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Effects of Peer Tutoring and Academic Self-Monitoring on the Mathematics Vocabulary Performance of Secondary Students with Emotional or Behavioral Disorders

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Abstract

This study examined the effects of reciprocal peer tutoring coupled with academic self-monitoring on the mathematics vocabulary acquisition of students with emotional or behavioral disabilities (EBD). Six middle school students from diverse backgrounds with EBD attending a public, urban middle school participated in the study. A rigorous multiple baseline across student dyads design was implemented. Results indicated that reciprocal peer tutoring coupled with academic self-monitoring increased assignment completion. Further, results of vocabulary and cumulative test scores indicated that students increased their math vocabulary during the intervention phase. Social validity data indicated that students and teachers felt they benefited from both peer tutoring as well as academic self-monitoring interventions. Limitations and directions for future research are discussed.

Effects of Peer Tutoring and Academic Self-Monitoring on the Mathematics Vocabulary Performance of Secondary Students with Emotional or Behavioral Disorders

According to the United States Department of Education (USDOE, 2004), students qualify for special education services under the emotional disturbance classification due to a pervasive mood of unhappiness or depression, an inability to establish satisfactory interpersonal relationships, and/or abnormal behaviors under routine circumstances that cannot be explained by sensory, intellectual, or other health factors. While these deficits co-morbidly impact both educational and social progress (Montague, Enders, Cavendish, & Castro, 2011, Wiley, Siperstein, Forness, & Brigham, 2010), the field has debated how to best address behavioral and academic deficits (Lane, Wehby, & Cooley, 2006).

Despite a clear need for academic supports for students with emotional behavioral disabilities (EBD), research endeavors have historically focused on determining how behavioral supports can be used to promote access to the general curriculum (Kauffman & Landrum, 2005; Templeton, Neel, & Blood, 2008). In the area of mathematics, students with EBD exhibit large achievement deficits that remain stable or worsen over time. A study by Nelson, Benner, Lane, and Smith (2004) demonstrated that math performance of students with behavioral disabilities was higher than students with learning disabilities in kindergarten; yet, by fifth and sixth grade, students with behavioral disabilities were performing significantly below students with learning

disabilities. Further, Siperstien, Wiley, and Forness (2011) found that academic deficits were significantly more pronounced in mathematics in districts serving students from lower socio-economic backgrounds than those in high-income schools and Wiley et al. (2010) found significant behavioral differences amongst youth with EBD. Currently, there is controversy regarding the over representation of minority students classified as EBD; yet, there is little empirical research involving secondary students from minority backgrounds (Forness, Kim, &Walker, 2012; Templeton, Neel, & Blood, 2008). In their meta-analysis of math interventions for students with EBD, Templeton et al. indicated the clear need for interventions to support math instruction, especially higher level mathematics skills.

Given the need for both academic and behavioral supports, one intervention that is gaining an evidence base for many students is peer tutoring (e.g. Fuchs, Fuchs, & Kazdan, 1999; Fuchs, Fuchs, Mathes, & Martinez, 2002; Sutherland & Snyder, 2007). Peer tutoring through the Peer-Assisted Learning Strategies (PALS) model involves highly structured reciprocal review of key information, on-going feedback, and praise (PALS, 2002). Several studies have validated the use of peer tutoring with secondary students with academic and social skills deficits (e.g., Calhoon, 2005; Fuchs et al, 2002). Sutherland and Snyder concluded that peer tutoring coupled with academic self-monitoring increased reading fluency of middle school students with EBD. Further, Linan-Thompson and Vaughn (2007) adapted the PALS strategy for middle school English Language Learners and observed increases in both knowledge acquisition and vocabulary. However, there is a need to extend research to include students with disabilities from diverse backgrounds (Okilwa & Shelby, 2010; Stenhoff & Lignugaris, 2007).

In addition to research supporting peer tutoring to enhance academic development in reading, several studies have focused on other subject areas such as social studies (Spencer, Scruggs, & Mastropieri, 2003), mathematics (Franca, Kerr, Reitz, & Lambert, 1990), and social skills development (Blake, Wang, Cartledge, & Garner, 2000) of middle school students with EBD. More specifically, Franca et al. indicated gains in math performance, positive attitudes towards mathematics, and effective peer relationships. Further, Spencer and colleagues reported increased test performance as well as on-task behavior improvements during peer tutoring.

While academic deficits are evident, students with EBD also experience significant difficulty with self-regulation (Ramsey, Jolivette, & Patton, 2007; Sheffield & Waller, 2010). As a result, a number of studies have investigated the use of academic self-monitoring to support academic progress and social skills development. Advantages of self-monitoring include extended time on-task (King-Sears, 2008), increased academic engagement (Brooks, Todd, Tofflemoyer, & Horner, 2003), and increased academic performance (Harris, Fridlander, Saddler, Fizzelle, & Graham, 2005). Further, Rafferty and Raimondi (2009) showed that students with EBD preferred monitoring of their academic over their behavioral progress during mathematics.

While there is an emergent literature base to support the use of peer tutoring in middle school classrooms, there is a need to extend current research in the area of peer tutoring to determine if vocabulary acquisition can occur across the curriculum (Kennedy, Lloyd, Cole, & Ely, 2012; Okilwa & Shelby, 2012). Given that vocabulary development is an essential component for content mastery (National Institute for Literacy, 2003), lack of vocabulary can greatly impact student progress across the curriculum, especially in domains such as mathematics (Reinholz et

al., 2011). While there is evidence that peer-mediated interventions have produced positive outcomes for students with EBD across subject areas (Spencer et al., 2003; Spencer et al., 2009), as a whole, study participants do not mirror ethnic or gender compositions of the EBD population (Forness, 2012; Ryan, Reid, & Epstein, 2004). Additionally, Hodge, Riccomini, Buford, and Herbst (2006) completed a comprehensive review of math interventions for students with EBD finding a lack of interventions to support acquisition of concepts beyond arithmetic. However, many studies supported the use of self-monitoring strategies to increase math achievement across grade levels. Given that Reinholz et al. (2011) found vocabulary knowledge a critical skill for successful navigation of word problems, Doabler et al. (2012) found vocabulary to be a barrier for secondary math achievement, and the lack of interventions at the secondary level (Hodge et al., 2006), it is plausible to evaluate the efficacy of peer tutoring and academic self-monitoring interventions to support diverse middle school students with EBD.

Research Purpose/Questions

The purpose of the study was to determine the effects of reciprocal peer tutoring and academic self-monitoring on mathematics vocabulary acquisition of six middle school students with EBD from minority backgrounds. The following research questions were addressed:

1. Does peer tutoring combined with academic self-monitoring increase mathematics vocabulary proficiency of middle school students with EBD?
2. Do students with EBD begin working on assessments more quickly after a peer tutoring combined with academic self-monitoring intervention?
3. How do students with EBD perceive peer tutoring and academic self-monitoring interventions?
4. How do teachers perceive peer tutoring and academic self-monitoring interventions for students with EBD?
5.

Method

Participants

Six middle-school students enrolled in a self-contained emotional support classroom participated in the study. Each participant's behavior impeded learning to a marked degree. Students were selected for study participation based on the following inclusion criteria: (a) males or females between ages 12-15; (b) identified by the school system as having an emotional or behavioral disorder; (c) documented difficulties with math vocabulary acquisition and assignment completion; (d) difficulty with interpersonal relationships, and (e) demonstrated consistent school attendance. All six of these middle school students were from a lower socio-economic urban school that lacked technological resources further justifying the implementation of cost-efficient interventions such as peer-tutoring and academic self-monitoring. The following is a description of each individual participant. Student characteristics are provided in Table 1. Pseudonyms were used to protect the anonymity of the six participants of this study.

Table 1
Participant Characteristics

Student	Age	Grade	Gender	Ethnicity	Language
Darren	14	8	Male	Hispanic	English/Spanish
Zach	13	8	Male	Hispanic	English/Spanish
Juan	14	7	Male	African American	English
Emanuel	13	8	Male	Caucasian/Hispanic	English
Nicki	12	6	Female	African American	English
Cash	14	8	Male	Hispanic	English/Spanish

Setting

The study took place in a diverse urban division located in the northeast United States that was completed in a public fully accredited, comprehensive middle school serving students enrolled in grades 6-8. This research was conducted in a special education classroom for students with EBD. Both the instructional assistant and the teacher's desks were in the classroom as well as 10 student desks. Instructional posters and a bulletin board summarizing the classroom management system were on display. Staffing ratios were one teacher and one instructional assistant to eight students. The teacher was a Caucasian female with seven years of experience working with students exhibiting emotional and behavioral disorders. She was highly qualified and pursing a master of education degree. The teacher was enrolled in a graduate level behavior management course during the time of this study. The classroom instructional assistant was also highly qualified and had received ongoing professional development in the areas of assessment, data collection, and progress monitoring. She was of Caucasian decent and had worked as an instructional assistant within the district for five years.

Research Design

In order to examine and document functional relation between independent and dependent variables, one of the most powerful single-case research designs was used: multiple baseline across student dyads (Gast, 2010; Horner, Carr, Halle, McGee, Odom, & Wolery, 2005; Kennedy, 2005). Multiple baseline was an appropriate design for this research study as it allowed (a) exploring whether peer tutoring and academic self-monitoring improved students' vocabulary skills as compared to traditional instruction; (b) avoiding the withdrawal of intervention, which would be unethical and impossible to reverse learned skills; and (c) replicating previous single-subject research on the effects of peer tutoring interventions within middle school emotional support classrooms (Sutherland & Snyder, 2007). According to the Kratochwill et al. (2010) there should be three attempts to demonstrate an effect at three different points in time and at least 5 data points in each phase. Thus, the introduction of the intervention was staggered across three pairs of students.

Measures

Dependent variables in this study included quiz latency, quiz scores, and cumulative test results. Latency was selected as a measure because work attempt or completion was an area of concern for the study participants and is often a concern for teachers and students with EBD. Quiz latency scores were calculated by recording the time from when the student was given the quiz until he/she began actively working on it. The beginning of work was defined as the student looking at his paper, engaged only with self, and writing on the paper. Latency data were

collected through direct observation. As the quiz was distributed to students, a stopwatch was started. The stopwatch was stopped when each student began working on a quiz. The latency time was recorded for each individual participant. If a student did not begin working on a quiz within 10 minutes, the session was discontinued and the quiz latency was scored as 10 minutes.

Each quiz included a vocabulary word bank and four definitions (described in detail below). Students were asked to write the correct vocabulary word next to each definition. Thus, each quiz was scored on a scale from 0 to 4 with each question being worth one point.

At the conclusion of the study, each student was provided with a 16-question cumulative test. Sixteen words were randomly selected from the entire set of vocabulary words presented during the study to test cumulative knowledge. Students matched the vocabulary word from a word bank to the correct definition.

Materials

Baseline materials. Critical vocabulary words were obtained from the state blueprints and district pacing guides and were included within daily instruction. Each lesson included new vocabulary words deemed critical to instruction by the teacher and district. A four-question vocabulary quiz was administered three times per week. The quiz consisted of four new terms typed in a word bank and four definitions written below. A key was developed by the researcher for each vocabulary quiz. The vocabulary words were identified as essential by the textbook or by the state vocabulary anchor. Students were asked to write the correct vocabulary word next to each definition.

Treatment materials. Critical vocabulary words were selected during the treatment phase in the same manner as during the baseline phase. Vocabulary card materials included four 3 inch by 5 inch index cards with a vocabulary word written in blue marker, pencil, and a textbook including a glossary of terms. Within each session, four new terms were introduced. Vocabulary quizzes utilized the same format as those developed in the baseline with four terms and four definitions typed on a worksheet. Students utilized a computer with Microsoft Excel to graph their progress.

Data Collection Procedures

Student pairs. Student pairs were determined using the PALS dyad intervention procedures (Fuchs et al., 1999). The teacher ranked students from high to low according to vocabulary and math skills performance. The list was then cut in half. The top-performing student was paired with the top of the lowest performing student, the second highest performing student was paired with the second lowest performing student, and finally the third highest performing student was paired with the lowest performing student. Given that students with EBD often have significant interpersonal challenges that have the potential to threaten their progress in peer-mediated interventions (Sutherland & Snyder, 2007; Sutherland, Wehby, & Gunter, 2000), the teacher confirmed students were appropriately matched using available classroom data.

Baseline. During flextime students were allotted 15 minutes to catch up on homework or to read silently prior to proceeding to lunch. During flextime students completed a four-question

vocabulary quiz including critical vocabulary words that involved writing a math vocabulary word supplied in a word bank next to a definition. Vocabulary words were identified as important on the district-pacing guides, state curriculum anchors, and by the primary instructor.

Direct observation data were collected by the researcher three times per week for quiz latency and quiz score. According to Alberto and Troutman (2012), latency is calculated by recording the amount of time from an instructional cue to an individual initiating a task. The amount of time from when a student was provided with a quiz and when he began writing on the quiz was considered quiz latency. The quiz score was calculated by recording the number of correct definitions. Students in the baseline phase submitted their papers to the teacher for evaluation and students in the treatment phase scored their papers using a key provided as described later.

Treatment. The researcher trained the teacher on implementation of the peer tutoring intervention using written structured procedures. To avoid exposure to treatment, students who did not receive the intervention completed flextime assignments in another part of the classroom. Student dyads were trained by the teacher and researcher as they entered the intervention phase. Training consisted of a) vocabulary card creation, b) turn taking, c) gist statements, and d) clarification and correction. Following traditional mathematics instruction, the intervention involved providing students with four 3 x 5 inch white index cards. The front of the card was blank and the back of the card included a red line, followed by blue lines. Each card had an essential vocabulary word from the grade level math text written by the primary researcher in blue marker that was supported by state mathematics vocabulary anchors. The intervention involved both students in a dyad writing a definition for the math text on the back of the card. Students were allowed to ask for assistance with the pronunciation of unfamiliar words included in the vocabulary word definition.

After both students in the dyad completed a set of vocabulary cards, the lower performing student quizzed the higher performing student by holding up a vocabulary card of his choice. The higher performing student then stated the definition. If the higher performing student correctly stated a summary of the definition then the lower performing student placed the card in a correct pile. If the student was unable to state the definition, the lower performing student read the correct definition. After the lower performing student quizzed the higher performing student, the higher performing student quizzed the lower performing student using the same process. Then the process was repeated so that both students acted as the tutor and tutee twice.

Prior to entering treatment the teacher and researcher modeled the peer tutoring strategy and reminded students to utilize the skills learned during social skills instruction for accepting and providing feedback. During the treatment phase, two students sat across from each other at a table outside of the classroom. The students then followed the aforementioned procedures.

Following the intervention, each student independently completed a four-question math vocabulary quiz that involved writing a vocabulary word from the word bank at the top of the quiz next to the correct definition. Just like in a baseline condition, quiz latency data were collected via direct observations by the researcher and the classroom instructional assistant. Quiz score data were also collected and checked for reliability of scoring in more than 30 percent of observational sessions.

After the vocabulary quiz was completed, each student in the treatment phase obtained a key from a folder and graded his/her paper using a marker. After self-scoring his quiz, each student in the intervention group logged onto the class computer and recorded his score in a Microsoft Excel spreadsheet developed by the researcher. This process is similar to the steps described by Gunter, Miller, Venn, Thomas, and House (2002) and adopted by Sutherland and Snyder (2007). Prior to treatment, the researcher taught each student to enter his/her scores into the spreadsheet and graph their progress, and then view a graph of each assessment. All scores were verified by the classroom teacher. Copies of the spreadsheets are available from the researcher. The entire intervention lasted from 15 to 20 minutes following the traditional instruction three times per week.

Interobserver Agreement, Fidelity of Treatment, and Social Validity

Interobserver agreement. Interobserver agreement was calculated for over 30 percent of the quiz latency, the amount of time it took each student to begin his quiz. Total agreement formula was used: least amount of time divided by greater amount of time multiplied by 100 (Alberto & Troutman, 2012. Agreement ranged from 83% to 100% with an overall agreement of 92% for quiz latency. Interobserver agreement was calculated for quiz scores using the formula agreements divided by disagreements plus agreements multiplied by 100 for all (100%) quiz and test scores during both the baseline and intervention phases (Alberto & Troutman, 2012. During the baseline phases the teacher graded quizzes and the researcher completed reliability checks of all graded quizzes. During the treatment phases, the teacher completed reliability calculations for students who self-scored their assignments. Interobserver agreement was 100 percent for quiz scores.

Treatment fidelity. Treatment fidelity required measures to ensure that the intervention, including both peer tutoring and academic self-monitoring, was implemented according to specified methods (Gast, 2010). A checklist was utilized to monitor scripted directions provided to students as well as to ensure that each component of the intervention: a) create vocabulary cards, b) reciprocal peer tutoring, c) vocabulary completion, and d) academic self-monitoring was conducted as planned across the implementation of each intervention phase. Data included the teacher reading a script instructing students on how to complete the peer tutoring phase and the researcher demonstrating academic self-monitoring. The classroom instructional assistant completed a checklist for over 30 percent of the sessions indicating that all components were completed with 100% consistency in all observations.

Social Validity

To address social validity, each student completed a four question interview at the mid-term and conclusion of the study. The instructor completed an interview as well. The following questions were asked to glean insight into student perceptions of peer tutoring and academic self-monitoring: (a) Do you like peer tutoring?, (b) Was it beneficial?, (c) Will you make flashcards to study math in the future?, and (d) Is self-graphing your progress helpful?

The classroom teacher was asked to respond to the following: (a) Please share your thoughts about peer tutoring; (b) Did you find peer tutoring to be helpful to your students?; (c) Did you

find self-monitoring to be beneficial to your students; and (d) Do you think that you will use peer tutoring and/or self-monitoring with your students in the future?

Data Analysis

Visual analysis. Visual analysis involves systematic visual inspection of data through repeated review to determine the presence of functional patterns (Alberto & Troutman, 2012. In a multiple baseline design, data are collected and students systematically enter treatment based on the stability of performance of the previous group entering treatment (Gast, 2010). Following the guidelines established by Kratochwill et al. (2010), data were visually analyzed within and across phases on six variables: (a) change in level; (b) data trend; (c) variability of data; (d) data overlap; (e) immediacy of effect; and (f) consistency of data pattern in similar phases within and across participants' dyads.

Statistical analysis. Quiz progress was calculated by determining mean quiz scores in baseline and treatment phases. Scores were then compared to evaluate intervention effectiveness. Latency data were calculated by determining the mean time it took each student to complete quizzes during the baseline and treatment phases. To determine if students maintained vocabulary, each student was administered a post-test consisting of 16 randomly selected vocabulary words.

Qualitative analysis. To address Research Questions 3 and 4, brief structured student and teacher interviews were conducted at the midpoint and conclusion of the interventions. The primary researcher took notes during each interview. Interview notes were reviewed, key points from individual students, and themes across students were noted. The constant comparative method was used to identify emerging themes within the interview responses (Glesne, 2011).

Results

Darren and Zach were the first to enter the intervention phase. The second dyad of participants, Juan and Emanuel, entered the treatment phase after stability of quiz performance data were obtained for both Darren and Zach (after session 10). Later after session 15, the third dyad, Nicki and Cash were able to start the intervention.

Math Vocabulary

Math quiz scores were calculated to answer the first research question pertaining to whether reciprocal peer tutoring and academic self-monitoring increase the level of math vocabulary of middle school students with EBD. Baseline data indicated problems in math vocabulary acquisition for five out of the six students. Despite Zach displaying high vocabulary acquisition baseline scores, he experienced difficulty with completing tasks, math performance, and working with peers. Therefore, the decision had been made for Zach to continue to participate in the study.

There were 3 demonstration effects at 3 different points of time across 3 dyads of students concluding that there was a functional relation between the beginning of the intervention and the change in quiz scores (see Figure 1). The quiz scores among all of the students improved in

predictable fashion as soon as they were introduced to the intervention. The difference in data patterns between baseline and treatment phases for 4 out of the 6 participants demonstrated moderate evidence of effect of peer tutoring and self-monitoring towards increasing vocabulary performance of these students with EBD (Kratochwill et al., 2010). The two exceptions were Zack, who demonstrated originally high baseline levels and Cash who only marginally improved his vocabulary quiz scores after the treatment was introduced. See Figure 1 for a summary of math quiz performance across dyads.

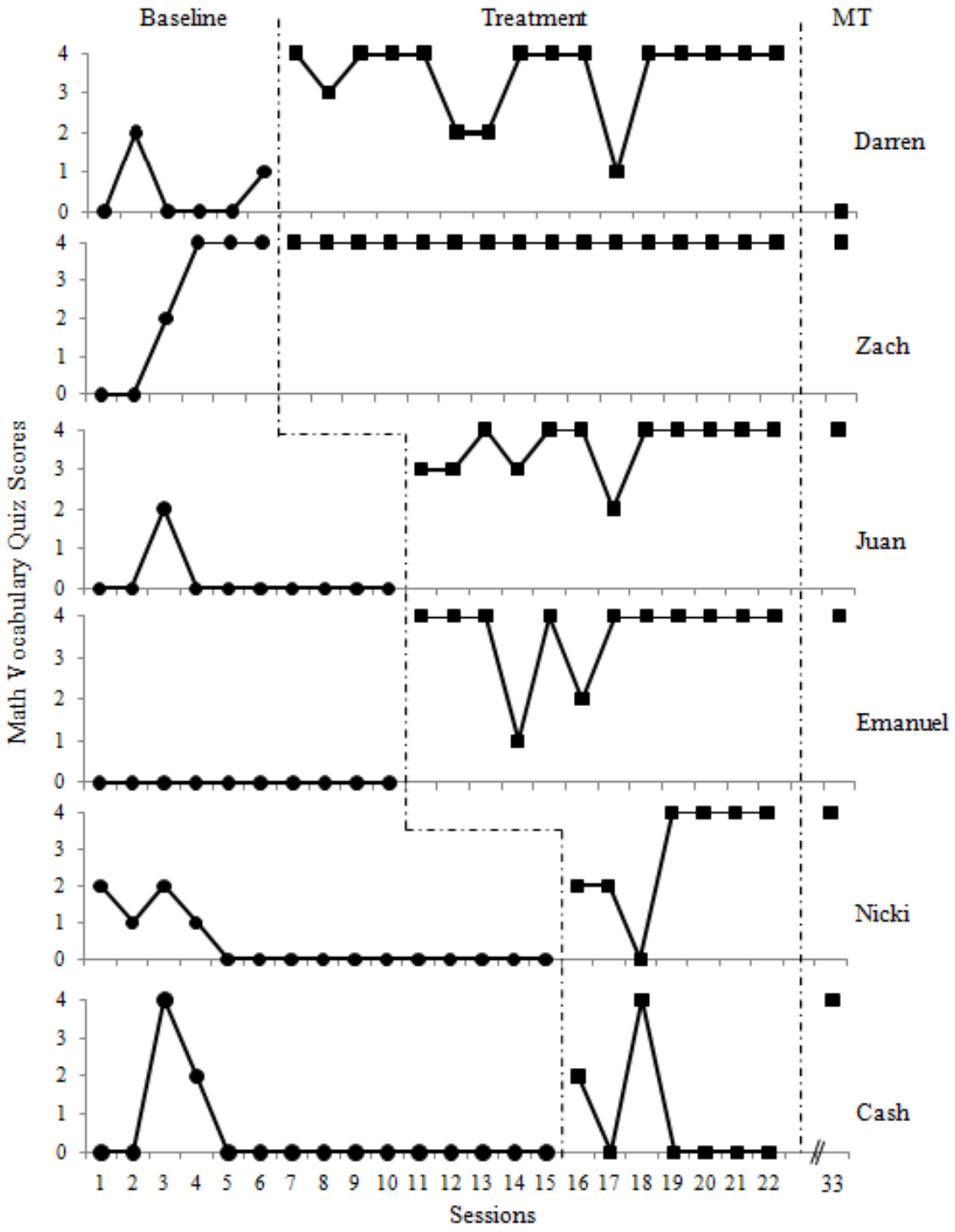

Figure 1. Math vocabulary quiz scores during baseline, treatment, and maintenance phases across 6 middle school students with emotional and behavioral disorders.

Dyad 1: Darren and Zack. Dyad 1 data revealed that Darren increased his math vocabulary performance, while Zach maintained perfect scores during the treatment phase. There was an immediate abrupt change in quiz performance for Darren as soon as he started the intervention.

His mean quiz score increased from 0.5 in baseline to 3.5 in the treatment phase. Percent of Non-overlapping Data (PND; Scruggs, Mastropieri, & Casto, 1987) was 81.5% and performance was consistently higher during the treatment phase with the exception of one data point. Darren reported earning his first 100% on a math quiz during the first day of the intervention phase.

Maintenance data from Dyad 1 indicated that Zach was able to earn a 4 out of 4 (100%) on his quiz. However, Darren refused to complete the quiz following peer tutoring and to record his score on the computer during the maintenance phase. Both Darren and Zach's cumulative test performance indicated that they retained the vocabulary learned (see Figure 2).

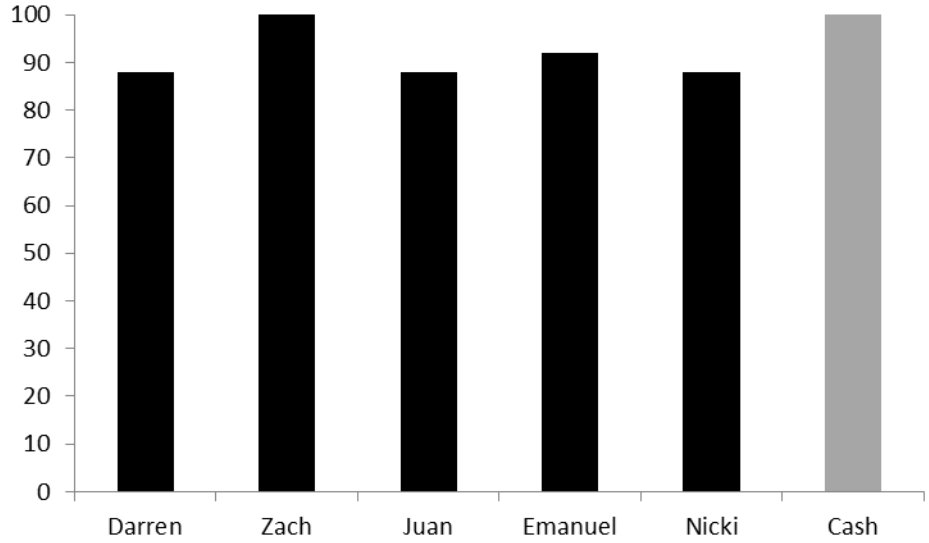

Figure 2. Participants' performance on the 16-questions cummulative math vocabulary posttest. Note: Cash responded orally.

Dyad 2: Juan and Emanuel. Dyad 2 results indicated that both Juan and Emanuel's vocabulary quiz scores dramatically and abruptly improved upon the initiation of the peer tutoring intervention. Moreover, Juan's mean quiz score increased from a 0.2 baseline score to 3.58 during the peer tutoring intervention. Emanuel's mean quiz score increased from 0 to 3.58. The variability of Juan and Emanuel's treatment data was caused by a few outlier data points. Both Juan and Emanuel's PND coefficients between the baseline and treatment phases were high, 92% and 100% respectively, demonstrating effectiveness of the interventions. This was consistent with the Dyad 1 data patterns. The data points in the maintenance phase as well as cumulative posttest results indicated that Dyad 2 participants maintained their vocabulary gains.

Dyad 3: Nicki and Cash. Dyad 3 results concluded that Nicki's vocabulary performance increased immediately after the introduction of the intervention. Her mean levels increased from a baseline score of 0.28 to a treatment score of 2.85. Nicki's PND was 57% due to a few elevated data points in the baseline and 0% quiz score during Session 18. In turn, Cash's vocabulary scores did not increase in the treatment phase demonstrating no functional relation between the dependent and independent variables. High variability of data resulting in 0% PND did not reveal the change in mean levels or trends of data. Despite inconsistent results in treatment, both Nicki and Cash earned the maximum possible score of 4 on the maintenance

quiz. Further, both students earned a 92% on the post-test and Cash, despite refusing to complete the post-test, was able to orally define each of the words on the posttest. See Table 2 for a summary of quiz range and mean scores for each of the six students.

Table 2
Mean Quiz Scores in Baseline and Treatment Phases for Each Participant

Student	Baseline Quiz Range	Baseline Quiz Mean	Treatment Quiz Range	Treatment Quiz Mean
Darren	0-2	.5	1-4	3.5
Zach	0-4	2.33	4-4	4.0
Juan	0-2	.20	2-4	3.58
Emanuel	0-0	0.00	1-4	3.58
Nicki	0-2	.28	0-4	2.85
Cash	0-4	.40	0-4	.86

Note. Scores ranged from 0 to 4 with 4 being the equivalent to 100%

Quiz Latency

To answer the second question as to whether students with EBD begin working on assessments more quickly after peer tutoring and academic self-monitoring interventions, the time it took for a student to begin actively working on quiz was recorded. Despite high variability of data, all six students exhibited problems with vocabulary quiz latency in the baseline condition. The high levels of quiz latency changed for 4 out of the 6 participants following the introduction of the intervention. The difference in data patterns between baseline and treatment phases for these 4 out of 6 students revealed moderate evidence that peer tutoring and self-monitoring decreased the amount of the time it took students to begin working on a quiz (Kratochwill, et al., 2010). As can be seen in Figure 3, there were 3 demonstration effects at 3 different points of time across 3 dyads of students to conclude that there was a functional relation between the beginning of the intervention and the change in quiz latency.

Dyad 1: Darren and Zack. Zack and Darren took on average 8.69 and 7.57 minutes respectively to begin the quiz during the baseline phase. In turn, on all treatment days, both Zach and Darren immediately started their quizzes. This was a significant, abrupt decrease in latency from baseline to treatment. While Zach earned perfect scores on his quizzes during the baseline phase, he experienced difficulty initiating the quiz as soon as it was provided. During the treatment phase, Zach's time to initiate his quiz significantly decreased and his quiz performance remained stable (100% PND score). Further, field notes indicated that Zach accepted reminders from Darren and returned to task when Darren asked him to do so. During Darren's baseline phase, he often reported not knowing the words and refused to complete two quizzes (e.g. Sessions 4 and 5). During the intervention, Darren's latency consistently remained under 2 minutes. (100% PND score). Neither student refused to complete a quiz during the treatment phase. Zack also maintained 0 minute quiz latency during the follow-up data collection. However, during the maintenance phase, Darren refused to complete his quiz after peer tutoring resulting in a high latency follow-up score.

Dyad 2: Juan and Emmanuel. As can be seen from Figure 3, both Juan and Emanuel had difficulty starting the quiz within the baseline condition (M = 8.87 and M = 9.66 min. respectively). However, while the decrease in quiz latency during treatment was obvious for Emanuel (immediate change in level to less than 0.5 min. and PND = 100%), Juan's improvements were hindered by great variability of data. Despite low PND score of 50%, Juan's data in the treatment phase showed a promising downward trend. In addition, both Juan and Emanuel completed all quizzes during the intervention and maintenance stages while refusing to do so during their baseline phase. Results mirror those in Dyad 1

Dyad 3: Nicki and Cash. Nicki's quiz latency was characterized by great variability. However, while a few outlier data points resulted in 0% PND, her data in the baseline showed an upward trend that gradually changed downward in the treatment phase. In addition, Nicki's latency reached the ceiling (10 minute) mark for 11 out of 15 baseline sessions. As soon as the peer tutoring and self-monitoring intervention started, she refused to complete only one quiz (in Session 18). Cash continued to refuse to complete many of the vocabulary quizzes even during the intervention phase. Further, Cash's quiz latency and performance was inconsistent. Cash orally defined each vocabulary word on each of his tests with 100 percent accuracy only after refusing to take both his daily quizzes on most days and his cumulative vocabulary test. See Figure 3 for a summary of quiz latency across participants.

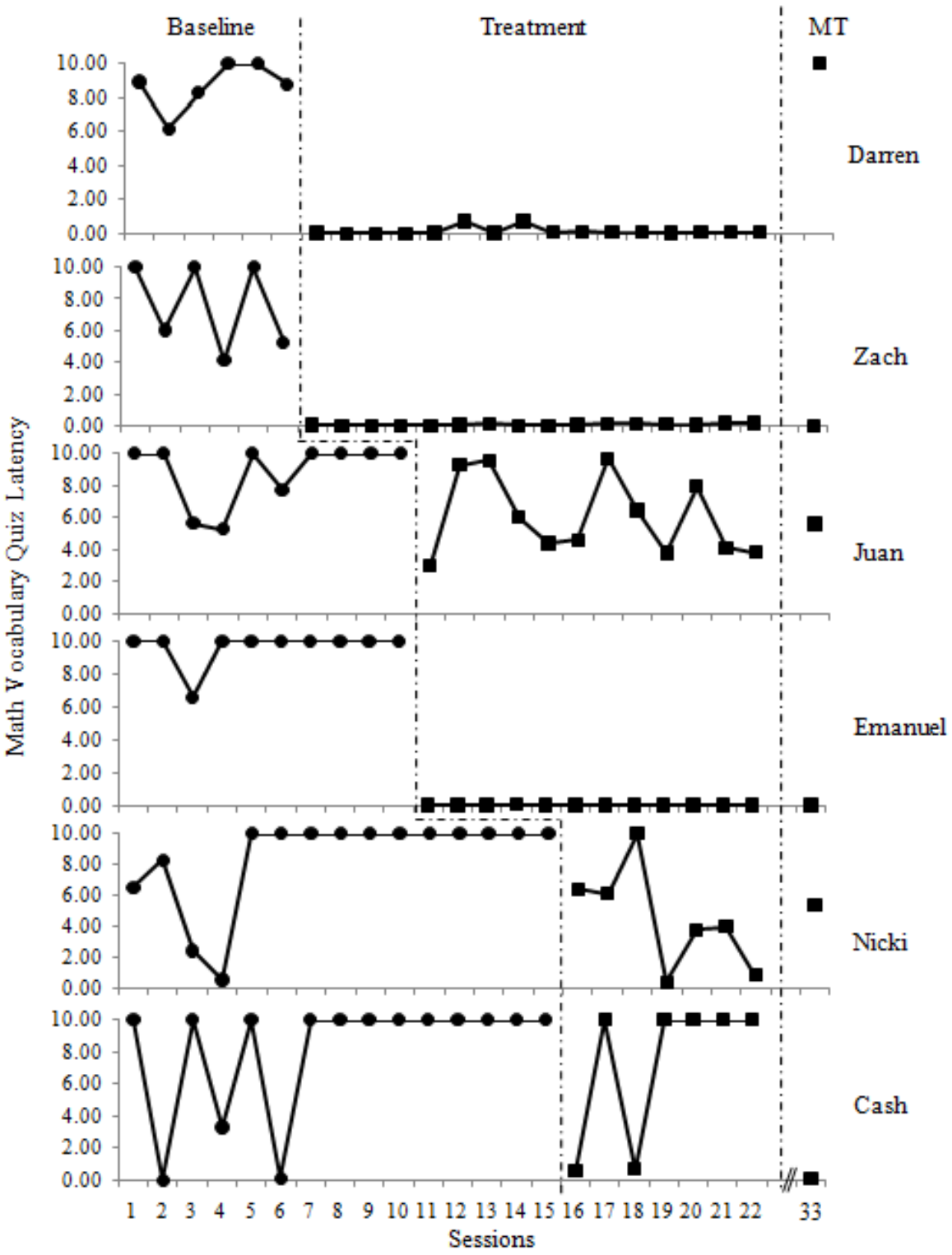

Figure 3. Math vocabulary quiz latency during baseline, treatment, and maintenance phases across 6 middle school students with emotional and behavioral disorders

Social Validity

Social validity measures provide information about how favorably participants view an intervention (Lane & Beebe-Frankenberger, 2004). While results of social validity measures utilized in one single subject study cannot be generalized to populations without replication, they do provide insight into the thoughts and perceptions of participants. Student interviews were completed to address how students perceived peer tutoring and academic self-monitoring. Both Darren and Zach, members of the first dyad, found peer tutoring to be beneficial during both the midpoint and conclusion stages of the intervention phase. Zach, the higher performing student, stated that he completed more of his quizzes because Darren needed his help. Zach reported that the tutoring was redundant for him; however, he enjoyed working on the computer. Darren shared that he liked using the flashcards and used the strategy in his science class and reviews the cards with his brother.

Dyad 2 participants, Juan and Emanuel, believed that peer tutoring helped them to remember vocabulary words that are on the state test. They also reported that they enjoyed working on the computer. Cash from Dyad 3 stated that monitoring his progress and studying would improve his math grade. Nicki concluded that she would like to make flashcards and study them on her own and then graph her progress on graph paper.

Cash said that he hated flashcards and taking vocabulary quizzes. He also shared that he did not enjoy working with Nicki. However, Nicki shared that she did not like taking quizzes but the flashcards and working with Cash was helpful.

Teacher Perceptions

Interviews were also conducted to investigate how the students' teacher perceived the effectiveness of peer tutoring and academic self-monitoring. The teacher reported that peer tutoring was helpful for teaching math vocabulary; however, she was skeptical in her ability to potentially keep up with the pacing guide if the peer tutoring method was implemented. She also noted that rotating peer tutoring with other strategies would likely maintain student interest. Further, the teacher shared that peer tutoring would be helpful for students who needed more repetition and review. The teacher concluded that she would use both peer tutoring and academic self-monitoring, particularly on the computer, in the future.

Discussion

Increased focus on academic achievement and school accountability over the last decade has led to academic, graduation, and post-high school outcome gains for many students, including those with disabilities. However, this trend is not evident for students with EBD (Institute for Educational Sciences, 2012). Despite many students with EBD having average or even above average intelligence, significant academic deficits in reading, writing, and/or mathematics have been observed (Kauffman, 2005; Lane & Menzies, 2009; Trout, Nordess, Pierce, & Epstein, 2003). With almost 60 percent of students with EBD failing to graduate (National Longitudinal Transition Study II; 2003), it is not surprising that they often experience significant difficulty with job acquisition and retention attributed to both social and academic deficits (Hallahan, Kauffman, & Pullen, 2011; Hockenbury, Kauffman, & Hallahan, 2000). Therefore, it is critical that quality practices are developed to meet the unique needs of secondary students with EBD.

It is important to continue to evaluate the effectiveness on interventions to support the academic and behavioral progress of students with EBD. Given the need for additional interventions to facilitate access to mathematics tasks beyond computation, the results of this study support the use of peer tutoring and academic self-monitoring for five out of six students who participated in the study. The results of the study may improve our understanding of academic and behavioral interventions implemented together to improve mathematics vocabulary and academic task engagement. Further, there is evidence that the intervention is effective with students with EBD who are bilingual.

Results suggest that peer tutoring coupled with academic self-monitoring may assist students with mastering mathematics vocabulary. There was a functional relation between the (a) an increase in math vocabulary quiz scores; (b) a decrease in math vocabulary quiz latency and the peer tutoring with self-monitoring intervention for at least 4 out of 6 participants demonstrating moderate effectiveness of the intervention (Kratochwill et al., 2010. Teachers and students report that the intervention is easily implemented with materials that are readily available in most classrooms. Additionally, the intervention supports the use of social skills while engaged in an academic task, which is often an area of concern for students with EBD.

In addition to a need to simultaneously providing academic and behavioral supports, there is also a need for low cost or no cost interventions that teachers and their students can readily implement. In a time of decreasing budgets and increasing student needs, it is paramount that continued access to the general curriculum is provided. Students are expected to access grade level math tasks that involve problem solving, synthesis, and analysis. Therefore, strategies to access higher level math tasks, such as peer tutoring, may be viable solutions to support access to the general mathematics curriculum.

The results of the study should be considered with some caution, as there are limitations. First, it is difficult to ascertain whether peer tutoring and/or academic self-monitoring is responsible for latency and score increases as both interventions were implemented simultaneously. As Templeton, Neal, and Blood (2008) suggest, self-monitoring is beneficial for students with EBD in mathematics and may be attributed to the gains. Further, Dyad 3 demonstrated great variability of data hindering the conclusions about the effectiveness of the intervention. Such variability may have been caused by the tension in the dyad when they did not want to work together. Therefore, while replication was observed across treatment for one phase, the within subject replication was not as strong for Dyad 3. Also, due to absences and disciplinary challenges, dyads did not always receive peer tutoring instruction immediately following traditional math instruction. One student had perfect scores in the baseline phase, which suggests the possibility of alternative explanations for the improved performance. Finally, although we attempted to establish equivalency across math vocabulary quizzes (e.g. difficulty of vocabulary words, time to complete, aligned with curriculum guide and state vocabulary anchors) we did not formally validate the quizzes.

Practitioners working with students with EBP should consider the strengths of their students and adjust peer tutoring groups to assist with social and academic skill development. Preliminary

findings suggest additional research in the areas of both peer tutoring and academic self-monitoring individually with urban students from a minority backgrounds, especially from Hispanic descent would be warranted. Further investigation into the use of peer tutoring for students with average to above average achievement is needed as well as an exploration of the impact of peer tutoring on performance of students with both internalizing and externalizing behaviors. This study provides evidence that peer tutoring is a viable option to afford students with EBD the opportunity to increase academic skills while simultaneously practicing social skills

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