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Middle School Math Teachers' Perceptions of Their Classroom Practices Among Students with Disabilities Before and During the Pandemic: A Pilot Study

JONTÉ A. MYERS
Georgia State University
jmyers45@gsyu.edu

BRADLEY S. WITZEL
Western Carolina University
bwitzel@email.wcu.edu

EMILY C. BOUCK
Michigan State University
ecb@msu.edu

JASMINE N. MATHIS
Georgia State University
jmathis18@student.gsu.edu

In this study, the authors examined middle school mathematics teachers' perceptions of their instructional practices with students with disabilities (SWDs) during face-to-face instruction before the COVID-19 pandemic and eLearning during the pandemic. A survey explored teachers' use of research-supported practices and the challenges and supports that influenced teachers' instructional practice. Results showed teachers' reported classroom practices remained relatively consistent across both instructional modalities. Teachers also reported difficulties in providing accommodations and using small group instruction during eLearning. They noted barriers to eLearning related to student engagement and instructional planning and delivery. Finally, the study's findings, limitations, and implications for future research and pre-and in-service preparation are discussed.

Keywords: mathematics instruction, research-supported practices, middle school, students with disabilities, eLearning

MIDDLE SCHOOL MATH TEACHERS' PERCEPTIONS OF THEIR CLASSROOM PRACTICES AMONG STUDENTS WITH DISABILITIES BEFORE AND DURING THE PANDEMIC: A PILOT STUDY

It is well-documented that many students across the U.S. underachieve in mathematics proficiency, and students with disabilities (SWDs) perform comparatively worse than their peers without disabilities. In 2019, only 45% of 4th-grade students without disabilities and 17% of SWDs scored at or above proficiency on the National Assessment of Education Performance (NAEP) math assessments (National Center for Education Statistics [NCES], 2020). While these elementary math scores are low, relative performance declines for secondary-aged students (i.e., Grades 6 to 12). From the NAEP data, only 38% of 8th-graders without disabilities and 9% with disabilities scored at or above the proficient level in math. While multiple factors contribute to the chronic low performance of students, evidence suggests ineffective mathematics instruction impacts students' learning early (Cook et al., 2016) and often leads to gaps in performance in secondary mathematics (Witzel, 2016). Students require effective and consistent instruction with research-supported practices to succeed in mathematics (Fuchs et al., 2014).

Research Supported Mathematics Practices for SWDs

Over the years, researchers have conducted several meta-analyses (e.g., Myers et al., 2021) and narrative reviews (e.g., Marita & Hord, 2017) of individual studies on mathematics interventions for secondary SWDs, particularly those with math learning disabilities (MLD). Authors of these studies concluded that students' math scores increased when provided with cognitive-based approaches (e.g., think-alouds and self-questioning) and strategies that help students identify underlying structures of problems, such as schema-based instruction (SBI). Further, evidence also supports the systematic use of visual representations, such as concrete-representational-abstract (CRA) instruction (Bouck et al., 2018) as well as pictorial representations (Jitendra et al., 2016) and technology-based approaches, such as enhanced anchored instruction (EAI; Bottge et al., 2018) for increasing student achievement.

Researchers consistently find explicit instruction embedded within research-supported mathematics practices for SWDs, including some of the aforementioned interventions (e.g., Marita & Hord, 2017). Explicit instruction is a systematic, direct approach to teaching that emphasizes a sequential progression in instruction (Gersten et al., 2009). In using explicit instruction, the teachers use advance organizers, task analyze a stepwise approach to content, model the approach, scaffold students' use of the approach

through highly interactive guided practice with feedback, then provide multiple opportunities for students to practice the approach (Doabler & Fien, 2013).

To be successful in mathematics, SWDs also often require additional support in the form of assistive technology (AT; Bouck et al., 2020), accommodations (Wickstrom et al., 2020), and small group instruction (Fuchs et al., 2014). These supports are essential for removing barriers to students' learning, facilitating access to the curricula, and increasing student progress towards their academic goals (Perelmutter et al., 2017). For example, math teachers can use virtual manipulatives, an AT, to help SWDs acquire and maintain computational skills, such as division (Bouck et al., 2020), and for learning more advanced math concepts, such as algebra (Bone et al., 2021). Teachers must also provide SWDs with required accommodations, typically outlined in their individualized education program (IEP), to increase students' access to the curriculum and ensure their learning is accurately assessed (Rice et al., 2019; Wickstrom et al., 2020). Further, small group instruction allows teachers to modify instruction to meet the individual learning needs of students needing intensive intervention, such as SWDs (Fuchs et al., 2014).

Online Teaching for Students with Disabilities

Despite attention in research to the use of technology, tools, and online applications (e.g., Kabel et al., 2021), limited research examines United States teachers' online mathematics instruction for secondary SWDs, which became essential during COVID-19. However, research exists internationally, for students without disabilities, and for content besides—or more general—than mathematics. Feng et al. (2021) compared the effect of online teaching during the pandemic and pre-pandemic traditional instruction in China, but SWDs were not explicitly included, nor were their results shared. The findings indicated secondary students' mathematics achievement was significantly higher pre-pandemic than during the pandemic, and students in rural areas scored lower than their urban peers. In a case study, Aslan et al. (2021) investigated the views of 18 Turkish teachers about the suitability of the middle school curriculum for eLearning during the pandemic. Teachers indicated a preference for direct instruction techniques during online instruction as they found it difficult to adapt other instructional approaches to eLearning. They also expressed concerns about student attendance and their lack of interest during instruction. The teachers also experienced difficulties in using reliable and valid tools to assess students learning. However, Aslan et al. (2021) did not explicitly discuss the impact of eLearning on SWDs.

Research focusing on online education for SWDs in the US mainly presents results more broadly, with a limited focus on mathematics. The body of literature mainly focuses on issues such as accessibility, accommodations, and teacher instruction. Only one study focused specifically on mathematics. Lambert and Schuck (2021) conducted a case study to examine the experiences of a special education teacher in teaching standard-based mathematics before and during remote instruction during the COVID 19 pandemic. They found that pre-pandemic the teacher provided SWDs with daily opportunities to solve challenging mathematical problems and taught self-regulation strategies to build students' meta-cognitive skills. In comparison, during remote instruction, the teacher faced challenges in supporting students in performing these same tasks. However, some scholars, such as Stella and Correy (2017) argued SWDs might be uniquely situated for online learning as it may highlight students' strengths and provide greater resources (e.g., more AT, Universal Design for Learning [UDL]).

On the contrary, other researchers of online instruction found teachers of SWDs face challenges in providing them with quality access to instruction. In a survey study of special education directors across 46 state and non-state jurisdictions, Burdette et al. (2013) found some schools were ill-prepared to provide online instruction to SWDs. The authors also reported several barriers to these students' access to online instruction, including inadequate funding, communication, support staff, and curriculum revision. Further, Ciampa (2017) studied the experiences of three special education teachers who received professional development (PD) around infusing technology in their content literacy instruction. Findings showed the teachers felt PD activities, such as modeling, engaging in one-on-one and collaborative planning, and receiving technical support, helped increase their ability to plan and infuse technology into their content literacy instruction. Rice (2018) highlighted three main approaches that instructional designers believed increased accessibility in online math courses: (1) composing clear learning objectives, (2) promoting individualized and contextualized learning, and (3) including visual and audio representations of concepts. However, the courses did not adequately address the literacy of SWDs in online learning.

Two studies focused primarily on accommodations for SWDs within online learning environments; researchers reported that teachers face challenges in providing students with necessary accommodations. In a survey study on teacher preparation for virtual instruction for SWDs, Smith et al. (2016) found that although teachers were generally keen to provide SWDs with suitable accommodations and use technology to increase their access to instruction, they felt inadequately prepared to do so. Teachers also thought they were ill-prepared in critical areas of online teaching for SWDs, such as instructional design, curriculum design, and assessment. Rice et al.

(2019) conducted a case study examining how a foster parent of a middle-grade SWD who participated fully in online learning perceived the school's response to the student's individual needs. The parent felt the school did not provide the quality of education the student was entitled to under the Individuals with Disabilities Education Act (IDEA).

Two more recent studies (Catalano et al., 2021; Jenkins & Walker, 2021) noted teachers' challenges in providing online instruction for SWDs. Catalano et al. (2021) examined teacher perceptions of students' access and participation in online learning during the pandemic. Using data from 300 K-12 teachers in NY State, they found SWDs enrolled in high needs districts were less likely to complete their assignments than their peers in low needs districts, with middle-grade SWDs being among the least compliant. The authors cited a lack of comprehension and motivation as contributing factors. Further, teachers were more concerned about the educational outcomes of SWDs than those without disabilities during the pandemic. In the second study, Jenkins & Walker (2021) surveyed 142 stakeholders in Virginia to evaluate the effectiveness of instructional delivery and procedural compliance related to students' IEP. The schools were generally rated as effective in addressing the procedural components of students' IEP but less effective with providing students with specialized instruction.

Current Study

To deliver effective instruction that leads to increased mathematics achievement among adolescents with disabilities, secondary mathematics teachers must use instructional practices supported by research (Myers et al., 2021). This premise is equally true for virtual instruction, particularly for SWDs (Cavanaugh et al., 2013). Given the unique learning needs of SWDs and the critical role effective teaching plays in their mathematics achievement (Fuchs et al., 2014), however, teachers of SWDs require support and training in effective online education (Darling-Hammond et al., 2020). An important first step in preparing mathematics teachers to use research-supported mathematics practices for SWDs during eLearning efficiently is to understand how the transition to virtual instruction during the pandemic impacted their use of these practices. Further, knowledge of the challenges teachers faced and supports they needed during eLearning is critical to preparing them to deliver virtual instruction that meets SWDs' math learning needs in the future.

The primary purpose of this study was to examine middle school mathematics teachers' perceptions on how the COVID-19 pandemic impacted their use of research-supported mathematics instructional practices for SWDs. It also examined instructional challenges teachers faced as they

shifted from traditional face-to-face instruction to eLearning during the pandemic. Finally, its goal was to identify the administrative and technical supports teachers needed in delivering eLearning mathematics instruction during the pandemic. As such, the following four research questions guided the current study: (a) Were there changes in middle school mathematics teachers' use of research-supported mathematics instructional practices for SWDs before and during the pandemic?, (b) Were there changes in teachers' classroom practices as it relates to providing suitable accommodations, AT, and other instructional supports for SWDs before and during the pandemic?, (c) What instructional challenges did teachers face as they moved from face-to-face to eLearning during the pandemic?, and (d) What administrative and technical supports did teacher require during eLearning instruction the pandemic?

METHOD

Setting

The study used a convenient sample of middle-grade mathematics teachers in a small urban school district located in the Southeastern region of the United States. The school district had a little over 60 schools serving a diverse population of over 50,000 students. During the 2019-2020 school year, students from ethnic minority groups (i.e., Blacks or Hispanic) made up 91% of the student body, with Black being the majority (69%). The remaining students included 10% White, 5% Asian, and 3% two or more races or other races alone. About 10% of students were English Language Learners, and 4% were SWDs. Almost all (99%) students came from low-income families. The median household income was about $49,000, about $20,000 below the national median income level in 2019. Middle grade students were enrolled in about one-third of the schools in the district and constituted a little under 30% of the total enrollment.

Participants

The study targeted full-time middle school mathematics teachers (N = 250) employed in the district during the 2019-2020 school year. Most (78%) had at least 3 years of experience, and the majority were full-time certified teachers (91%). This study focused on middle school teachers (i.e., assigned to sixth, seventh, or eighth grade to some extent) who taught at least one student with an identified disability, including general education teachers, special education teachers, and those that held dual certification (i.e., general and special education). Of the 250 teachers targeted for participation, 139

responded to the survey. However, of these respondents, only 79 consented and completed the survey. Of the 79, 85% (n = 67) indicated they taught SWDs as defined by students with an IEP or 504 plan. Of the teachers that taught SWDs, 53 were assigned to middle school classrooms. Therefore, a total of 53 participants were included in the final sample.

Of the 53 eligible participants, 71.7% identified as Female, 22.6% as Male, and 5.7% preferred not to say. Over three-fourths of respondents identified as Black (81.1%). The other respondents identified as White (3.8%), Asian (1.9%), and Other or preferred not to say (13.2%). A little over one-third of participating teachers earned their teaching credentials through an alternative route (34%; e.g., Teach for America) and about 60% (58.5%) through a traditional teacher preparation program. The others indicated Other or preferred not to say. Almost half of the responding teachers held a master's or specialist degree (47.2%), over one-third had a bachelor's (37.7%). The remaining participants indicated they held a doctoral degree (11.3%) or did not state their educational level (3.8%). Four-fifths of the responding teachers were certified in mathematics (81.1%); about one-tenth indicated they did not hold mathematics certification or chose not to answer the question. Most of the teachers were general education teachers (73.6%), followed by special education (11.3%), and then both general education and special education (5.7%). The remaining teachers indicated Other. Most of the respondents (86.8%) had received prior training in delivering virtual mathematics instruction in K-12. Further, 86.8% had experience using a virtual learning environment to provide mathematics instruction pre-pandemic, and about 88.7% had received training on the specific eLearning platform used by their school during the pandemic. Finally, almost 100% had used an eLearning platform to assess student learning before the pandemic.

Study Design & Procedures

The study used a non-experimental survey research design, including quantitative and qualitative data collected through an online survey. In survey research, researchers collect, analyze, and synthesize qualitative and quantitative data to draw inferences (Creswell & Clark, 2017). Survey designs are practical when researchers are interested in examining trends in quantitative data and using qualitative data to understand any observed trends (Creswell & Clark, 2017).

Instrument & Instrument Development

An online survey with a combination of Likert-type, binary, and open-ended responses was used to collect data for the current study. The authors developed the survey using established guidelines (Dillman et al., 2014)

to ensure its validity and reliability. In the first two phases, the instrument format was determined, and two authors created an initial pool of potential items. Next, one of the authors, an expert in secondary mathematics instruction, evaluated the items to improve the survey's content validity. The items were revised based on the content expert's feedback, and we created an initial draft of the survey. The initial draft survey underwent another round of extensive review by consultants in the field of survey development. These experts ensured the instrument matched its purpose and reviewed the items to ensure the survey's clarity and appropriateness. Based on the consultants' feedback, the authors reviewed several items and made improvements to the instrument. The survey went through multiple iterations as the authors worked with the consultants to refine the items and format. Next, the survey was piloted with 10 math teachers who worked in the targeted school district to complete it online; the data from these 10 teachers was excluded from the analysis. The 10 teachers' feedback was used to create the final version of the survey.

The final survey included both open-ended qualitative and closed-ended quantitative items. It began with three open-ended items that required unconfined responses. These qualitative items required teachers to outline the instructional challenges they faced, supports they received, and features they would include in a customized instructional math software, respectively. Next, participants were required to complete a set of questions comprising 10 binary items (i.e., yes/no) addressing their training and experience before and during the COVID-19 pandemic. Participants were asked about their pre-service (i.e., teacher preparation) and in-service (i.e., PD) training in implementing eLearning mathematics instruction prior to COVID-19. For example, *"Prior to COVID 19, I took at least one course that prepared me to deliver math instruction in K-12 eLearning environments."* They also responded to items on their use of technology (e.g., Smartboard) and eLearning platforms for teaching and assessing students' learning.

The binary questions were followed with a series of seven-point nominal Likert items that used two distinct sets of responses. The first set of Likert items required participants to rate their frequency of research-supported instructional practices before the pandemic and during the pandemic (i.e., *Much More Frequently During eLearning Instruction (1), More Frequently During eLearning Instruction (2), A Little More Frequently During eLearning (3), About the Same for Both Forms of Instruction (4), A Little More Frequently During Face-To-Face instruction (5), More Frequently During Face-To-Face Instruction (6) or Much More Frequently During Face-To-Face Instruction (7))*. These items assessed whether there were changes in teachers' mathematic instructional practices and behaviors, such as planning for instruction, providing corrective feedback, modeling mathemati-

cal tasks, and assessing students' prior knowledge. Items also measured the extent to which teachers were able to give students reasonable accommodations and small group instruction. Participants also responded to statements addressing their accessibility to essential services, supports, and resources for assisting SWDs, such as AT, parental support, and instructional technology. For example, *"I received assistive technologies to support the learning of SWDs."*

The second set of Likert items required participants to rate their level of agreement or disagreement with statements related to the eLearning platform they used to provide instruction for students during the pandemic. (i.e., *Strongly Disagree, Disagree, Somewhat Disagree, Neutral, Somewhat Agree, Agree, or Strongly Agree*). Participants answered items related to the instructional resources they needed and the suitability of the eLearning platforms they used for supporting students' learning and assessing their academic performance. For example, *The eLearning platform I used for math instruction was suitably designed to meet students.' individual instructional needs.* Items also focused on the level of support teachers received from administration and instructional support staff (e.g., coaches and learning specialists). The survey was concluded with a combination of open-ended and close-ended items addressing teachers' demographics and professional characteristics. Participants provided data on their professional background, such as teaching experience, degree area (i.e., math or math related), and certification status during the 2019 school year. Further, they provided information on their gender and racial/ethnic identity.

For the purposes of this article, the authors focused on participants' responses to the open-ended questions on the challenges they faced and supports they received, binary questions on the pre-service and in-service preparation for delivering online math instruction, and the Likert items addressing teachers' use of research-supported practices. These items were targeted due to a desire to research teachers' use of research-supported instructional practices for supporting SWDs in mathematics from face-to-face instruction before the pandemic and eLearning during the pandemic and the challenges faced and supports teachers needed during eLearning. The items addressing teachers' demographic and professional backgrounds were also included to describe the characteristics of research participants.

Data Collection and Analysis

The survey was distributed via a secure anonymous link using Qualtrics® survey software. The school district's Division of School Leadership and Improvement office distributed the survey. First, a representative sent an introductory email to middle school mathematics teachers announcing the upcoming survey. Prospective participants were informed that they were

voluntarily consenting to participate in a research study. In July, they were sent a link to the survey at the end of mandatory PD activity for mathematics teachers throughout the school district. The survey took about 15 minutes to complete and participants, who choose to, were provided with a $10 gift card for completing the survey. Five email reminders were sent during the 8-week study period from July to September 2020 to increase the response rate. One author removed identifying information from the data set before analyses were performed. The only identifying information collected was the email addressed for respondents who opted to receive the gift card. De-identified data was analyzed using IBM® SPSS® Statistics 26.0 (2019) and Microsoft Excel.

For the quantitative data, descriptive statistics, including frequency distribution tables and percentages were used to summarize the data. For questions in which responses were 1-7, ranging from more during eLearning to more during face-to-face, researchers combined responses. Specifically, responses to much more frequently during eLearning instruction and more frequently during eLearning instruction were combined (i.e., more during eLearning); a little more frequently during eLearning, about the same for both forms of instruction, and a little more frequently during face-to-face instruction were combined (i.e., about the same); and more frequently during face-to-face instruction and much more frequently during face-to-face instruction were combined (i.e., more during face-to-face).

For the qualitative items, a systematic process was used to code relevant themes emerging from participants' responses to the open-ended items (Busetto et al., 2020). First, two researchers reviewed the responses to identify potential themes for further exploration for each of the open-ended items. A coding protocol was developed for each of the items based on identified themes. After finalizing the protocol, two researchers independently coded all the responses by theme for each question, resulting in double-coded responses. In instances where responses included multiple themes, items were coded to reflect each (Ames et al., 2005). To assess consistency and reliability in our coding, we calculated interrater reliability (IRR) in our coding procedures. To be counted as an agreement, both researchers had to code the response under the correct theme(s) addressed. The IRR was calculated as the number of agreements divided by the total number of agreements plus disagreements times 100. An IRR of 89.6% was obtained and the coders resolved discrepancies in coding through a consensus meeting. Following completion of the qualitative coding, the data was summarized using descriptive statistics. The qualitative data was used to support or reject conclusions drawn from the quantitative data or elaborate on the quantitative findings (Busetto et al., 2020).

RESULTS

Use of Research-Supported Instructional Practices

In terms of the research-supported practices for SWDs, most respondents indicated these practices occurred about the same during eLearning as face-to-face learning: stimulated prior knowledge, provided corrective feedback, modeled mathematical instruction, provided guided practices opportunities, provided independent practice, taught strategies, and used visual aids (see Table 1). Across each of these seven areas, the next most frequent response was more during face-to-face. Across the different groups (e.g., middle school math teachers with and without prior training or courses related to eLearning and general education vs. special education teachers), the most frequent response was about the same. However, for special education teachers (n = 6), about the same was 50% for a few categories.

Accommodations and Assistive Technologies (AT)

Across the seven categories addressing instructional support and AT for SWDs (see Table 2), most respondents indicated they needed about the same with eLearning and face-to-face learning. The lowest percentage (e.g., 67.9%) for about the same occurred for difficulty in providing reasonable accommodations, of which 28.3% said it was more during eLearning, and provided small group instruction, of which 28.3% said it occurred more during face-to-face learning. Similar patterns were found when the middle school teachers were subdivided into those who had prior training or courses related to eLearning (n = 46) as well as were general education teachers (n = 39). Special education teachers also reported the lowest frequency for about the same for difficulty in providing reasonable accommodations but not for providing small group instruction (100% the same). Rather, about one-third of special education teachers indicated they received more assistance from parents for SWDs during eLearning (two-thirds the same). For other groups, there was generally a balance between more during eLearning or more during face-to-face, slightly favoring face-to-face.

Table 1
Frequencies of Responses Involving Research-Supported Practices Associated with Educating Students with Disabilities

	Stimulated prior knowledge	Provided corrective feedback	Modeled mathematical instruction	Provided guided practice opportunities	Provided independent practice	Taught strategies	Used visual aids
All Teacher Respondents (and all middle school teachers who educated students with disabilities) [N=53]							
More during eLearning	11.3%	11.3%	7.5%	5.7%	9.4%	9.4%	7.5%
About the same	60.4%	67.9%	66.1%	60.4%	71.7%	69.8%	71.7%
More during F2F	28.3%	20.8%	26.4%	34%	18.9%	20.8%	20.8%
Teacher Respondents Who Indicated Prior Training or Courses Related to eLearning [N=46]							
More during eLearning	10.9%	13%	8.7%	6.5%	8.7%	8.7%	8.7%
About the same	58.7%	65.2%	63%	56.5%	71.7%	69.6%	69.6%
More during F2F	30.4%	21.7%	28.3%	37%	19.6%	21.7%	21.7%
Teacher Respondents Who Indicated No Prior Training or Courses Related to eLearning [N=7]							
More during eLearning	14.3%	0%	0%	0%	14.3%	14.3%	0%
About the same	71.4%	85.7%	85.7%	85.7%	71.4%	71.4%	85.7%
More during F2F	14.3%	14.3%	14.3%	14.3%	14.3%	14.3%	14.3%
Teacher Respondents Who Indicated They were General Education Teachers [N=39]							
More during eLearning	7.7%	10.3%	7.7%	2.6%	10.3%	10.3%	7.7%
About the same	56.4%	69.2%	66.7%	61.5%	71.8%	69.2%	71.8%
More during F2F	35.9%	20.5%	25.3%	35.9%	17.9%	20.5%	20.5%
Teacher Respondents Who Indicated They were Special Education Teachers [N=6]							
More during eLearning	50%	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%
About the same	50%	83.3%	66.7%	50%	50%	50%	66.7%
More during F2F	0%	0%	16.7%	33.3%	33.3%	33.3%	16.7%
Teacher Respondents Who Indicated They were General Education & Special Education Teachers [N=3]							
More during eLearning	0%	33.3%	0%	33.3%	0%	0%	0%
About the same	100%	66.7%	66.7%	66.7%	100%	100%	100%
More during F2F	0%	0%	33.3%	0%	0%	0%	0%

Note: Other from teacher roles not included

Table 2
Frequencies of Responses Involving Educating Students with Disabilities

	Difficulty providing reasonable accommodations	Needed AT for SWDs	Received AT for SWDs	Needed IT for SWDs	Provided small group instruction to SWDs	Received assistance from parents for SWDs	SWDs sought assistance
All Teacher Respondents (and all middle school teachers who educated students with disabilities) [N=53]							
More during eLearning	28.3%	5.8%	1.9%	7.5%	3.8%	9.4%	3.8%
About the same	67.9%	86.5%	84.9%	84.9%	67.9%	79.2%	77.4%
More during F2F	3.8%	7.7%	13.2%	7.5%	28.3%	11.3%	18.9%
Teacher Respondents Who Indicated Prior Training or Courses Related to eLearning [N=46]							
More during eLearning	28.3%	6.7%	2.2%	8.7%	4.3%	10.9%	4.3%
About the same	67.4%	84.4%	82.6%	82.6%	67.4%	76.1%	82.6%
More during F2F	4.3%	8.9%	15.2%	8.7%	28.3%	13%	17.4%
Teacher Respondents Who Indicated No Prior Training or Courses Related to eLearning [N=7]							
More during eLearning	28.6%	0%	0%	0%	0%	0%	0%
About the same	71.4%	100%	100%	100%	71.4%	100%	71.4%
More during F2F	0%	0%	0%	0%	28.6%	0%	28.6%
Teacher Respondents Who Indicated They were General Education Teachers [N=39]							
More during eLearning	25.6%	5.3%	2.6%	10.3%	2.6%	5.1%	2.6%
About the same	71.8%	89.5%	89.7%	84.6%	69.2%	84.6%	82.1%
More during F2F	2.6%	5.3%	7.7%	5.1%	28.2%	10.3%	15.4%
Teacher Respondents Who Indicated They were Special Education Teachers [N=6]							
More during eLearning	33.3%	0%	0%	0%	0%	33.3%	0%
About the same	66.7%	100%	83.3%	100%	100%	66.7%	100%
More during F2F	0%	0%	16.7%	0%	0%	0%	0%
Teacher Respondents Who Indicated They were General Education & Special Education Teachers [N=3]							
More during eLearning	0%	0%	0%	0%	0%	0%	0%
About the same	100%	100%	66.7%	66.7%	66.7%	66.7%	33.3%
More during F2F	0%	0%	33.3%	33.3%	33.3%	33.3%	66.7%

Note: Note, one respondent did not answer needed AT (GE teacher). Other from teacher roles not included.

Challenges Faced in Transitioning to eLearning

Of the 53 respondents, most (n = 48; 92%) indicated they faced challenges in transitioning from face-to-face to eLearning. Among the 48 respondents, the following five themes emerged from their responses: (a) student engagement and participation (90%); (b) instructional planning and delivery (88%); (c) assessment of student learning (36%); (d) technological issues (student; 62%); and (e) technological issues (teachers; 60%). In terms of student engagement and participation, they principally lamented the lack of resources and student training in eLearning. One stated, "Locating digital manipulatives that were engaging to hold students' attention." Another reported, "Getting students to lead a class discussion was difficult as well because they were not technologically savvy enough to use certain platforms."

Respondents faced challenges in two categories related to instruction, including planning and delivery and assessment. For instructional planning and delivery, the challenges centered mainly on providing explicit and individualized instruction. One respondent wrote, "Planning for learning online was difficult for me because some lessons required manipulatives which students did not have access to." One participant stated, "Independent practice was challenging due to the fact that working with a student or students who need assistance was rather cumbersome." Another participant, a special education teacher, cited their inability to individualize instruction for SWDs as an overwhelming challenge, "Being able to work hands-on with students who really need additional support." And another noted, "Guided math is difficult. I can't see what students are writing on their paper or assignment while they work on it. I would like to know ways to implement tasks virtually to differentiate instruction" Likewise, respondents faced issues related to student assessment, mainly in the areas of test administration and assignment completion and submission. One wrote, "It was also more difficult to monitor them when it came to administering and proctoring assessments." At the same time, another stated, "Some students did not have the technology to submit copies of their completed assignments into Google Classroom."

Evidence also suggested both teachers and students faced several technical issues as they transitioned to eLearning. For teachers, these issues centered primarily on a lack of knowledge on using the tech platform. One respondent shared, "I need more training with technology formats such as Zoom and other computer programs to enhance instruction," while one of her colleagues stated, "I did not know how to use Google Classroom. I did not have time to do adequate research and PD to learn these things before we went online with students." The technological issues students faced were related to lack of computer and internet access. One respondent commented that, "the majority of my students did not have devices or internet to receive

virtual instruction." Another said, "Not all students had adequate equipment and Wi-Fi to attend sessions," while another wrote, "It was difficult to reach all of the students because some of them did not have computers and/or internet service. Some of them did not attempt to do any work."

Administrative and Technical Supports Needed for eLearning

Less than one-half (n = 21) of the respondents indicated they needed administrative, technical, or other support to deliver eLearning mathematics instruction. We identified two main categories of supports among these respondents: (a) technological (41%) and (b) instructional (29%). Teachers identified several areas where they required technical assistance and support, such as instructional hardware acquisition (e.g., document cameras), appropriateness of eLearning platform selection, and applications for supporting instruction knowledge acquisition (e.g., Google Classroom and Zoom). For example, one stated he needed "PD on digital resources. PD on how to effectively teach via remote learning. Sample lesson plans." Likewise, another expressed, "The challenge I faced was learning new online platforms to connect with the students I supported." The instructional supports respondents identified were largely limited to instructional delivery. "I needed support on how to deliver math via online instruction," one respondent stated explicitly. Further, another stated she needed support in "effectively using Google classroom to support instruction." Another expressed similar sentiments, stating she required "technical support to model math concepts."

DISCUSSION

Historically, the vast majority of public school students, including SWDs receive mathematics instruction face-to-face with their teacher (Catalano et al., 2021). However, the COVID-19 pandemic resulted in instructional shifts, including the move to emergency remote or online instruction (Catalano et al., 2021). As such, this study sought to identify the challenges middle school mathematics teachers faced in teaching SWDs when transitioning from face-to-face instruction to eLearning during the early stages of the pandemic. Our analyses suggest four main findings: (a) teachers reported few changes to their instructional and classroom practices as they shifted to eLearning during the pandemic; (b) teachers indicated declines in providing accommodations and using small group instruction during eLearning; (c) a small fraction of teachers faced challenges related to poor student engagement and instructional planning and delivery; and (d) a limited number of respondents needed administrative and technical supports during eLearning.

First, our quantitative analysis reveals teachers reported few changes to their instructional and classroom practices as they shifted to eLearning during the pandemic. This observation was consistent across each of the seven research-supported mathematics instructional practices and the different subgroups of teachers (i.e., special education vs. general education vs. dual certified). We also learned teachers' reported use of and need for auxiliary supports (i.e., accommodations and AT) were generally the same across both forms of instruction. Together, our results suggest these middle school mathematics teachers felt generally prepared to deliver online mathematics instruction for SWDs. Consequently, the pandemic largely did not impact the middle school mathematics teachers' perception of the quality of their online mathematics instruction to SWDs.

Our results are unexpected as they are inconsistent with the conclusions drawn by previous investigations. Burdette et al. (2013) found teachers were ill-prepared to provide online instruction to SWDs due to a lack of various resources and supports. Smith et al. (2016) also suggested special education teacher preparation may not be adequately preparing teachers for eLearning. Similarly, Catalano et al. (2021) and Jenkins & Walker (2021) indicated teachers are ill-equipped to motivate SWDs to engage in online learning and provide them with specialized instruction and accommodations that support their learning. Further, Lambert and Schuck (2021) highlighted the challenges in helping students to solve problems and develop self-regulated learning strategies during remote instruction. We hypothesized profound evidence of significant declines in teachers' instructional behaviors. Mainly, we expected reductions in their use of research-supported practices during the pandemic as eLearning platforms might not effectively facilitate quality mathematics instruction that promotes student achievement, especially for middle school students (Feng et al., 2021); yet our findings suggested otherwise.

While this research study does not provide empirical evidence to fully explain the stability in teachers' classroom practices and their provision of AT and accommodations across both forms of instructional delivery, the quantitative and qualitative data offer several possible reasons for this result. First, most of the middle-grade teachers we surveyed had prior training and knowledge in providing online mathematics instruction and experience in eLearning for assessing student learning. Second, the majority also received PD on the specific virtual instruction program they used during and prior to the pandemic. Researchers highlight the need for teacher preparation and training in delivering online instruction for SWDs in essential areas, such as assessment (Ciampa, 2017; Smith et al., 2016). A third explanation for this finding may be teachers received adequate administrative and technical supports that are critical for promoting SWDs' access to the curriculum during eLearning (Ciampa, 2017; Burdette et al., 2013) and the

efficient transition to online instruction for SWDs (Darling-Hammond et al., 2020). Results of the current study supports these assertions. In fact, one participant expressed, "administrative personnel helped calm parents and distributed necessary information regarding online instruction. We were able to have online support meetings for parents, students, and staff. Our technology department was able to solve issues remotely and in a timely manner."

The middle school teachers in this study reported they maintained the use of explicit instruction from face-to-face to eLearning. This finding was similar to Aslan et al.'s (2021) showing teachers focused on direct instruction during virtual instruction. The lack of differences in teachers' use of research-supported instructional practices during pre-pandemic traditional instruction and virtual learning is encouraging. However, teachers did not highlight what made their instruction explicit. Therefore, some teachers may have considered even vague use of modeling as a completing an explicit instruction approach rather than implementing multiple components of the explicit instruction approach. Students who struggle in mathematics, especially those with disabilities, benefit from systematic delivery of explicit instruction in mathematics (Gersten et al., 2009). Teachers' maintenance of the use of visual aids and AT in teaching across both forms of instruction is critical given the effectiveness of AT and online tools, such as virtual manipulatives, in supporting SWDs' math learning (Bouck et al., 2018).

A second main finding of the current study was that although teachers' practices did not change generally, they could not efficiently provide SWDs with required accommodations and use small group instruction during eLearning. These findings are not entirely unexpected. During the pandemic, researchers reported schools found it difficult to give SWDs the accommodations and other instructional supports (e.g., specialized instruction) needed to help them meet their IEP goals during eLearning (Catalano et al., 2021; Jenkins & Walker, 2021). This observation is likely because some teachers we surveyed suggested that online learning platforms were not suitable for adapting instruction to meet their students' individual learning needs, a conclusion supported by other researchers (Aslan et al., 2021; Jenkins & Walker, 2021; Rice et al., 2019). In addition, some respondents indicated they did not have adequate instructional time during eLearning and faced challenges in accessing additional resources for supporting virtual instruction, two critical impediments in teachers' use of small group instruction (Alsaeed, 2017).

Our findings that teachers experienced difficulties with providing accommodations and individualized instruction, though expected, are discouraging. Accommodations and small group instruction are essential for differentiating and intensifying instruction for SWDs, increasing their access to

mathematics instruction (Perelmutter et al., 2017). Further, the IDEA mandates schools provide SWDs with accommodations and small group instruction with appropriate intervention to ensure they have access to a free and appropriate public education. Hence, our findings hint at potential inequity in access to online mathematics instruction for SWDs, an urgent concern raised by education stakeholders (Darling-Hammond et al., 2020; Rice et al., 2019). Teacher preparation programs for eLearning must address competencies in these critical areas to prepare teachers to provide online mathematics instruction for SWDs (Catalano et al., 2021; Smith et al., 2016). Additionally, in-service training in incorporating accommodations into and tailoring instruction for SWDs during eLearning is also critical to efforts to provide these students with an equitable learning experience (Smith et al., 2016).

Our third central finding involves the lack of student engagement and instructional planning and delivery difficulties that emerged as challenges in virtual instruction for some teachers. These findings are consistent with the extant literature (Aslan et al., 2021; Smith et al., 2016). For eLearning to be successful, teachers must gain dexterity with digital learning tools for fostering student engagement (e.g., video chat and break out) and assessing students' learning efficiently (Darling-Hammond et al., 2020). The lack of engagement may be byproduct of access to key components of virtual learning, including reliable internet, computers, or other technological devices during eLearning (Catalano et al., 2021). While not examined explicitly within this study, researchers have highlighted the potential inequity in education related to the digital divide that primarily impacts students from low-income communities (Darling-Hammond et al., 2020). Given SWDs are more likely to attend schools in these communities, the digital divide as it relates to unequal access to hardware (e.g., computers) and internet is more likely to impact SWDs (Catalano et al., 2021). Bridging the digital divide is critical in improving SWDs access to curriculum and ensuring that mathematics teachers provide high-quality instruction that promote positive student outcomes (Darling-Hammond et al., 2020).

Finally, the results from this pilot survey suggested most teachers did not need additional supports for eLearning. This finding is not unexpected given that most of the teachers we surveyed indicated receiving training and had prior experience in providing virtual mathematics instruction. While a limited number of teachers required auxiliary supports for eLearning, most did not. Respondents indicated they needed two main types during eLearning: technological and instructional. These findings are analogous to those reported in previous studies (Ciampa, 2017; Smith et al., 2016). Together, these results further strengthen the need for teachers of SWDs to be trained in planning and delivering eLearning instruction. Much of this training

should begin at the pre-service level and continue in-service, as a part of ongoing PD. Districts must also provide teachers with additional time to plan instruction that meet the needs of their students, especially those with disabilities (Darling-Hammond et al., 2020). Yet, current evidence suggests teachers are not adequately prepared to deliver online instruction that meets students' learning needs (Aslan et al., 2021; Catalano et al., 2021).

Implications

The global pandemic created a unique opportunity to understand how the sudden shift from face-to-face instruction to virtual learning impacted middle school teachers' use of research-supported practices and their challenges during online mathematics teaching and learning. Our research offers some key implications, particularly for teacher training and preparation. First, our results suggest the importance of pre-service and in-service training in delivering effective virtual instruction for SWDs. The training sessions should require teachers to demonstrate competencies in using effective research-based practices that enhance SWDs' access to the content and their mathematics learning. Training focused on helping teachers in critical areas related to math instruction for SWDs, such as accommodations, instructional design, assessment, and AT is also necessary. Second, districts are encouraged to adopt eLearning platforms explicitly designed to address students' learning needs. However, in-service training and PD focused on increasing teachers' awareness of these platforms and preparing teachers and students to use them effectively are necessary. Finally, an implication exists for school administrators to provide teachers with ready-to-use materials and other instructional resources suitable for online instruction for SWDs and training in using them.

Limitations and Future Directions

One obvious limitation of the current study is the small sample. Although 139 respondents attempted the survey, for a response rate of about 55%, only 53 (21%) provided adequate data or were eligible for inclusion (i.e., middle school teachers delivering mathematics instruction to SWD to some extent). Hence, our findings are based on data with an acceptance rate that falls below the acceptable threshold for survey research (Salant & Dillman, 1994). However, this limitation does not invalidate our findings, given the current study represents a pilot effort to understand how the pandemic impacted teachers' instructional practices. Another limitation relates to the sample used in the current research. The study used a convenient sample from a single school district, limiting the generalizability of our findings. While our conclusions lack generalizability, the strength of our research is

that it provides an informative account of middle school mathematic teachers' experience in delivering research-supported practices for SWDs during virtual instruction. A third limitation is that we used descriptive statistics as the data limited our ability to perform inferential statistics (e.g., T-Test). Even given this limitation, descriptive statistics were appropriate as it enable comparisons across participants and instructional components. A final limitation is our results are based on teachers' self-reports, instead of independent observations of their classroom practices. Hence, we cannot verify the accuracy of the reported data.

This study adds to the limited literature on the instructional experiences of middle school teachers of SWDs during the pandemic, particularly in mathematics. Additional replication studies using more robust samples across multiple school districts, states, or regions are needed to increase the generalizability of results. Future research using designs that facilitate inferential statistical testing of hypotheses can also add to our knowledge of how the pandemic may have impacted teachers' mathematics instruction. Likewise, additional research using case studies design is needed to understand the contextual conditions and factors that likely impacted teachers' instructional behaviors during the pandemic. Lastly, future research should investigate correlations between changes in teachers' mathematics instructional practices during the pandemic and the SWDs' mathematics achievement.

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