated three main themes and seven sub themes related to SE teachers' knowledge, as presented in Table 2. Overall, it is an equal number for qualitative and quantitative research (47.4 percent each design) with only 5.2 percent using a mixed method. Previous studies tended to focus in exploring SE teachers' knowledge, which consists 10 of the articles reviewed (Aiyeleso, 2016; Rosas & Cambell, 2010; van Garderen et al., 2013; Brownell et al., 2010; Feng & Sass, 2013; Martin, 2018; Brown, 2019; Greer & Meyen, 2009; Aydemir, 2013; Hinton et al., 2015). We found five studies which compared SE teachers' knowledge and general mathematics teachers' knowledge (Sheppard & Wieman, 2020; Ekstam et al., 2017[a]; Goldman & Gilmour, 2020; Weiss et al., 2018; Alazemi, 2018), while only one study compared SE teachers' knowledge between pre-service and in service teachers (Flores et al., 2010). Finally, three articles focused on pre-service teachers' knowledge in mathematics (Griffin et al., 2009; Ekstam et al., 2017[b]; Rosas & Cambell; 2010). The articles published from 2009 to 2020 are constant with a minimum of one article or a maximum of three articles published yearly. There was a loop between 2012 until 2014, which we did not find any articles related to SE teachers' knowledge in the databases that we used.

Table 2. The main themes and sub-themes of SE teachers' knowledge

Authors	Method	SMK		PCK			KLDC	
		MCK	HCK	KCS	KCT	KCC	SLD	MLB
1. Aiyeleso (2016)	Qualitative			√	√	√	√	√
2. Sheppard & Wieman (2020)	Quantitative	√		√			√	√
3. Ekstam et al. (2017 [a])	Quantitative	√						
4. Flores et al. (2010)	Quantitative	√		√	√		√	√
5. Griffin et al. (2009)	Qualitative	√		√	√		√	√
6. Ekstam et al.(2017 [b])	Quantitative	√		√	√		√	
7. Goldman & Gilmour (2020)	Quantitative	√		√	√		√	√
8. Rosas & Cambell (2010)	Quantitative	√						
9. van Garderen et al.(2013)	Qualitative	√		√	√	√	√	√
10. Brownell et al. (2010)	Qualitative	√	√	√	√		√	√
11. Feng & Sass (2013)	Quantitative	√		√	√		√	√
12. Martin (2018)	Quantitative	√						
13. Brown (2019)	Qualitative	√		√	√			√
14. Greer & Meyen (2009)	Qualitative	√			√	√		
15. Aydemir (2013)	Qualitative	√		√	√			
16. Hunt et al. (2016)	Qualitative	√	√	√	√		√	√
17. Weiss et al. (2018)	Qualitative	√		√	√		√	√
18. Alazemi (2018)	Quantitative	√			√			
19. Hinton et al. (2015)	Mixed method	√			√			

Subject matter knowledge (SMK)	Pedagogical content knowledge (PCK)	Knowledge of students with learning disabilities (KSWLD)
MCK – mathematics content knowledge HCK – horizontal content knowledge	KCS – knowledge of content and students KCT – knowledge of content and teaching KCC – knowledge of content and curriculum	SLD – Students' learning deficits MLB – Mathematics learner behavior

3.1 *Subject matter knowledge (SMK)*

Subject matter knowledge (SMK) is vital knowledge that can boost the teachers' competency in teaching. It is defined as specific and extensive knowledge related to the subject's that a teacher will teach (Shulman, 1987). This kind of knowledge will help teachers connect the topics and diversify their teaching (Norton, 2018; Vlahava & Antoniou, 2019). In this study, SMK emerged another two sub-themes: mathematics content knowledge (MCK) and horizontal content knowledge (HCK). Eighteen articles emphasized the importance of SMK, while only two of them were found to focus on HCK.

3.1.1 Mathematics content knowledge (MCK)

MCK consists of knowledge about the ideas, concepts, facts and representations of mathematics. Through 18 articles that focused on MCK, we found that respondents or participants (SE teachers) did not demonstrate competence in MCK as desired. While Ekstam et al. (2017 [a]) reported that SE teachers only acquired average mathematical knowledge, SE teachers in Hinton et al. (2015) performed below the expectation of standard curriculum and in Rosas and Cambell (2010), the worst SE teachers scored below 50 percent in basic mathematics proficiency. It is also revealed that mathematics teachers rank MCK higher than SE teachers regarding essential knowledge in teaching mathematics (Sheppard & Wieman, 2020).

3.1.2 Horizontal content knowledge (HCK)

Meanwhile HCK is how teachers can relate mathematics topics and connect abstract ideas into the context or life situation. Only two articles mentioned HCK and how important it is for SE teachers to master this knowledge. As we realize that SE education intends to prepare special needs students in surviving real life, it makes HCK a significant knowledge to be conquered by SE teachers (Tamani, Sokrat & Radid, 2019). SE teachers in Hunt et al. (2016) disclosed that they are making connections between mathematics content to be familiar with LD students' daily life.

3.2 *Pedagogical content knowledge (PCK)*

As for pedagogical content knowledge (PCK), it is a way of how teachers deliver the contents that they acquire. Lee Shulman had introduced PCK in 1987, and this knowledge goes beyond the subject matter knowledge (SMK). Under PCK, there were three sub-themes: knowledge of content and students (KCS), knowledge of content and teaching (KCT) and knowledge of content and curriculum (KCC).

3.2.1 Knowledge of content and students (KCS)

This knowledge highlighted how teachers could choose good examples and content that suits the students' need. Thirteen papers prioritized KCS as essential knowledge for SE teachers while the other six articles did not find this knowledge, as necessary. Hunt et al. (2016) revealed that SE teachers would bridge mathematics content with students' previous mathematics knowledge. They searched for tasks that can be understood by LD students. It is also observed that SE teachers created diverse learning materials to meet the needs of students with LD (Weiss et al., 2018).

3*.2.2 Knowledge of content and teaching (KCT)*

One of the important elements of successful teaching is knowledge of content and teaching (KCT). Teachers choose suitable teaching strategies, decide, and reflect on what has been taught. Fifteen articles reviewed how SE teachers are mastering KCT in teaching mathematics. Studies exposed that SE teachers are most likely to apply teacher-centred strategy by using a direct instruction approach and posed low level questions (Aydemir, 2013; Griffin et al., 2009; Yıldız & Uzunboylu, 2018). SE teachers in Finland were also reported to have more insufficient pedagogical knowledge than general mathematics teacher (Ekstam et al., 2017 [a]). Thirty-six percent of teachers in Hinton et al. (2015) research was found to use procedural teaching strategy. It is more surprising when 20 percent of SE teachers in Griffin et al. (2009) did not make sure how to explain and represent mathematics concepts. In contrast, Aydemir (2013) disclosed that SE teachers are more knowledgeable about teaching methods for LD students. SE teachers in Hunt et al. (2016) tried to do student-centred teaching while SE teachers in Weiss et al. (2018) applied individualized and differentiated learning.

3.2.3 Knowledge of content and curriculum (KCC)

Out of nineteen articles, three of them stressed out about KCC in which a knowledge that helps teachers adapt the national curriculum with the content that they want to deliver. This adaptation includes time allocation, learning aids and teaching strategies. The most significant finding for KCC is 33

percent of respondents (SE teachers) performed below 70 percent when tested using elementary level curriculum-based assessment (Hinton et al., 2015).

3.3 Knowledge of students with learning disabilities (KSWLD)

Students with LD are well-known for having barriers in learning. Under KSC, two sub-themes pop up: students' learning deficit (MLD) and mathematics learner behavior (MLB).

3.3.1 Students' learning deficit (SLD)

While the mixed categories of LD in a classroom have their deficits regarding their medical history, psychological needs and immature psychomotor, previous studies were keen to consider the importance of possessing knowledge. Eleven articles articulated that knowledge of SLD is a must for SE teachers to teach mathematics effectively. It is found that SE teachers need to ascertain among other things unequal understanding, missing skills of every student and addressing LD specific needs (Hunt et al., 2016). Besides, Weiss et al. (2018) reported teachers should have known about disabilities students to teach them. It also unfolded that SE teachers rank high on individual students' knowledge as crucial knowledge in teaching mathematics than mathematics teachers (Sheppard & Wieman, 2020).

3.3.2 Mathematics learner behavior (MLB)

With knowledge of the weakness for every category of students with LD, SE teachers also need to master MLB knowledge. Eleven studies highlighted this knowledge as requisite knowledge for SE teachers who teach mathematics towards students with LD. In Sheppard and Wieman's (2020) study, the mathematics and SE teachers agreed to rank high on how students learn mathematics on essential knowledge in teaching mathematics. Many SE teachers realize that students with LD struggled in mathematics (Griffin et al., 2009) and will modify mathematics problem complexity to suit the students' ability (Hunt et al., 2016).

4. Discussion

In this section, the knowledge will be divided into two parts which are essential knowledge and assisting knowledge. Subject matter knowledge (SMK) and pedagogical content knowledge (PCK) are the core for SE teachers in teaching mathematics. Meanwhile knowing about students' characteristics with LD is the supporting knowledge that will enhance the learning process.

4.1 Requisite knowledge to teach mathematics towards students with LD.

In this study, we specifically quote SMK as mathematics content knowledge (MCK). We can conclude that MCK is confirmed to be basic knowledge that every teacher needs to master to teach a subject effectually. According to Ball et al. (2008) who introduced the mathematical knowledge for teaching (MKT) model, MCK is a part of essential knowledge that a teacher needs to dominate. Rosas and Campbell (2010) mentioned that teachers who did not master in mathematics are often unqualified. Furthermore, in previous studies, MCK has proven to contribute to students' learning process. It is said to be foremost for students' success in mathematics (Ekstam et al. [a], 2017) and having teachers with good MCK can boost students' achievement in the subject (Reid & Reid, 2019). Teachers with low MCK

will lead to poor students' mathematical knowledge and learning outcomes (Rosas & Campbell, 2010; Goldman & Gilmour, 2020). It is also supported by the findings in Goldman and Gilmour (2020) that students with autism spectrum disorder (ASD) who were taught by a SE teacher scored lower in mathematics scores. Feng and Sass (2013) proved that SE teachers who took advanced degrees in mathematics positively impact students with LD achievement.

On the other hand, MCK is also related to mathematics teaching efficacy. Ekstam et al. (2017 [b]) revealed that MCK has an indirect effect on SE teachers' effectiveness. According to Martin (2018), a high level of MCK links to mathematics teaching efficacy. Similarly, the findings are also supported by Griffin et al. (2009) results that 60 percent of SE teachers who had strong MCK background felt prepared to teach mathematics because of their knowledge of mathematics and mathematics' teaching. In Flores et al. (2010) research, SE teachers who felt competent to teach mathematics performed better in problem-solving (Flores et al., 2010). In contrast, few other studies revealed that SE teachers had more anxiety and not confident to teach mathematics due to their insufficient training in the subject matter (Aydemir, 2013; Alazemi, 2018; Brown, 2019).

The diversity of learners in the LD classroom requires SE teachers to be creative and selective in deciding their teaching plan (Fanzeres & Cruz-Santos, 2018). This situation relates to pedagogical content knowledge (PCK) including knowledge of students, teaching and curriculum. Flores et al. (2010) stated that teachers should be competent in content, materials and strategies to meet individual student needs. They should apply various and specialized instruction modes such as direct instruction, teach by demonstrating, concretization, and concurrent teaching methods in teaching mathematics regarding the LD needs (Aydemir, 2013; Aiyeleso, 2016). Subsequently, SE teachers are also encouraged to use and adapt the special curriculums to serve students with LD in creating a practical lesson for the children (Aiyeleso, 2016). To translate curriculum standard into aligned curriculum, SE teachers should possess good content knowledge (Greer & Meyen, 2009). The consequences of the lack of training in PCK will affect the students' learning outcomes (Goldman & Gilmour, 2020; Akoul, Lotfi & Radid, 2020).

4.2 Supporting knowledge to teach mathematics towards students with LD.

Other than MCK and PCK as discussed, we believe that SE teachers must acquire the knowledge of students with LD. As we realized with the diverse learners in the LD category, it is compulsory for teachers to learn the deficits and characteristics to make the lessons effective. Each type of student with LD has its traits and flaws to be identified. In general, most LD students perform slower than mainstream students in academics especially in mathematics (Griffin et al., 2009). With that, SE teachers need to be more knowledgeable about the deficiency of students with LD and be alert to attend to the students' demand (Aiyeleso, 2016). Weiss et al. (2018) mentioned that knowledge of students' disabilities must apply individualized and adapted learning plus to create learning aids that match students with LD. SE teachers need to put more effort into teaching mathematics to students with LD because they need to be treated as individual children that are unique in their own way. It requires knowledge about how children gain and apply their mathematical skills (Flores et al., 2010).

5. Conclusion

Different key terms and meaning may lead to missing related articles in the identification process. For example, individual scholars used 'student with LD' while using the key term 'learning disabilities students. Some of the authors defined LD as mathematics learning disabilities or 'dyscalculia'

which brought a different meaning to our study (LD in our research refers to ASD, ADHD, GDD and down-syndrome students). This dissimilarity may affect the chances of excellent and relevant articles that were reviewed.

Nevertheless, the current study disclosed an overview of teachers' knowledge in teaching mathematics towards students with LD. Three main themes describe SE teachers' expertise area associated based on a systematic literature review conducted. First and foremost is mathematics content knowledge (MCK), a powerful indicator of students' learning outcomes. Next is pedagogical content knowledge (PCK), the prominent topics among scholars. PCK consists of content-students, content-teaching and content-curriculum that important for lesson planning. Finally, the knowledge of learning disabilities characteristics (KLDC) covers all parts to understand students with LD such as their deficiency, weakness and behavior in learning mathematics to create a first-class learning experience. With this SLR, we hope it can support future research involving SE teachers in academic areas, specifically mathematics.

6. Recommendations

The pinpoint of this systematic literature review steered the research to suggestions for future study. As we can see from figure 1, out of 891 papers for eligibility, 872 research works were excluded because it focused on general mathematics teachers, not special education teachers. It shows there are golden opportunities to explore more about SE teachers' knowledge in teaching mathematics. The scope of SE teachers' knowledge can have more depth, especially understanding learning disabilities characteristics, including their deficiency and behavior in learning mathematics.

References

Adeniyi, S. O., & Kuku, O. O. (2020). Impact of learning interventions on mathematics achievement among learners with hearing impairment. *Contemporary Educational Researches Journal*, *10*(4), 131–143. https://doi.org/10.18844/cerj.v10i4.5214

Aiyeleso, M.M. (2016). The ideal special education teacher in Nigeria. *Asia Pacific Journal of Education, Art and Science 3*(3), 1-5. https://tinyurl.com/ydksyg2c

Akoul, M., Lotfi, S., & Radid, M. (2020). Effects of academic results on the perception of competence and self-esteem in students' training. *Global Journal of Guidance and Counseling in Schools: Current Perspectives*, *10*(1), 12–22. https://doi.org/10.18844/gjgc.v10i1.4874

Alazemi, B.A.H.E (2018). Exploring pre-service special and general teachers' belief and attitudes in math and learning and teaching mathematics. Dissertations. University of Northern Colorado. https://digscholarship.unco.edu/dissertations/486/

Aydemir, T. (2013). The views of special education teachers about mathematics instruction in special education. *Procedia-Social and Behavioural Sciences 106*, 3133-3140.https://doi.org/10.1016/j.sbspro.2013.12.362

Ball, D.L., Thames, M.H. & Phelps, G.C. (2008). Content knowledge for teaching what makes it special? *Journal of Education Teacher 59(5),* 389-407. https://tinyurl.com/ygy4zwrq

Bishara, S. . (2021). The cultivation of self-directed learning in teaching mathematics. *World Journal on Educational Technology: Current Issues*, *13*(1), 82–95. https://doi.org/10.18844/wjet.v13i1.5401

Brown, R. (2019). A phenomenological investigation into the self-efficacy of SE team teachers with regard to their mathematics content knowledge. Dissertations.Liberty University. https://digitalcommons.liberty.edu/doctoral/2097/

Brownell, M.T., Sindelar, P.T., Kelly, M.T. & Danielson, L.C. (2010).Special education teacher quality and preparation: Exposing foundation, constructing a new model. *Exceptional Children 76*(3), 357-377. https://doi.org/10.1177%2F001440291007600307

Ekstam, U., Korhonen, J., Linnanmaki, K. &Aunio, P. (2017 [a]). Special education and subject teachers ' self-perceived readiness to teach mathematics to low performing middle school students. *Journal of Research in Special Education Needs*, 10.1111/1471-3802.12393. https://doi.org/10.1111/1471-3802.12393

Ekstam, U., Korhonen, J., Linnanmaki, K. &Aunio, P. (2017 [b]). Special education pre-service teachers' interest, subject knowledge, and teacher efficacy beliefs in mathematics. *Teaching and Teacher Education 63*, 338-345. https://doi.org/10.1016/j.tate.2017.01.009

Fanzeres, L. J. L. T., & Cruz-Santos, A. (2018). Adulthood transition of students with special educational needs in Portugal: Preliminary results of professionals perceptions. *Global Journal of Psychology Research: New Trends and Issues*, *8*(1), 44–51. https://doi.org/10.18844/gjpr.v8i1.3272

Feng, L. & Sass, R. T. (2013). What makes special education teachers special? Teacher training and achievement of students with disabilities. *Economics of Education Review 36*, 122-134. https://doi.org/10.1016/j.econedurev.2013.06.006

Flores, M.M., Patterson, D.S., Shippen, M.E., Hinton, V. & Franklin, T.M. (2010). Special education and general education teachers' knowledge and perceived teaching competence in Mathematics. *Issues of the Undergraduate Mathematics Preparation of School Teachers 1*, 1-10. https://csuepress.columbusstate.edu/bibliography_faculty/2145/

Goldman, S.E. & Gilmour, A.F. (2020). Educating students with Autism Spectrum Disorders: Is teacher certification area associated with academic outcomes?.Journal of Autism and Development Disorders. https://doi.org/10.1007/s10803-020-04561-w .

Greer, D.L. & Meyen, E.L. (2009). Special education teacher education: A perspective on content knowledge. *Learning Disabilities Research and Practice 24*(4), 196-203. https://doi.org/10.1111/j.1540-5826.2009.00293.x

Griffin, C.C., Jitendra, A.K. & League, M.B. (2009). Novice special educators' instructional practices, communication patterns, and content knowledge for teaching mathematics. *Teacher Education and Special Education 32*(4), 319-336. https://doi.org/10.1177%2F0888406409343540

Hinton, V., Flores, M., Burton, M. & Curtis, R. (2015). An investigation into pre-service SE teachers' mathematical skills, self-efficacy and teaching methodology. *Issues of the Undergraduate Mathematics Preparation of School Teachers 1*, 1-10. https://eric.ed.gov/?id=EJ1061104

Hunt, J.H., Valentine, C., Bryant, D.P., Pfannenstiel, K.H. & Bryant, B.R. (2016). Supplemental Mathematics Intervention: How and why special educators intensify intervention for students with LD. *Remedial and Special Education 37*(2), 78-88. https://doi.org/10.1177%2F0741932515597293

Martin, O.E. (2018). Factors influencing SE teachers' mathematics teaching efficacy. Dissertations.Liberty University. https://digitalcommons.liberty.edu/doctoral/1759/

Refugio, C. N., Galleto, P. G., Noblefranca, C. D., Inoferio, H. V., Macias, A. O., Colina, D. G., & Dimalig, C. Y. (2020). Content knowledge level of elementary mathematics teachers: The case of a school district in the Philippines. *Cypriot Journal of Educational Sciences*, *15*(3), 619–633. https://doi.org/10.18844/cjes.v15i3.4551

Rosas, C. & Campbell, L. (2010). Who's teaching math to our most needy students? A descriptive study. *Teacher Education and Special Education 33*(2), 102-113.https://doi.org/10.1177%2F0888406409357537

Sheppard, M.E. & Wieman, R. (2020).What do teachers need? Math and SEN teacher educator's perception of essential knowledge and experience. *Journal of Mathematics Behavior 59*, 1-11. https://doi.org/10.1016/j.jmathb.2020.100798

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard educational review*, *57*(1), 1-23. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Tamani, S., Sokrat, H., & Radid, M. (2019). The impact of the type of questions asked in continuous assessment on students' outcomes. *International Journal of Learning and Teaching*, *11*(2), 60–65. https://doi.org/10.18844/ijlt.v11i2.849

van Garderen, D., Thomas, C.N., Stortmont, M. & Lembke, E.S. (2013). An overview of principles for special educators to guide mathematics instruction. *Intervention in School and Clinic 48*(3), 131-141. https://doi.org/10.1177%2F1053451212454006

Vlahava, K., & Antoniou, F. (2019). The relationship between teaching styles and SEN students' reading comprehension achievement. *New Trends and Issues Proceedings on Humanities and Social Sciences*, *6*(7), 62–72. https://doi.org/10.18844/prosoc.v6i7.4513

Weiss, S., Markowetz, R. & Kiel, E. (2018). How to teach students with moderate and severe intellectual disabilities in inclusive and special education settings: Teachers' perspectives on skills, knowledge and attitudes. *European Educational Research Journal*, 1-20. https://doi.org/10.1177%2F1474904118780171

Yıldız, E. P., & Uzunboylu, H. (2018). Comparıson Of Instructıonal Desıgn Models: An Instructıonal Desıgn Model; Example Of The Near East Unıversıty. *International Journal of Innovative Research in Education*, *5*(3), 74–84. https://doi.org/10.18844/ijire.v5i3.3835