Powell, S. R., Barnes, M. A., Root, J., Hughes, E. M., Ketterlin-Geller, L., Nelson, G., Rojo, M., Allsopp, D. H., Witzel, B. S., Myers, J. A., Flores, M. M., Lembke, E. S., Burns, M. K., Namkung, J., Poncy, B., Ennis, R. P., Morin, L. L., Arsenault, T. L., Doabler, C. T., Hinton, V., Satsangi, R., Kong, J. E., Jimenez, B., Bundock, K., Codding, R. S., King, S., Dueker, S. A., Arizmendi, G., Gilley, D., Brafford, T., Stevens, E. A., Clarke, B., Riccomini, P. J., & Peltier, C. (2025). The NCTM/CEC position statement on teaching mathematics to students with disabilities: What's in it and what's not. *Research in Special Education*, *2*, 1–37. https://doi.org/10.25894/rise.2796

RESEARCH IN SPECIAL EDUCATION

ALETHEIA SOCIETY

NON-EMPIRICAL PAPER

The NCTM/CEC Position Statement on Teaching Mathematics to Students with Disabilities: What's in It and What's Not

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Submitted: 05 February 2025 **Accepted:** 28 February 2025 **Published:** 06 March 2025

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ABSTRACT

A joint position statement issued in December 2024 by the National Council of Teachers of Mathematics (NCTM) and the Council for Exceptional Children (CEC) on teaching mathematics to students with disabilities lacked substantive, actionable, research-validated recommendations to support the work of practitioners in the field. Herein, we provide a rationale for ways in which the eight recommendations for teachers included in the position statement fell short, provided misleading information, and ignored the large body of research on providing mathematics instruction for students with mathematics disability or difficulties. In response, we offer seven actionable, research-validated recommendations, including: (a) use systematic, explicit instruction; (b) use clear and concise mathematical language; (c) use multiple representations, including number lines; (d) develop fluency; (e) develop word-problem solving; (f) provide response opportunities, feedback, and practice; and (g) collect data to adapt instruction.

Keywords: mathematics; disability; mathematics instruction; evidence; research

In December of 2024, the National Council of Teachers of Mathematics (NCTM) and the Council for Exceptional Children (CEC) issued a practitioner-targeted position statement on teaching mathematics to students with disabilities (henceforth called the "position statement"). The position statement included three declarations about the teaching of mathematics to students with disabilities, followed by actionable recommendations in six areas: teacher educators and state education departments, general education and special education teachers of mathematics, school- and district-level leadership, funding agencies, researchers, and professional organizations.

A position statement from two national organizations focused on the teaching of mathematics to all students with disabilities is essential and timely. It has been two decades since NCTM argued students with disabilities have long been victims of low expectations (NCTM, 2005). Given the strong research base on mathematics within the field of special education, the focus in CEC teacher preparation standards on the use of research-validated practices, and the emphasis in both general and special education legislation about the use of research-validated practices in particular for students with disabilities, the expectation was that such a position statement would reflect a consensus of current empirical evidence in the field. Unfortunately, the NCTM/CEC position statement fell well short of this expectation.

In this paper, we first provide an overview of the NCTM/CEC position statement and its development. Then, we focus on the position statement's eight actionable recommendations provided for general and special education teachers, reviewing the supporting evidence for each. Finally, we suggest research-validated, actionable recommendations that *should have* been included. This paper is intended to be the first of several efforts to produce research-validated documentation with clear, executable steps for a range of educational partners, including teacher educators, state education departments, general education teachers, special education teachers, mathematics interventionists and tutors, related service providers, school and district administrators, researchers, and policy makers.

DISABILITY, MATHEMATICS DISABILITY, AND MATHEMATICS DIFFICULTIES

We begin by describing the three populations of students targeted by this position statement. First, there are *students with a disability*. In the United States, a student with a disability has a school-identified or school-recognized disability from one of the 13 categories outlined by the Individuals with Disabilities Education Act (IDEA, 2004) or qualifies for protections and services under Section 504 of the Rehabilitation Act. We would expect many students with a disability to have Individualized Education Program (IEP) goals in mathematics. Second, there are *students with a mathematics disability.* In the United States, the term mathematics disability is not specifically defined by the IDEA legislation. However, similar terms like *dyscalculia, developmental dyscalculia,* or *mathematical learning disability* are used in the United States and abroad (American Psychiatric Association, 2013; Decarli et al., 2023). Third, there are *students with mathematics difficulties.* In many empirical studies, this group of students exhibits persistent difficulties with mathematics without an official identification of disability. Much of the research with mathematics difficulties has focused on intervention programming aimed at remediating or ameliorating these challenges, with the goal of preventing later identification of a disability. As such, researchers often refer to this subpopulation of students in intervention research as *at-risk students*.

Over the last several decades, researchers have conducted hundreds of rigorous experimental studies focused on improving mathematics outcomes for students with a disability (or disabilities), mathematics disability, and mathematics difficulties (G. Nelson, Crawford, et al., 2022; Rojo et al., 2024). In this paper, we rely on empirical research and research-validated approaches across these three student groups because they often demonstrate similar needs and are thus treated similarly in both research and practice. As such, we will use the term *students with mathematics disability or difficulties* throughout.

THE 2024 NCTM/CEC POSITION STATEMENT

A group of approximately 10 individuals with expertise in mathematics from general education and special education met regularly over a period of a year to produce and refine the NCTM/CEC position statement. Their meetings began in the summer of 2023, at which time the group agreed that the joint position statement should focus on practical suggestions for mathematics instruction for all students with disabilities, regardless of the perceived severity of their disability. This decision was pivotal in shaping the development of the statement, as it required expanding the focus beyond disabilities that are typically considered *mild or moderate* (e.g., mild intellectual disability, autism spectrum disorder) or classified as *high incidence* (e.g., specific learning disability, emotional and behavioral disorders).

Within the group, however, there was disagreement about using research to drive recommendations within the position statement. As a result, research and empirical evidence were not prioritized, contradicting the emphasis on research in both general education and special education legislation in the United States (Every Student Succeeds Act [ESSA], 2015; IDEA, 2004), as well as in most documentation from CEC, including their initial and advanced standards for teacher preparation (Berlinghoff & McLaughlin, 2022; CEC, 2015). Furthermore, the field of special education has always been rooted in data and research (B. G. Cook & Schirmer, 2003; D. Fuchs & Fuchs, 1995).

The lack of reliance on research within the position statement ignores the robust research base on teaching mathematics to students with mathematics disability or difficulties. For example, G. Nelson, Crawford, et al. (2022) identified 36 syntheses of mathematics intervention (with a total of 836 studies, some represented in multiple syntheses), and we provide many more examples of this robust research base throughout this paper. In the next section, we review the research for the three declarations included at the beginning of the NCTM/CEC position statement.

Declarations Within the Position Statement

The first three pages of the seven-page NCTM/CEC position statement describe three declarations (see Table 1). We agree that all three declarations are essential for success in mathematics, with the first two supported by federal legislation and recent case law (see Table 1 for examples). Those same two declarations describe the importance of instruction on grade-level content; however, the statement provides no guidance on how to help students with grade-level content when they likely have had difficulty with content from previous grade levels. Although this declaration challenges the common but harmful assumption that students with mathematics disability or difficulties should be limited to learning content and skills commensurate with their current level of performance, it overlooks the cumulative nature of mathematics. That is, foundational mathematics content is important for later success with more complex mathematics content (Claessens & Engel, 2013; Davis-Kean et al., 2022; Geary et al., 2013; Jordan et al., 2017; Morgan et al., 2009). As a result, teachers are unable to focus solely on grade-level content if students have unfinished learning from earlier grades. A previous statement from 11 organizations that address disability and difficulties noted the essential focus on grade-level content and also included language on the need for supplemental instruction to meet individual student needs (Council for Learning Disabilities, 2019). Such language would greatly improve the NCTM/CEC position statement. Furthermore, while the final declaration about educators being supportive of students' abilities is an important highlight, the recommendations in the position statement that follow fail to provide teachers with actionable steps to increase students' mathematical knowledge.

Before moving on to the actionable recommendations, we want to make one additional point. In the first declaration regarding the supports needed for success with grade-level content, the position statement suggests that co-teaching and collaboration serve as effective vehicles for addressing this need. Co-teaching, a service delivery model that may provide increased access to research-validated practices, remains an area in which the research on its effects on student

POSITION STATEMENT DECLARATION	CONNECTIONS TO LEGISLATION AND CASE LAW
"students with disabilities have a right to access and be provided with appropriate supports to be successful with grade/course level content" (p. 1, NCTM/CEC, 2024)	• Free and appropriate public education (FAPE; Board of Education v. Rowley, 1982; IDEA, 2004) • Students should "be involved in and make progress in the general education curriculum" (IDEA, 2004) • All states should adopt "challenging academic content standards" that "apply to all public school students" (ESSA, 2015) • Students should have "appropriately ambitious goals" (Endrew v. Douglas County School District, 2017)
"students with disabilities have a right to high-quality instruction aligning with content and intervention designed to facilitate success with grade-level content" (p. 2, NCTM/CEC, 2024)	• Student instruction should be based on "scientifically-based instruction practices" and "research-based practices" (IDEA, 2004) • Student instruction should use "evidence-based" practices, defined as "demonstrates a statistically significant effect on improving student outcomes" (ESSA, 2015) • The teaching of mathematics should rely on the "best available scientific evidence" (p. xiii, National Mathematics Advisory Panel, 2008)
"students with disabilities have a right to be supported by educators who believe in their abilities" (p. 3, NCTM/CEC, 2024)	(None)

Table 1 Position Statement Declarations and Connections to Legislation and Case Law.

Note. CEC = Council for Exceptional Children; ESSA = Every Student Succeeds Act; FAPE = Free appropriate public education; IDEA = Individuals with Disabilities Education Act; NCTM = National Council of Teachers of Mathematics.

achievement is still in its infancy, particularly in mathematics. In a recent review, co-teaching experts and researchers made the following observations about the instructional practice:

> An encouraging finding that the quantity of co-teaching studies has significantly increased in the past 15 years is offset by the discouraging observations that (a) special educators in many locales still function primarily as classroom assistants within a one teaching, one assisting arrangement and (b) scant attention has been paid to research on the specialized instruction that students with disabilities must receive in co-taught classes and its impact on outcomes (Friend & Barron, 2024, p. 8).

Some meta-analyses have reported positive effects of co-teaching for students with disabilities, yet more research needs to be conducted to understand the characteristics that moderate co-teaching (King-Sears et al., 2021) and to identify the specific characteristics of high-quality co-taught mathematics instruction. In addition, authors of meta-analyses about co-teaching have reported methodological or study quality concerns related to co-teaching studies (Losinski et al., 2019). Regardless, it is worth noting that co-teaching is only as effective as the extent to which research-validated instructional practices are integrated into the co-teaching model—a nuance that the position statement does not address.

In the next section, we review the cited research included within the position statement. As mentioned earlier in this paper, reliance on research-validated practices for instruction is described as essential in both general education legislation (i.e., ESSA) and special education legislation (i.e., IDEA) in the United States as well as in the teacher preparation standards from the CEC. Therefore, we would expect a position statement to be firmly grounded in research.

Research Cited Within the Position Statement

Table 2 provides an overview of the 34 citations included in the position statement. Approximately half of the citations were documents from organizations or book citations. Given that books are seldom peer reviewed and authors often do not explain the research conducted for the book, we consider book citations to be less reliable than research from peer-reviewed journal articles. Of the 13 publications from peer-reviewed articles in the position statement, only six were specific to mathematics. Notably, while the position statement aimed to address mathematics instruction for students with disabilities, less than half (n = 6) of the peer-reviewed articles included any mention of students with disabilities. Only four studies addressed mathematics *and* disability (Cooper & Farkas, 2023; Heyd-Metzuyanim, 2013; Root, Saunders, et al., 2021; Scheuermann et al., 2009) and only one of these studies (Scheuermann et al., 2009) shared original research evaluating academic student outcomes.

CATEGORY	DESCRIPTION AND CITATION
Peer-reviewed journal articles	Mathematics citations • A study of preservice teachers' lesson plans linked to students' mathematical thinking (Aguirre et al., 2013) • A case study about students' communication and identity in mathematics (Andersson & Wagner, 2019) • An analysis of motivation as a mediator for achievement via National Center on Educational Statistics High School Longitudinal Study (Cooper & Farkas, 2023) • A case study about an author's mathematics classroom interactions with a student with a disability (Heyd-Metzuyanim, 2013) • A practice article on teaching mathematics to students with extensive support needs based on a different reference (Root, Saunders, et al., 2021, based on L. S. Fuchs, Newman-Gonchar, et al., 2021) • A single-case research design study evaluating effects of explicit inquiry routine on mathematics performance for students with learning disabilities (Scheuermann et al., 2009)
	Non-mathematics citations • A literature review about teachers' expectations (Busaad, 2020) • A case study of teachers' expectations of students with disabilities (Cameron & Cook, 2013) • A conceptual analysis on feedback (Hattie & Timperley, 2007) • An article focusing on race, culture, and identity in education research was selected by the editors to be published in a special issue (Langer-Osuna & Nasir, 2016) • An opinion statement on strength-based practices (Raley et al., 2021) • A validation study on a self-efficacy assessment (Usher & Pajares, 2009) • A summary of a career change study (Williams, 2010)
Practice guide	• Synthesis of intervention research related to students with mathematics difficulties (L. S. Fuchs, Newman-Gonchar, et al., 2021)
Documents from organizations	• Standards for preparing teachers of mathematics (Association of Mathematics Teacher Educators Writing Team, 2020) • A position statement on multi-tiered systems of support (CEC, 2021a) • A position statement on the teacher workforce (CEC, 2021b) • A white paper about tools to reduce delinquency (National Association of State directors of Special Education & National Disability Rights Network, 2007) • A resource about identity in K-12 mathematics (NCTM, 2024) • A resource about catalyzing change in middle school mathematics (NCTM, 2020) • A resource about principles to action in mathematics (NCTM, 2014) • A resource about UDL (CAST; Pusateri, 2022)

(Contd.)

CATEGORY	DESCRIPTION AND CITATION
Books or book chapters	• A book on social cognitive theory (Bandura, 1986) • A book on self-efficacy (Bandura, 1997) • A book on constructing algebra (Fosnot & Jacob, 2010) • A book chapter on collaboration (Friend & Barron, 2021) • A book that synthesized 2,100 meta-analyses about achievement (Hattie, 2023) • A book about teacher knowledge of mathematics in China and the United States (Ma, 2010) • A book about mathematics success and failure of African-American youth (Martin, 2000) • A book about helping students learning mathematics (National Research Council, 2001) • A book about asset-based mathematics in grades 6–12 (Steele & Honey, 2024)
Legislation	• IDEA (2022) – report to Congress • IDEA (2004)
Data	• TIMSS results (Mullis et al., 2015)

Table 2 Research Cited Within the Position Statement.

Note. CAST = Center for Applied Special Technology; CEC = Council for Exceptional Children; IDEA = Individuals with Disabilities Education Act; NCTM = National Council of Teachers of Mathematics; TIMSS = Trends in International Mathematics and Science Study; UDL = Universal Design for Learning.

While several of these citations may be appropriate in the NCTM/CEC position statement, what was absent from the position statement was a reliance on the large corpus of high-quality research studies in the area of mathematics disability and difficulties. A large corpus of hundreds of experimental studies examining the effects of mathematics interventions for students with mathematics disability and difficulties has been conducted over the last several decades, published in journals after rounds of peer review. For instance, G. Nelson and McMaster (2019) named 34 studies focused on early-numeracy intervention, with student samples including students with mathematics disability or difficulties; Lein et al. (2020) reviewed 31 studies with word-problem interventions for students with mathematics difficulties; Ennis and Losinski (2019) identified 10 studies about fraction interventions for students with a disability; and Bone et al. (2021) reviewed 18 studies focused on algebra and students with a learning disability. Browder et al. (2008) identified 68 experimental studies about mathematics instruction for students with significant disabilities, and Bowman et al. (2019) updated this effort by adding 24 additional studies. As another example, Hughes and Yakubova (2019) reviewed 11 studies about mathematics instruction using technology for students with autism. Notably, many of the studies in these systematic reviews of students with mathematics disability or difficulties have to do with instruction in domains of mathematics that are critical for higher level mathematical thinking and performance for all students (National Mathematics Advisory Panel Report, 2008).

Across mathematics content areas, Chodura et al. (2015) reviewed 35 studies on interventions for students with mathematics difficulties; Jitendra et al. (2018) named 19 studies focused on mathematics interventions at the secondary level; and Rojo et al. (2024) identified 223 studies across the elementary and secondary levels in which researchers implemented a mathematics intervention with students with mathematics disability or difficulties. In fact, the literature on instructional practices for students with mathematics disability or difficulties is well documented going back decades. For example, over 20 years ago, Baker et al. (2002) identified 15 studies on mathematics interventions to improve the outcomes for students with mathematics difficulties. The omission of such research from the position statement is a significant shortcoming, especially given that CEC advocates for and produces documentation about high-quality research (B. G. Cook et al., 2015) and the use of research-validated practices through their high-leverage practices (Aceves & Kennedy, 2024).

In the next section, we delve into the research supporting the actionable recommendations for mathematics instruction for students with mathematics disability and difficulties that were included in the position statement.

Actionable Recommendations for General Education and Special Education Teachers of Mathematics Within the Position Statement

After the three pages of declarations, the position statement provided two pages of "actionable recommendations" (p. 3) for educational partners. We recommend that future author teams explore the research base underlying the recommendations for teacher educators and state education departments, school and district-level leadership, funding agencies, researchers, and professional organizations. In this section, we explore the research base for the eight actionable recommendations for general and special education teachers of mathematics, because teachers are essential to providing mathematics instruction to students with mathematics disability or difficulties. Please note, the bolded header presents the exact language from the position statement.

1. Incorporate Universal Design for Learning framework in unit and lesson planning. Universal Design for Learning (UDL) offers a framework for designing learning environments that are maximally accessible to all students. UDL highlights three aspects of the learning environment in which flexibility can be incorporated: (a) multiple representations of the content, (b) multiple means of action and expression of students' knowledge, and (c) multiple means of engaging with the content and peers (CAST, 2024; Smith et al., 2019). Although UDL provides a comprehensive approach to accessibility, research on its efficacy in improving learning outcomes remains limited (Boysen, 2024). In a systematic review of 32 studies investigating the implementation of UDL on student learning, Zhang et al. (2024) noted considerable variability in how the framework was conceptualized and operationalized. Furthermore, some experts, such as Anastasiou et al. (2024), suggested that UDL principles may conflict with cognitive load theory, particularly the use of multiple representations, which could be overwhelming to some students. While some evidence points to the potential of UDL for supporting student learning, this evidence is weak for mathematics specifically. In a meta-analysis of experimental studies, King-Sears et al. (2023) observed a moderate, positive effect for UDL-based instruction on STEM-related content, yet this only included one mathematics intervention study (which had insignificant effects). The aggregated findings across content areas suggested that the effect of UDL-based instruction for students with a disability was greater than for those without. These results indicate that UDL may have promise but further investigation is warranted.

Similar to co-teaching, UDL could serve as a framework that facilitates access to research-validated practices for students. However, due to inconsistent implementation of the UDL guidelines and challenges in measuring UDL outcomes (Edyburn, 2021), it is impossible to draw conclusions about the efficacy of UDL in improving accessibility, and consequently, learning outcomes. As such, UDL might not be the ideal first actionable recommendation for teachers in the position statement. Although the UDL framework holds theoretical promise and is content, age, and setting neutral, it may be more productive to recommend future research to use UDL to guide the selection and implementation of research-validated instructional practices for students with mathematics disability or difficulties.

2. Use appropriate and accurate multiple representations, such as simultaneously presenting Concrete-Semiconcrete-Abstract (CSA). The practice of teaching mathematics concepts and procedures through use of hands-on manipulatives (i.e., concrete), static drawings (i.e., semi-concrete), and abstract symbols has a research base in mathematics education and special education dating back nearly 60 years (Bruner, 1966). This approach, sometimes referred to as CRA (concrete-representational-abstract) or scaffolded representations (which is different from UDL's multiple means of representation), enables students to see and interact with mathematics using a variety of tools and models to deepen understanding of concepts and procedures.

Recent systematic reviews have identified several types of representations as efficacious for improving student mathematics outcomes. For example, Carbonneau et al. (2013) identified instruction with concrete manipulatives to have an advantage compared to instruction with only abstract symbols in general education. Similarly, Peltier, Morin, et al. (2020) determined concrete manipulatives were important for improving mathematics outcomes for students with mathematics disability or difficulties. Park et al. (2022) identified virtual manipulatives as a contributing factor to improved mathematics outcomes for students with a learning disability. Bouck et al. (2018) and Ebner et al. (2025) determined the CSA approach as a significant tool for the learning of mathematics, and numerous systematic reviews have identified multiple representations more broadly as integral to efficacious mathematics interventions for students with mathematics disability or difficulties across preschool, elementary, and secondary settings (S. C. Cook et al., 2020; Hwang et al., 2019; Jitendra et al., 2018; Liu et al., 2021; Mononen et al., 2014; Morin & Agrawal, 2022; Myers et al., 2021; G. Nelson, Crawford, et al., 2022; Powell, Doabler, et al., 2020; Powell, Mason, et al., 2021; Spooner et al., 2019; Zhang & Xin, 2012).

Given the strong and consistent research base supporting multiple representations, their adoption should be featured in a list of actionable recommendations for teachers. It would be helpful to provide greater details on CSA as well as its variations with virtual representations (e.g., virtual-representational-abstract stages), whether through sequential (e.g., Bouck et al., 2019; Flores et al., 2014; Satsangi & Sigmon, 2024) or integrated approaches (e.g., Bouck et al., 2024; Hinton & Flores, 2024; Root, Cox, et al., 2021; Satsangi, Hammer, & Evmenova, 2018; Satsangi, Hammer, & Hogan, 2018). These detailed recommendations are necessary so that teachers can have a deeper understanding of the nuances of using representations and discern how to use multiple representations to focus on mathematical reasoning while applying operational knowledge (Morano, Flores, et al., 2020). Furthermore, greater detail about the use of CSA would build insight into more efficient ways to create active learning experiences through multiple representations to teach mathematics content to students who may have a wide range of skills and needs and to understand which representations are most appropriate for teaching specific mathematics content to different groups of students at various stages of learning.

3. Plan proactively using a preventative model for instruction. There are several parts of this recommendation's sentence that could be important for teaching mathematics, but without clarity in the position statement, the expectations for teachers remain ambiguous. First, the phrase "plan proactively" warrants attention. So much of supporting students with a mathematics disability or difficulties involves proactive planning, including writing IEP goals, planning effective instructional approaches to teach specific content in order to reach those goals, and planning assessments to measure progress. Interestingly, assessment (and the collection of student data) was not mentioned in the NCTM/CEC position statement. The use of student assessment data to analyze instructional practices and make necessary adjustments to improve student outcomes is one of the six high-leverage pillar practices described by CEC (Aceves & Kennedy, 2024) and the use of assessment to support learning and provide useful information to teachers and students is one of NCTM's six principles for school mathematics (NCTM, n.d.). Furthermore, more than 90% of states use a multi-tiered system of supports (MTSS) framework driven by direct collection and analysis of student performance data (I-MTSS Research Network, 2024). It is a major oversight not to have any mention of assessment in a position statement focused on students with mathematics disability or difficulties.

Relatedly, within this recommendation, the use of a "preventative model," could be perceived as a reference to MTSS, a common approach with research to support its use in supporting all learners in mathematics (Choi et al., 2020). The choice of the term "preventative" is noteworthy, given there was no distinction between teaching mathematics for students with mathematics disability and those with mathematics difficulties (i.e., at risk for disability). Often, MTSS or response-to-intervention (RtI) is used by schools to support students with mathematics difficulties to prevent the identification of a disability. However, a single teacher cannot implement MTSS on their own. MTSS has to involve an entire district, with leadership and teachers working together (Freeman et al., 2015). Also, any conversations about MTSS should include all students, even those with significant cognitive disabilities (Thurlow et al., 2020). Beyond academics, and of particular importance to students with a disability, any mention of MTSS should also involve a focus on behavior (Adamson et al., 2019; Grigorenko et al., 2020; Nitz et al., 2023).

In both planning and prevention, the use of data-based decision making (DBDM; Schildkamp, 2019), sometimes referred to as data-based individualization or DBI (Powell et al., 2024), is essential. Within a DBDM framework, teachers use data to drive decisions about instruction and whether the instruction is meeting individual student needs (Schumacher et al., 2017). DBDM is essential in the teaching of students with mathematics disability or difficulties as the framework promotes responsiveness to individual student needs. In a recent meta-analysis, Jung et al. (2018) determined that DBDM was a viable framework for supporting students who have intensive academic needs. Whether through MTSS, DBDM, or a combination of both, successful implementation requires a financial investment by districts so that teachers have access to (a) planning time and professional development, (b) a thoughtfully structured school day to ensure dedicated intervention time is built into the daily schedule beyond core mathematics instruction, and (c) qualified mathematics interventionists to provide targeted and intensive intervention to students. We emphasize these components of successful MTSS or DBDM implementation because they should be taken into consideration when any preventative model is mentioned within such a position statement. These are not easy or inexpensive things to do, and often teachers do not have control over many levers that could lead to successful implementation (Mason et al., 2019).

4. Position students with disabilities as valuable owners and contributors to the mathematics being learned. Although we agree that students should be regarded as valuable owners and contributors to mathematics, it is difficult to pinpoint direct empirical evidence for this claim. One way to frame this recommendation is to draw on the literature addressing the development of self-regulation or self-determination skills for students with mathematics disability or difficulties, which is particularly important for secondary transition (Chiang & Howe, 2024) and has been incorporated in mathematics interventions for secondary students with an intellectual disability (e.g., Gilley et al., 2021; Gilley et al., 2023). In a recent systematic review, Elhusseini et al. (2022) determined self-regulation interventions could lead to improved academic outcomes for students with and without a disability. A position statement could provide detailed guidance on self-regulation and offer teachers practical strategies to support its development.

Within this actionable recommendation, it might be important to focus on student mathematics anxiety and self-efficacy. Students with mathematics disability or difficulties often demonstrate higher mathematics anxiety (Devine et al., 2018; Namkung et al., 2024). Although mathematics anxiety generally has a moderately negative impact on mathematics performance (Barroso et al., 2021; Namkung et al., 2019), difficulties in foundational mathematics skills have a much stronger impact on mathematics outcomes for students with mathematics difficulties, above and beyond the effects of mathematics anxiety (Codding et al., 2023). Similarly, within this actionable recommendation, the literature on student mindset towards mathematics may be important. Burnette et al. (2023) reported that mindset interventions were significantly related to multiple academic outcomes (not only mathematics outcomes), though the effects were very small. Macnamara and Burgoyne (2023) identified no impact of mindset interventions on academic outcomes. This is similar to a study by L. S. Fuchs, Wang, et al. (2021) in which they noted no significant advantage for students who participated in mindset activities embedded within a mathematics intervention. Clarity around this actionable recommendation could help teachers spend instructional time on factors that more substantially enhance mathematics understanding of students with disability or difficulties.

5. Provide paired time for students to share and rehearse their thinking and ideas in multi-modal ways before moving to a whole group discussion. There are many ideas to unpack in this single sentence. First, the term "paired time" could imply that students must work exclusively in pairs, yet it is unclear whether small groups, such as those with three or four would suffice. Research is inconclusive that students taught in smaller group formats (e.g., two students) have an advantage over students taught in larger small group formats (e.g., five or more students; see Doabler et al., 2019 and Clarke et al., 2022 for a comparison). A meta-analysis of 223 mathematics intervention studies from Grades K through 12 identified no significant differences in mathematics outcomes when comparing individual interventions to small groups or whole group interventions to small groups (Rojo et al., 2024). Second, "share" and "rehearse" are different practices. Sharing involves communicating mathematical ideas, whether through speech, gestures, writing, or other means. Rehearsing involves practice until proficiency is achieved, which research has demonstrated as important for the learning of mathematics (Burns et al., 2019). Although self-explanations from students may be related to sharing and rehearsing, impactful self-explanations require scaffolded support from teachers (Rittle-Johnson et al., 2017) and may not yield additional improvements in mathematics outcomes beyond those achieved through mathematics practice alone (L. S. Fuchs, Schumacher, et al., 2016). Third, the term "multi-modal" needs clarification as to whether this refers to multiple representations described in the second actionable recommendation. Fourth, "before moving to a whole group discussion" implies a fixed sequence to instruction, a topic that remains one of the largest debates in the teaching of mathematics.

Rather than trying to unpack this actionable recommendation's unclear message, it may be more helpful to review the research related to cognitive load, which could help teachers design instruction that accounts for a student's working memory capacity and processing of new information (Kirschner, 2002). Cognitive load theory (Sweller, 1988) is based on the framework that working memory has a limited capacity for temporarily storing and manipulating information. When this capacity is overloaded, learning becomes less effective, leading to decreased performance. As described by Kennedy and Romig (2024), working memory can be overloaded when students are tasked with technical language by increasing the demands of language comprehension, presented too many concepts at once, provided with irrelevant information, asked to digest a large amount of text at one time, or given abstract ideas without visual representations.

Reducing cognitive load via effective instruction is especially important for students with mathematics disability or difficulties, who often have limited working memory compared to other students (Barnes et al., 2020; Lanfranchi et al., 2012; Swanson et al., 2021; Willcutt et al., 2013). Therefore, teachers need to design instruction that mitigate these demands on students' limited working memory. With this in mind, teachers can help students take new knowledge and organize it in meaningful ways into pre-existing schemas within long-term memory (Sweller & Chandler, 1991). Effective instruction also needs to move from easier content to more difficult content in manageable chunks, with various levels of scaffolding provided to students (van Merriënboer & Sluijsmans, 2009), which includes attention to the cognitive-linguistic load of mathematics (Alt et al., 2014; Arizmendi et al., 2021). Researchers have also linked successful word-problem interventions for students with mathematics disability or difficulties to the recognition of common schemas within word problems (Alghamdi et al., 2020; Cox & Root, 2020; L. S. Fuchs, Seethaler, et al., 2021; Peltier, Sinclair, et al., 2020; Powell, Berry, et al., 2021; Root & Browder, 2019). While it is unclear whether this actionable recommendation is focused on cognitive load, we suggest two improvements. First, the statement should clarify the meaning of each of the components of this recommendation. Second, it should include explicit information about cognitive load and strategies for designing instruction to support cognitive load for students with mathematics disability or difficulties.

6. Provide a variety of interactive learning experiences. This recommendation is notably underspecified. We would expect all mathematics instruction to be "interactive." Explicit instruction, which will be described later in this paper, is highly interactive and engaging with a continuous feedback loop provided to students via frequent opportunities to respond (Doabler et al., 2015; Hughes et al., 2017). Verbalizations and purposeful discourse also have research support, which could be another avenue for interactive learning experiences (Liu & Xin, 2017; Rosenzweig et al., 2011). Although the use of multiple representations, such as CSA, can provide an interactive learning experience, the recommendation should clarify what constitutes a "variety" of learning experiences. While this sixth recommendation alludes to ways that students with mathematics disability or difficulties can engage in the learning of mathematics, which is essential for the learning of mathematics (Doabler et al., 2015), clarification is necessary to understand how this might be implemented in a school setting.

7. Use flexible grouping structures to cultivate a community of learning. Although flexible grouping is identified as one of the high-leverage practices for students with disabilities (McLeskey et al., 2017), there is a lack of clarity about the meaning or implementation of this recommendation for mathematics. For targeted mathematics support on specific mathematics content, research suggests homogeneous groupings may lead to efficient gains (Steenbergen-Hu et al., 2016), particularly in mathematics within an MTSS framework (Choi et al., 2020). "Grouping structures" could encompass peer tutoring or peer-assisted learning strategies, which has a strong evidence base to support its use in mathematics (Allsopp, 1997; Bowman-Perrott et al., 2013; Codding, Chan-Iannetta, et al., 2011; Dobbins et al., 2014; L. S. Fuchs et al., 2002; Hawkins et al., 2009) and with students with a disability (Ledford & Wolery, 2013; Sperry et al., 2010; Zhang & Wheeler, 2011). As with the prior actionable recommendations, we propose that this recommendation should offer more detailed guidance to make this truly actionable.

8. Build meaningful connections between concepts and procedures. It has long been argued that conceptual understanding and procedural fluency must coexist for students to truly grasp mathematics (Ball et al., 2005). The "Math Wars," in which tension arose about the role of conceptual understanding and procedural fluency, were largely settled in the early 2000s with the recognition that these elements are intertwined with students' ability to reason quantitatively, apply strategies, and think mathematically (Baroody et al., 2007; Rittle-Johnson, 2017; Star, 2005). Together, they form the foundation of mathematical proficiency and problem solving (National Academies of Sciences, Engineering, and Medicine [NASEM], 2001). There is no dispute that students must build meaningful connections between concepts and procedures.

Conceptual understanding involves knowing the fundamental ideas that underlie working with numbers, such as concepts, operations, and relations (Crooks & Alibali, 2014). It is not about knowing isolated and disconnected facts but having an integrated understanding of important mathematical ideas (NASEM, 2001). Procedural fluency is defined as knowing procedures; when and how to use them appropriately; and performing them flexibly, accurately, and efficiently (NASEM, 2001; Rittle-Johnson et al., 2001). It is not just about performing operations quickly but about solving problems efficiently, identifying and correcting errors, applying algorithms in contextualized settings, and generalizing understanding to novel situations (Star, 2005). Given the interplay between conceptual and procedural knowledge and the necessity to balance conceptual and procedural instruction (Heatly et al., 2015), it would be constructive for a position statement to provide research-validated guidance about the dual development of conceptual and procedural knowledge as well as clarify that one (i.e., conceptual knowledge) does not have to develop before another (i.e., procedural knowledge; Rittle-Johnson et al., 2015). In many ways, the use of multiple representations (CSA) could help students see connections between concepts and procedures (Agrawal & Morin, 2016). Further, explicit instruction could be used to help students develop deep mathematical knowledge about concepts and procedures in a way that other instructional approaches (e.g., inquiry) may leave too much up to chance and the individual student.

In reviewing the research underlying the eight actionable recommendations, we determined that many of these recommendations were underspecified or lacked a substantive research base, particularly for students with mathematics disability or difficulties. We also noted that several commonly recommended practices for the mathematics instruction of students with mathematics disability or difficulties were absent from the position statement. In the next section, we propose research-validated practices that should have been included in the NCTM/CEC position statement.

RESEARCH-VALIDATED PRACTICES FOR THE TEACHING OF MATHEMATICS TO STUDENTS WITH MATHEMATICS DISABILITY AND DIFFICULTIES

As described in the previous section, the research to support some of the actionable recommendations within the position statement was scant to non-existent. For the recommendations with some research support, there was limited guidance for teachers as to how to put such recommendations into practice. In this section, we provide–what we consider to be–actual actionable recommendations for general and special education teachers who support the mathematics learning of students with mathematics disability or difficulties (see Figure 1). As much as possible, we rely on research that has been synthesized across multiple research studies (i.e., systematic reviews, syntheses, meta-analyses). We provide a review of the hundreds of high-quality research studies in mathematics disability and difficulties that was absent from the NCTM/CEC position statement.

1. Use systematic, explicit instruction. For decades, the instructional approach that has amassed the strongest research base in mathematics, particularly when supporting students with mathematics disability or difficulties, is *systematic, explicit instruction* (Baker et al., 2002; Chodura et al., 2015; Doabler & Fien, 2013; Ennis & Losinski, 2019; L. S. Fuchs, Newman-Gonchar, et al., 2021; Gersten et al., 2009; Kroesbergen & Van Luit, 2003; G. Nelson, Cook, et al., 2022; Powell, Mason, et al., 2021; Spooner et al., 2019; Stevens et al., 2018). Importantly for a position statement on teaching mathematics to students with mathematics disability and difficulties, the National Mathematics Advisory Panel (2008) suggested that

> explicit instruction with students who have mathematical difficulties has shown consistently positive effects on performance with word problems and computation … the Panel recommends that struggling students receive some explicit mathematics instruction regularly. Some of this time should be dedicated to ensuring that the students possess the foundational skills and conceptual knowledge necessary for understanding the mathematics they are learning at their grade level. (p. xxiii)

Research-Validated Practices for the Teaching of Mathematics
to Students with Mathematics Disability or Difficulties

1. Use systematic, explicit instruction
2. Use clear and concise mathematical language
3. Use multiple representations, including number lines
4. Develop fluency
5. Develop word-problem solving
6. Provide response opportunities, feedback, and practice
7. Collect data and adapt instruction

Figure 1 Research-Validated Practices for the Teaching of Mathematics.

The meaning of systematic, explicit instruction is one of the most poorly understood concepts in education. Unfortunately, the terms systematic and explicit have been conflated with "drill and kill" teaching of lower-level or foundational mathematical skills. In contrast to these popular, if misguided, notions, systematic, explicit instruction in mathematics involves (a) the design of instruction that teaches mathematical knowledge in a sequence based on developmental theories of the hierarchical and integrated nature of mathematics (Siegler & Chen, 2008; Xu & LeFevre, 2021), for example, the importance of developing multiplicative reasoning abilities (multiplication and division) as a foundation for understanding fractions; (b) the importance of co-developing conceptual and procedural knowledge and application of learning to real world contexts through making such relationships and applications explicit during instruction; and (c) ensuring sufficient retrieval practice to consolidate new learning in long-term memory (Agarwal et al., 2021) with appropriate and informative corrective feedback to further consolidate learning (Wisniewski et al., 2020).

In conversations about instructional approaches for mathematics, inquiry- or discovery-based approaches are often named. However, there is limited empirical support for inquiry-based methods for supporting mathematics outcomes for students with mathematics disability or difficulties (Hughes et al., 2017; Krawec & Steinberg, 2019; Mayer, 2004). Research indicates that these approaches may face challenges in effectively teaching complex and abstract mathematical concepts, like those encountered in calculus. A meta-analysis by Alfieri et al. (2011) reported that unassisted discovery learning was less effective than systematic, explicit instruction, particularly in subjects requiring a high degree of prior knowledge. Kirschner et al. (2006) argued that minimal guidance during instruction was less effective and efficient for novice learners dealing with complex information, which is of particular importance given the difficulties that students with mathematics disability or difficulties have with cognitive load (see above). Kirschner et al. wrote:

> Although unguided or minimally guided instructional approaches are very popular and intuitively appealing, the point is made that these approaches ignore both the structures that constitute human cognitive architecture and evidence from empirical studies over the past half-century that consistently indicate that minimally guided instruction is less effective and less efficient than instructional approaches that place a strong emphasis on guidance of the student learning process. (p. 75)

These findings indicate that as mathematical content becomes more abstract and complex, the effectiveness of discovery-based methods may diminish, necessitating more structured instructional approaches. A small body of research indicates that inquiry-based approaches supplemented with explicit instruction and additional scaffolds (such as Enhanced Anchored Instruction) could result in small student gains (Bottge et al., 2007). However, these approaches are limited in that they are complex to create and less efficient than systematic, explicit instruction alone to implement, and there is still very limited research that indicates that they result in improvements in students' mathematics outcomes (Krawec & Steinberg, 2019).

As described by Doabler and Fien (2013), Hughes et al. (2017), and Powell, Bouck, et al. (2023), systematic, explicit instruction is a thoughtfully planned combination of segmenting complex skills, modeling (i.e., think-alouds), student engagement with prompts and scaffolding, opportunities for students to respond and engage in discourse, and purposeful practice opportunities. Systematic, explicit instruction is essential for students who are learning novel mathematics content or for students who have unfinished learning with previously introduced mathematics content. With explicit instruction, students can learn to connect conceptual and procedural knowledge, which aligns to the eighth actionable recommendation of the NCTM/CEC position statement. Once students have a strong foundation with specific content, they may be able to engage successfully in more inquiry-oriented tasks, but a strong mathematical foundation is essential before that occurs. This approach does not "dehumanize" nor presume incompetence; instead, it leverages the science of learning to give every student a chance to be successful in mathematics.

2. Use clear and concise mathematical language. As students interact with systematic, explicit instruction, using mathematical language is necessary to fully participate in the learning of mathematics (L. S. Fuchs, Newman-Gonchar, et al., 2021). All students, including students with mathematics disability or difficulties, can benefit from increased attention to this research-validated practice. Students may have co-occurring difficulties with mathematics and language processing, which may be due to an underlying brain-based language disorder (i.e., developmental language disorder and/or dyslexia), but may also be due to difficulties with the language of instruction for emergent bilingual students (Arizmendi et al., 2021; King & Powell, 2023; Kong et al., 2023; Powell, Berry, et al., 2020).

Mathematics language is important for understanding and communicating about mathematics concepts and procedures (see eighth actionable recommendation of the NCTM/CEC position statement). It is also necessary for the understanding and solving of text-based mathematics problems (i.e., mathematics word problems; Stevens, Leroux, et al., 2024). The language of mathematics involves the numbers, symbols, words, and representations used to represent mathematics. One component of mathematics language–mathematics vocabulary–offers a fruitful focal point of instruction for teachers. Lin et al. (2021) determined that a significant relation between mathematics vocabulary and mathematics performance exists. Forsyth and Powell (2017) showed that students with mathematics difficulty exhibited lower mathematics vocabulary performance than students without such difficulty, while Lariviere et al. (2025) learned that students with mathematics disability or difficulties can improve vocabulary knowledge when provided with an intervention that focuses on mathematics vocabulary.

As described by Hughes et al. (2016) and Powell et al. (2019), teachers need to ensure students have many opportunities to learn and interact with formal mathematics vocabulary terms. Students also need to develop precise definitions for every vocabulary term. Patterson and Hicks (2020) suggested using vocabulary cards with students and introducing them using systematic, explicit instruction. They also engaged students in activities in which vocabulary terms were compared to examples and non-examples of the term. Stevens et al. (2023) determined use of a graphic organizer to explore vocabulary terms and their definitions, illustrations, related words and phrases, and applications across mathematics content led to improved mathematics vocabulary scores for students. Similarly, Lin and Powell (2023) observed improved mathematics vocabulary performance after students used game-based activities as well as a semantic map to become more familiar with mathematics vocabulary. G. Nelson and Kiss (2021) taught student-friendly definitions of vocabulary; encouraged students to use vocabulary in verbal communications with other students; tied vocabulary terms to equations, pictures, and concrete manipulatives; and asked students to add vocabulary to their own glossary; and these activities helped students improve their mathematics vocabulary scores. In conclusion, the research in this area shows many ways to support student learning of the language of mathematics.

3. Use multiple representations, including number lines. This is the one actionable recommendation we will repeat from the original position statement, but we will enhance it with the added focus on number lines. As described above, the research base for use of multiple representations is robust for students with mathematical disability or difficulties. As one such representation, number lines are versatile visual models shown effective in improving students' rational number understanding (L. S. Fuchs, Malone, et al., 2016; L. S. Fuchs et al., 2013; Zhang et al., 2017) and were identified as one of six instructional recommendations for teaching students with mathematics disability or difficulties in the most recent practice guide from the Institute of Education Sciences (L. S. Fuchs, Newman-Gonchar, et al., 2021). Students with mathematics disability or difficulties struggle with tasks involving numerical magnitude such as comparing and ordering whole numbers and fractions (Gersten et al., 2005). Number lines are effective instructional scaffolds because they provide a clear, continuous visual representation of numerical magnitude and relationships. Importantly, when teaching complex rational number topics, number lines enhance a more abstract conceptual understanding of operations that support student cognition across elementary through secondary mathematics curricula (Bailey et al., 2014; Siegler et al., 2010).

4. Develop fluency. As students develop an understanding of mathematics, it is also important for them to develop accuracy, efficiency, and flexibility with that understanding (L. S. Fuchs, Newman-Gonchar, et al., 2021; NCTM, 2023). As reflected in the cognitive stages of learning (Haring & Eaton, 1978), students acquire initial knowledge of specific mathematics content then move to develop fluency with that content. *Fluency* in mathematics is doing mathematics easily and accurately (Powell, Bouck, et al., 2023) and is important across mathematics domains. That is, it would be helpful for students to count objects easily and accurately, identify shapes easily and accurately, multiply fractions easily and accurately, calculate the area of a rectangle easily and accurately, place data into a line plot easily and accurately, and solve systems of equations easily and accurately. Often, conversations about fluency move directly to fact fluency; yet fluency–the ease and accuracy with mathematics–is crucial across all mathematics content.

Fluency develops through carefully designed productive practice opportunities, and it is widely recognized that repeated practice is important to cement learning (Codding et al., 2019; Schutte et al., 2015). Students with mathematics disability or difficulties need more practice opportunities than students without difficulties to develop fluency with the same content (Burns et al., 2015). Often, the students who need more practice actually engage in less practice, while the students who need less practice get more practice (Burns et al., 2015). We address practice in a forthcoming section, but, for now, we feel an actionable recommendation would be amiss if we did not spend a paragraph on mathematics fact fluency.

As described by Morano, Randolph, et al. (2020), mathematics fact fluency involves the quick, accurate retrieval of foundational facts. Note the focus on both accuracy and efficiency (i.e., quickness). In standards used in many states in the United States, the typical expectation is that students "fluently add and subtract within 20" and "know from memory all sums of two one-digit numbers" by the end of Grade 2 (p. 19, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). By the end of Grade 3, students should "fluently multiply and divide within 100" and "know from memory all products of two one-digit numbers" (p. 23, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Price et al. (2013) demonstrated that students with efficient recall of mathematics facts (as they described, "memory-based" p. 156) showed higher high-school mathematics scores. Therefore, mathematics fact fluency is an important component of conversations about mathematics instruction.

The literature about mathematics facts and students with mathematics disability or difficulty is quite robust. Researchers have determined that practice strategies like incremental rehearsal (Burns, 2005), cover-copy-compare (Poncy et al., 2010; Stocker & Kubina Jr., 2017), flash cards (Mann et al., 2012; Powell, Akther, et al., 2023), and technology-based practices (P. M. Nelson et al., 2013) can lead to improve fact performance for students with disability or difficulties. L. S. Fuchs, Newman-Gonchar, et al. (2021) suggested that one way to build fluency was through the embedding of timed activities into mathematics content instruction. Given that time is at a premium in all mathematics classrooms, timed activities provided at appropriate dose can be helpful for producing measurable effects (Codding, Burns, et al., 2011; Duhon et al., 2022; Poncy & Skinner, 2011; Powell, Akther, et al., 2023). Guidance for how much instruction is needed to effectively increase student fact fluency is critical with research supporting efficient learning gains with less than 10 minutes of daily instruction (Duhon et al., 2022). Another way to enhance short-duration, high-intensity practice activities is to distribute practice across the day and/or week (Codding et al., 2016; Powell, Akther, et al., 2023; Schutte et al., 2015).

Another critical piece supported in the literature that has repeatedly been shown to increase learning outcomes is the incorporation of components such as goal setting, self-graphing, and rewards to increase the learning rates of fluency. Fluency practice should not happen in a vacuum and teachers should help students be aware of their performance, set goals to improve performance, and provide meaningful feedback linking effort to improved learning outcomes.

5. Develop word-problem solving. One channel in which students demonstrate their mathematics knowledge is through application on text-based problems, often referred to as word-problem solving. A number of systematic reviews have demonstrated that students with mathematics disability or difficulty benefit from targeted word-problem support (Shin et al., 2021; Zhang & Xin, 2012; Zheng et al., 2013), particularly with a focus on the schemas of word problems (S. C. Cook et al., 2020; Jitendra et al., 2016; Kong et al., 2021; Lein et al., 2020; Myers et al., 2022; Peltier & Vannest, 2017; Root, Ingelin, et al., 2021; Root, Jimenez, et al., 2020).

Across the studies included in the word-problem reviews, authors regularly included elements of systematic, explicit instruction to help students learn how to interpret and solve word problems (e.g., L. S. Fuchs, Seethaler, et al., 2021). In addition to systematic, explicit instruction, effective methods for supporting word-problem solving for students with mathematics disability or difficulties included meta-cognitive strategies, schema instruction, mathematics vocabulary supports, and multiple representations (Myers et al., 2024; Myers et al., 2022; Peltier & Vannest, 2017; Stevens, Tanner, et al., 2024). Through meta-cognitive strategies, a method to support self-regulation during the problem-solving process, students are taught to read, plan, solve, and check their problem solving. In schema instruction, students are taught to classify problems by common word-problem types (Montague, 2008; Peltier & Vannest, 2017). In many studies, an explicit focus on mathematics vocabulary essential to interpreting word problems is incorporated within the word-problem instruction (Stevens et al., 2023).

Finally, researchers regularly include representations (e.g., graphic organizers, concrete manipulatives) to support students in connecting the word problem's text to conceptual and procedural knowledge (Myers et al., 2024). Students use graphic organizers to support the comprehension of text-based problems by organizing essential information into the visual display (Ives & Hoy, 2003; Jitendra et al., 2017; Root, Ingelin, et al., 2021). For concrete or virtual manipulatives, students may use manipulatives (e.g., counters) on top of the actual graphic organizers (i.e., within ten frames to compare two amounts; Browder et al., 2018) or separately to model concepts represented in the text-based problems (e.g., multiple sets of the same quantity; Root, Cox, et al., 2021).

Frequently, researchers recommend teachers combine multiple strategies to best support students with mathematics disability and difficulties in word-problem solving (L. S. Fuchs, Newman-Gonchar, et al., 2021; Powell, Akther, et al., 2023; Powell & Fuchs, 2018). For instance, meta-cognitive strategies effectively pair with schema instruction and representations. In the strategy FOPS, students Find the problem type (schema), Organize the information in the problem using a graphic organizer, Plan to solve the problem, and Solve the problem (Alghamdi et al., 2020). Similarly, systematic, explicit instruction on word-problem vocabulary (e.g., more, fewer, than) can be effectively and efficiently paired with a meta-cognitive strategy and schema instruction (L. S. Fuchs, Seethaler, et al., 2021). The goal in combining such strategies is to not only support students' word-problem solving outcomes, but also to generalize to real life situations (Powell, Berry, et al., 2021; Root, Cox, et al., 2020). Therefore, an important final component of word-problem solving instruction is to connect word problems to real-life examples.

6. Provide response opportunities, feedback, and practice. Although we described response opportunities, feedback, and practice in the sections on systematic, explicit instruction and fluency (see above), these ways to engage in mathematics learning are so important and have such a robust research base that we wanted to include a separate section about them. The research base on opportunities to respond (OTR) has a long history and has, over time, shown that providing students with many response opportunities with feedback positively impacts learning outcomes in both academics, including mathematics, and behavior (e.g., Carnine, 1976; Codding et al., 2019; Common et al., 2020; Dawes et al., 2024; MacSuga-Gage & Simonsen, 2015; Skinner et al., 1997; Sutherland & Wehby, 2001; Van Camp et al., 2020). OTR can be described as learning tasks that require student responses followed by timely positive and corrective feedback (MacSuga-Gage & Simonsen, 2015; Van Camp et al., 2020). Unfortunately, some mathematics teachers appear not to provide appropriate levels of OTR for students (Whitney et al., 2015), suggesting teachers need to better understand how to effectively provide their students with OTR. An important aspect of providing students with many OTR is that response opportunities can occur across the systematic, explicit instructional cycle, not only during independent, student practice or homework time. Teachers can provide increased OTR during whole-group instruction, small-group instruction, or guided practice, which increases opportunities for timely feedback. Recent research suggests that OTR also has promise for being an effective practice when intensifying instruction within MTSS (Van Camp et al., 2020).

As students learn more and more mathematics content, it is important they engage in effective practice to become proficient (i.e., fluent) with such content. *Blocked* practice is practice on one type of mathematics content within a single session, whereas *interleaved* practice is practice on multiple types of mathematics content within the same session. Interleaved practice helps students learn when to apply specific strategies to solve a problem. *Distributed* or *spaced* practice occurs over multiple sessions, as students practice previously learned content and move from acquiring knowledge to developing fluency with that knowledge (Haring & Eaton, 1978).

Interleaved and distributive practice are research-validated student practice strategies that have been shown to increase academic outcomes for students with mathematics disability or difficulties (e.g., Brunmair & Richter, 2019; Doabler et al., 2012; Dunlosky et al., 2013; Foster et al., 2019; L. S. Fuchs et al., 2023; Jordan et al., 2024; Nazari & Ebersbach, 2019; Rohrer et al., 2015; Rohrer et al., 2020; Schutte et al., 2015). For example, Rohrer et al. (2015) and Rohrer et al. (2020) determined that interleaved practice resulted in higher scores on mathematics measures for middle-school students compared to blocked practice. Schutte et al. (2015) learned that distributive practice resulted in higher fluency rates with mathematics facts compared to blocked practice. Foster et al. (2019) showed that interleaved practice that was distributed across time resulted in improved geometry outcomes compared to blocked practice. Despite the effectiveness of interleaving practice, Dedrick et al. (2016) noted in their analysis of mathematics textbooks frequently used in the United States that most of the practice problems (78%) were blocked, only 11% were interleaved, and the remaining could not be identified suggesting students are not receiving practice opportunities that result in greater mathematics outcomes. Other studies have revealed similar findings (e.g., Doabler et al., 2012), suggesting that students are not benefiting from more effective interleaved practice opportunities compared to blocked practice.

7. Collect data and adapt instruction. As described above, the practice of consistently collecting student data and then responding to that data via adaptations to instruction is a hallmark of special education. Often, this cycle of data collection and response can be filtered through a data-based decision making (DBDM) framework (see earlier section on preventative models), which has evidence to support its use (Jung et al., 2018). DBDM or DBI is a framework for teachers to provide instructional support and make any necessary changes to instruction for students based on ongoing assessments (Powell, Lembke, et al., 2021).

Accurate assessment of targeted skills is important to identify the student's needs. Additionally, specific considerations should be made to provide linguistically appropriate assessments with regard to emergent bilingual students (Kong et al., 2023). That is, mathematics assessments conducted in the student's primary language, in addition to language of instruction, could provide a more accurate representation of the student's mathematical understanding. These testing practices provide insight into whether there is an underlying difficulty with understanding mathematical concepts and procedures, or if difficulties are due to limited proficiency in the language of instruction in mathematics.

Diagnosis and remediation of errors is also an important part of the process of ensuring high-quality instruction. Ongoing progress monitoring should include formative assessment, at least weekly, to identify error patterns in student responses. This can lead to more individualized instruction that better meets the needs of the students (Dueker & Grande, 2024). All considered, DBDM or DBI is a helpful framework in which teachers can integrate a variety of research validated instructional practices, many of which are mentioned above, and it allows teachers to individualize the instructional decision making for an individual student–which is essential for students with mathematics disability or difficulties.

CONCLUSION

Although many of us were initially excited by the idea of the position statement between these two professional organizations, we ultimately found the final product disappointing. The current position statement did not rely on the robust research base in the area of mathematics disability and difficulties, nor did it add to the existing documentation about mathematics from national organizations and standards.

We believe that NCTM and CEC should revise this position statement on the teaching of mathematics to students with mathematics disability and difficulties to incorporate empirically validated research from mathematics education, special education, teacher education, and cognitive science on the learning of students with mathematics disability or difficulties. In the absence of such a revision, we would suggest for the NCTM and CEC to remove the position statement from their respective websites and issue a statement as to why it was removed and how they plan to revise the statement based on research. Given that position statements often form the impetus for pre-service teacher coursework and in-service professional development, we believe it would be educational malpractice to continue to publish the position statement in its current form. If NCTM and CEC do not revise the position statement, we hope that this paper—along with other papers based on empirical research and the many, rich reviews (i.e., syntheses, meta-analyses, and practice guides)—will be relied upon to inform the instructional practices in mathematics for all of those responsible for the education of students with mathematics disability or difficulties.

COMPETING INTERESTS

The authors have no competing interests to declare.

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