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A Comparison of One-to-One Embedded Instruction in the General Education Classroom and One-to-One Massed Practice Instruction in the Special Education Classroom

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Abstract

A single subject alternating treatment design was used to compare the relative effectiveness of one-to-one embedded instruction in the general education classroom and one-to-one massed practice instruction in a special education class. Four middle school students with developmental disabilities, their special education teacher, and paraprofessional participated in the study. The results indicate that embedded instruction is an effective instructional strategy for students with developmental disabilities being served in inclusive settings. However, the results indicate that there was some difference in the efficiency of the two instructional formats. Two students reached criterion more rapidly in the one-to-one massed instructional intervention while the one-to-one embedded instruction was more efficient for one student. There was no difference between the interventions for the fourth student. Finally, the study validated previous research that found that both special education teachers and paraprofessionals can, with minimal training, accurately implement embedded instructional interventions in the general education classroom. Implications for practitioners and researchers are discussed.

KEY WORDS: One-to-One Instruction, Embedded Instruction, Massed Instruction, Constant Time Delay, Inclusion, Students with Severe Disabilities

The number of students with developmental disabilities served in inclusive settings has increased steadily over the last decade (Lipsky & Gartner, 1996; U.S Department of Education, 2002). Research has suggested that inclusive educational programs have a number of potential educational and social benefits for both students with and

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without disabilities (Cole, Waldron, & Majd, 2004; Harrower, 1999; Hunt & Goetz, 1997; McDonnell et al., 2003; Salend & Duhaney, 1999). Despite the positive outcomes associated with inclusive education, professionals have raised a number of concerns about providing appropriate instruction for students with developmental disabilities in general education settings. Of increasing importance is the need to empirically validate the effectiveness and efficiency of inclusive instructional procedures for students with developmental disabilities and to compare them to traditional special education delivery procedures. Researchers and practitioners must begin to take what we know works out of separate special education classrooms and evaluate the procedures in the context of instructional delivery in inclusive settings. Specifically, there is a need to examine instructional procedures in general education settings that have been validated in traditional special education settings and provide the systematic and individualized instruction needed by students with developmental disabilities (McDonnell, 1998; Schuster, Hemmeter, & Ault, 2001).

Previous research on embedded instruction as an instructional strategy has begun to address this issue (Harrower, 1999; McDonnell, 1998; Wolery, Ault, & Doyle, 1992). Embedded instruction is a strategy that can be used to provide students with developmental disabilities systematic instruction within the typical routines of general education classrooms. Like more traditional teaching strategies used in special education, embedded instruction allows the teacher to systematically control all the instructional procedures. The primary difference from traditional teaching formats is that the instructional trials are distributed within and across class activities rather than being presented rapidly one after the other in a massed practice format. This allows the instructional trials to be presented when naturally occurring opportunities arise within the ongoing routines and activities of the general education setting.

There has been a great deal of research examining embedded instructional strategies used to teach young children with and without disabilities in inclusive early childhood settings (Wolery, et al., 1992; Wolery et al., 1997). For example, Chiara et al. (1995) used embedded instruction to successfully teach picture naming skills to three students identified as having developmental delays. Daugherty, Grisham-Brown, and Hemmeter (2001) found an embedded constant time delay procedure to be effective for teaching target numbers to children with speech and language delays. Other studies have successfully used embedded instruction to teach preschoolers with significant disabilities Individualized Education Program (IEP) goals in the context of naturally occurring inclusive preschool activities

(Grisham-Brown, Schuster, Hemmeter, & Collins, 2000; Horn, Lieber, Li, Sandall, & Schwartz, 2000). Studies have also shown that play skills of children with disabilities can be improved when instruction is embedded within play periods with peers without disabilities (Fox & Hanline, 1993), and peer imitation training can be successfully embedded into art activities for students with disabilities (Venn, Wolery, Werts, Morris, DeCesare, & Cuffs, 1993). Researchers have also demonstrated the utility of embedding instruction into naturally occurring activities and transitions in inclusive early childhood special education settings (Wolery, Anthony, Caldwell, Snyder, & Morgante, 2002; Wolery, Anthony, & Heckathorn, 1998).

Embedded instruction has recently received increased attention as a strategy for providing instruction to school aged students with developmental disabilities in general education classes (Johnson & McDonnell, 2004; Johnson, McDonnell, Holzwarth, & Hunter, 2004; Reisen, McDonnell, Johnson, Polychronis, & Jameson, 2003; Wolery et al., 1997). For example, McDonnell, Johnson, Polychronis, and Reisen (2002) used embedded instruction to teach four students with moderate mental retardation to read or define words that were drawn from a vocabulary list in their general education classes. Students were taught the skills in the context of naturally occurring activities in the general education classes by a special education paraprofessional. A multiple baseline across behaviors design was used to measure the effects of embedded instruction on the targeted skills. Results of the study indicate that embedded instruction led to the acquisition and maintenance of the target skills. The research also demonstrated that paraprofessionals could successfully, and with a high degree of fidelity, implement the embedded instructional procedures during the naturally occurring activities and transitions in the general education classes.

While embedded instruction appears to be a potentially useful strategy to provide systematic and individualized instruction to students with developmental disabilities in general education settings, there is little research that demonstrates that it is as effective as other more traditional instructional strategies used in special education settings. For example, one-to-one discrete trial presentations have been commonly used with children with developmental disabilities (Snell & Brown, 2000; Westling & Fox, 2004). One-to-one discrete trial training is widely accepted as an effective instructional format for teaching skills in an intensive and efficient manner. The target skills are taught within a highly structured format that provides clear and concise instruction, additional prompts, and a reinforcer for successfully performing the skill. The trials of instruction are provided on a

single behavior in a massed fashion with only a brief pause between trials. These one-on-one instructional procedures have been viewed as highly effective for students with moderate to severe disabilities (Vaughn, Moody, & Schrumm, 1998). Existing research has primarily focused on the relative effectiveness of massed and distributed trial training on the learning of individuals with developmental disabilities (Dunlap, 1984; Mulligan, Guess, Holvoet, & Brown, 1980). Studies have found both instructional formats to be effective for students with developmental disabilities. Additionally, they have not found significant differences between the two instructional formats on the rates of skill acquisition. For example, a study by A. McDonnell (1996) compared the effects of massed practice instruction to a combined massed practice and distributed practice format on the acquisition, transfer, and generalization of prompted requests for five students with developmental disabilities. Results indicated that there were only minimal differences in the relative effectiveness of the two trial distribution formats.

The purpose of the present study was to compare the relative effectiveness of one-to-one embedded instruction to a one-to-one massed trials instructional format. Specifically, we compared one-to-one embedded instruction implemented with each student in one general education class with one-to-one massed trials instruction implemented in the students' self-contained special education class. The instructional formats were implemented by the special education teacher and a paraprofessional who supported the students in their general education classes.

Method

Participants and Settings

Four middle school students with developmental disabilities, their special education teacher, and a special education paraprofessional participated in the study. Students were selected for participation based on the following criteria: (1) presence of developmental disabilities; (2) students had to be enrolled in age appropriate general education classes for a minimum of two hours each school day; (3) students had to receive part of their educational programming in separate special education classes; (4) the student's parents or guardians must have given consent for participation in the study; (5) the student's general education teacher had to agree to allow the embedded instructional procedures to be implemented in their classrooms.

Students with disabilities. Bill was a 13-year-old male Hispanic student in the seventh grade with Down Syndrome. He was classified as having an Intellectual Disability. Bill had C-TONI intelligence scores

of 59 (Picture non-verbal), 64 (Geometric non-verbal), and 59 (Non-verbal). He typically used gestures and single syllable utterances to communicate with others. Bill was easily distracted and would often refuse to work in his classes. He was enrolled in two general education classes. During the remainder of the day he received a combination of instruction on IEP goals in a self-contained special education classroom and community-based instruction on functional life skills. The study was implemented in Bill's general education Foods Class where Bill was the only student with a significant disability, and in the self contained special education classroom. The general education teacher employed several instructional strategies including lecture, small group activities, and individual seat-work. Bill attended class independently and his teacher arranged for the necessary adaptations and accommodations needed for class participation. The special education setting used a variety of instructional strategies including whole and small group activities, but the majority of instructional time was characterized by one-on-one instruction delivered by the special education teacher, paraprofessionals, and peer tutors.

Sarah was a 15-year-old female of Vietnamese background in the eighth grade. She was classified as having an Intellectual Disability. Sarah had C-TONI intelligence scores of 56 (Picture non-verbal), 67 (Geometric non-verbal), and 51 (Nonverbal). Sarah had good receptive language skills but had expressive skills that were limited to the use of gestures, single words, and short phrases. Sarah was enrolled in two general education classes during the school day. During the remainder of the day she received a combination of instruction on IEP goals in a self-contained special education classroom and community-based instruction. The study was implemented in Sarah's general education Teen Living Class and in the self-contained special education classroom. Sarah was the only student with a disability in her Teen Living class. The general education teacher employed several instructional strategies including lecture, whole class and small group activities, and individual seat-work. Sarah attended class independently and her teacher arranged for the necessary adaptations and accommodations needed for her to participate in the class. The special education setting primarily utilized one-on-one instruction delivered by the special education teacher, paraprofessionals, and peer tutors.

Andy was a 15-year-old male Caucasian with Down Syndrome in the eighth grade. He was classified as having an Intellectual Disability. Andy had an IQ of 46 as measured by the WISC III. Andy had good receptive and expressive language skills but had difficulty articulating some words. Andy was enrolled in three general education classes during the school day. During the remainder of the day he received a

combination of instruction on IEP goals in a self-contained special education classroom and community-based instruction. The study was implemented in Andy's general education Earth Science Class and in the self-contained special education classroom. The general education teacher employed several instructional strategies including lecture, small group activities, and individual seat-work. Andy was the only student with a disability, and he attended class independently. His teacher arranged for the necessary adaptations and accommodations to access the general education curriculum. The special education setting primarily utilized one-on-one instruction delivered by the special education teacher, paraprofessionals, and peer tutors.

Toby was a 15-year-old male Caucasian in the eighth grade. He was classified as having an Intellectual Disability. Toby had a WISC III IQ score of 46. Toby had good receptive language skills but had expressive skills that were limited to the use of single words and short phrases. Toby also had problems articulating some words. He rarely initiated interactions with peers or special education staff. Toby was enrolled in three general education classes during the school day. During the remainder of the day he received a combination of instruction on IEP goals in a self-contained special education classroom and community-based instruction. The study was implemented in Toby's general education Teen Living class and in the self-contained special education classroom. The general education teacher employed several instructional strategies including lecture, small group activities, and individual seat-work. Toby attended class independently and his teacher arranged for the necessary adaptations and accommodations needed for him to complete assignments for the class. The special education setting primarily utilized one-on-one instruction delivered by the special education teacher, paraprofessionals, and peer tutors.

Special education teacher. A special education teacher implemented the one-to-one massed and one-to-one embedded instructional procedures with Bill and Sarah. The teacher, age 49, had a MEd. in Special Education and had a state teaching license in the area of Severe Disabilities. The teacher had 27 years of teaching experience and has supported students with disabilities in general education classes for 15 years. She reported that while there were no courses in her degree program that prepared her to support students with disabilities in inclusive settings, as a part of ongoing professional development she had attended four workshops on how to teach students with disabilities in the general education setting.

Special education paraprofessional. A special education paraprofessional implemented the one-to-one massed and one-to-one embedded instructional procedures with Andy and Toby. The paraprofessional,

age 48, had received a High School Diploma and had four years of paraprofessional experience. She had not completed any district training on how to teach students with disabilities in the general education classroom, but had been actively involved in supporting students in their general education classes for four years prior to the study.

Instructional Targets

The instructional targets for the study were selected collaboratively with the students' special and general education teachers prior to the implementation of the study. Instructional targets were all drawn from the general education curriculum and were consistent with the content requirements for the students without disabilities in the general education classes. Bill was taught to identify six cooking symbols (i.e., Bake, Mix, Stir) from a picture cooking program that would enable him to complete the required cooking activities in his general education Foods class. Sarah was taught to identify ten shirt necklines to complete a "Clothing and Fashion" unit in her general education Teen Living class. Andy was taught to define six vocabulary terms from a unit on "States of Matter" completed by all students in his general education Science class. Toby was taught to identify the eight teen living themes used on a symbol chart to identify major class themes by all students in his Teen Living general education class. All the symbols were simple line drawings combined with text that related to movies the class watched that described the major themes of the class. For example, one symbol, "Best Friends Wedding," was represented by the movie title written out over a line drawing of a wedding ring. Students in the Teen Living class were expected to use the symbols to identify the themes of daily activities. All the target skills were identical in content to the content requirements for the students without disabilities in the respective general education classes. They were also consistent with the goals included in the students' IEPs and were appropriate for their functioning level. The instructional targets were matched in terms of difficulty and were randomly assigned to an experimental condition. The introduction of the instructional interventions was counterbalanced across participants, and the number of instructional trials in each condition was controlled to ensure they were equivalent. Table 1 presents the instructional targets and the condition (one-to-one embedded and one-to-one massed) for each of the four students.

Dependent Measures

The dependent measures used to compare the relative effectiveness of one-to-one embedded and one-to-one massed practice were the percent of correct responding during testing probes, total trials to

Table 1
Instructional Sets

Student	Instructional Format	
	One-to-One Embedded	One-to-One Massed
Bill (Cooking Symbols)	Mix Preheat Dip	Cut Stir Melt
Sarah (Necklines)	V Neck Crew Off-the-shoulder Square Cowl	U Neck Jewel Sweetheart Keyhole Scoop
Andy (States of Matter)	Boil — Change from liquid to a gas Melt — Change from solid to a liquid Freeze — Change from liquid to a solid	Solid — Keeps shape and size Liquid — Keeps size, changes shape Gas — Changes shape and size
Toby (Teen Living Symbols)	Roxanne — Like yourself Mr Holland — Set goals Best Friends Wedding — Prepare for marriage Bates Motel — Independence	Mr. Mom — Socially approved gender roles Mrs. Doubtfire — Prepare for career Pee Wee — Have good friends Willy Wonka — Be responsible

criterion, and the perceptions of the teacher and paraprofessional regarding the utility and acceptability of the two instructional formats.

Percent of correct responses during test probes. Weekly test probes were conducted by the authors to assess the acquisition of the target skills taught through one-to-one embedded and one-to-one massed practice. Although the embedded instruction was carried out in the general education classroom, all the test probes were conducted in the special education classroom in order to avoid disruption of the general education classes. All the test probes were scheduled at times when the students were normally in the special education classroom. During the test probes, one of the authors sat at a table in the special education classroom and presented the stimulus materials to the student. The student was prompted to either identify the symbol, neckline, or provide a definition. During the probes the students would be asked to respond once to each of the stimuli in both instructional sets. The stimuli were randomly presented, and were the same materials used in the instructional conditions. Students were not presented with

any feedback on their performance during or after the testing probes. The students were praised for attending and staying on task. Student responses were then recorded as either correct or incorrect. The percent of correct responses were then calculated for each test probe.

Total trials to criterion. The student's rates of acquisition under both instructional conditions was assessed by calculating the total number of instructional trials required for the student to meet instructional criterion (performance of 100% accuracy on all the target stimuli in the instructional condition for two consecutive test probes). In addition, the authors calculated the total number of instructional trials provided to each student in each session of both the one-to-one embedded and one-to-one massed practice instructional procedures to ensure their equivalence.

Social validity. Social validity was assessed by using a follow up questionnaire to quantify the special educator's and the paraprofessional's perceptions of the instructional techniques. Using a Likert scale (1-Strongly Disagree to 6-Strongly Agree) the teacher and paraprofessional responded to eight questions and rating the practicality, efficiency, and effectiveness of the one-on-one embedded instructional procedures. In addition, they were encouraged to provide feedback on comments on their questionnaires.

Instructional Design and Procedures

The study utilized a single subject alternating treatment design (Holcombe, Wolery, & Gast, 1994) to compare the relative effectiveness of one-to-one embedded instruction in the general education classroom and one-to-one massed practice instruction in the special education class. The experimental conditions included baseline, one-to-one embedded instruction in the general education classroom, and one-to-one massed practice instruction in the special education class. The instructional formats were counterbalanced across the students.

Baseline. Baseline data were collected by the authors using the testing probe procedures already described. Three baseline probes were conducted for all the target stimuli to ensure behavioral stability prior to the implementation of the instructional interventions. Baseline data was collected on three consecutive days for each participant. Following baseline, all four participants had two different times for instruction established, one in a general education classroom regularly attended by the participants (one-to-one embedded instruction) and one in their special education classroom (one-to-one massed practice). The two instructional interventions were implemented and alternated across class periods in the same day.

One-to-one embedded instruction in the general education classroom. In the one-to-one embedded instructional condition, the special education teacher and the paraprofessional were provided with an instructional script that outlined the embedded instructional procedures. Instructional trials were delivered during transitions, breaks, and any other naturally occurring opportunities in the routine of the general education setting. The instructional set (i.e., flashcards) was presented a minimum of three times in each session. The instructional sets in each condition were presented the same number of times each day. For example, if the instructors presented the instructional set five times during the embedded instruction, the instructional set for the one-to-one massed trials was presented five times.

The stimuli were presented to the students on 3x5 index cards. Instructional procedures consisted of constant time delay, differential reinforcement, and error correction. The discrete instructional trials were distributed over the span of a single class period and instructional sessions were to occur daily until skill acquisition was demonstrated. If the participant responded correctly, they were praised. If the participant response was incorrect they received verbal error correction. For example, during embedded instruction in the general education classroom, Bill's special education teacher would utilize naturally occurring instructional opportunities (e.g., time at the start of class when the teacher is handing back assignments to students) in his Foods class to present a target cooking symbol on a 3x5 index cards and ask "Bill, what does this symbol mean?" Bill immediately received a verbal prompt (0 second time delay-i.e. "Bill, this symbol means bake.") to ensure that there were no opportunities for an incorrect response. Bill's response was coded. If his response was correct he was praised. Error correction would follow every incorrect response. Specifically, the instructor would indicate that he had made an incorrect response by saying "no," then providing a model for the correct response. For example, if Bill responded incorrectly to the stimulus for "bake," the instructor would say "No, Bill. This symbol means bake." The student was praised if they responded to the model. This format would continue until he reached instructional criteria for a phase shift (Two consecutive instructional sessions at 100% accuracy). In the second phase, Bill would receive the verbal prompt after a three second time delay. Instructional trials were distributed over a 40 minute general education class period. Training was completed when he met the instructional criteria of two consecutive test probes at 100% accuracy with no prompts. The instructional techniques were identical for all four students.

One-to-one massed practice in the special education classroom. In the one-to-one massed instructional format, the special education teacher and the paraprofessional were again provided with an instructional script. The same instructional procedures were used in the one-to-one massed trials format and the embedded instruction. However, in the one-to-one massed trials format, the instruction was delivered in the context of the special education classroom. In addition, instead of distributing the trials, all the trials were massed together with each stimulus presented one after another with no pauses or breaks. Instruction was conducted as part of a 40 minute session in which students received one-to-one instruction on several objectives one after another. For example, Bill was provided instruction on the food symbols used in the study along with instruction on functional sight words, writing his name, counting money, and telling time.

Training and Procedural Fidelity

The special education teacher and the paraprofessional were trained to implement the two instructional interventions during a half hour training session conducted prior to the implementation of the study. The training included a summary of the current research and rationale for embedded instruction and massed practice. The special educator and paraprofessional were also given the training using the instructional scripts that were individualized for each participant. The training scripts provided an outline of the constant time delay procedures, reinforcement, and error correction procedures. The procedures were modeled by the first author, then the special educator and paraprofessional implemented the instructional procedures and were provided feedback. Training was continued in both the general and special education classes. The training concluded when both the special educator and paraprofessional were able to implement the instructional interventions with 100% accuracy for two consecutive observations.

Fidelity data were collected on the special educator's and paraprofessional's implementation of the one-to-one embedded and one-to-one massed practice instructional interventions. The first author conducted the fidelity observations in both the general and special education settings during 27.1 % of all the instructional sessions. The observations measured the procedural fidelity of the instructional interventions. The author utilized a checklist that tracked the delivery of instructional cues, error correction procedures, and reinforcement for each instructional trial. If the implementation of each step of the instructional script was correct, the observer would record a "+." If there was an error on either the delivery of instructional cues, error

correction procedures, or reinforcement the observer would record a "-." The special educator's and paraprofessional's procedural fidelity was calculated by dividing the number of steps implemented correctly by the total number of steps and multiplying by 100. The mean fidelity across the special educator's and paraprofessional's instructional interventions in the one-to-one embedded condition was 99.4% with a range of 98 to 100. The mean fidelity across the special educator's and paraprofessional's instructional interventions in the one-to-one massed trials condition was 99.2% with a range of 97 to 100.

Reliability

Interobserver reliability data on student performance was gathered during 90% of all testing probes. During the probes, one of the authors would implement the test probe procedure while another would observe. Both authors independently recorded whether the student's response to the stimulus material was correct or incorrect. Reliability was calculated by dividing the number of agreements between the individual implementing the test probe and the observer by the total number of trials and multiplying by 100. Interobserver agreement was 100% across all observations.

Results

Percent of Correct Responses During Testing Probes

Figures 1-4 show the percent of correct responses during each of the experimental conditions. These data indicate that both one-to-one embedded instruction and one-to-one massed practice were effective in teaching the students the targeted skills. All four participants reached the established criterion in both instructional interventions. However, these data also indicate differences between the instructional interventions for some students. The data for Toby indicate no difference between the two instructional techniques. Andy reached criterion more rapidly with the one-to-one embedded instruction. The one-to-one massed practice was more effective for Bill and Sarah, though only by one test probe session for Bill.

Total Trials to Criterion and Trials Per Instructional Session

Table 2 summarizes the total trials to criterion and the total number of trials per instructional session for each student in each instructional format. In the one-to-one embedded condition, Bill required 240 discrete trials to reach criterion. He received an average of 15 trials per instructional session and completed the training in 16 days. In the one-to-one massed practice condition, Bill required 150 discrete trials

Figure 1. Percent of Correct Response During Test Probe for Bill.

Figure 2. Percent of Correct Response During Test Probe for Sarah.

Figure 3. Percent of Correct Response During Test Probe for Andy.

Figure 4. Percent of Correct Response During Test Probe for Toby.

Table 2
Total Trials to Criterion Per Instructional Set and Average Trials Per Session

Student	Embedded Instruction		Massed Instruction	
	Total Trials to Criterion	Average Trials Per Session	Total Trials to Criterion	Average Trials Per Session
Bill	240	15	150	15
Sarah	615	19.2	505	20.2
Andy	255	13.4	342	12.7
Toby	245	13.6	245	13.6

to reach criterion. He received an average of 15 trials per instructional session and had the training completed in 10 days. In the one-to-one embedded condition, Sarah required 615 discrete trials to reach criterion. She received an average of 19.2 trials per instructional session and completed the training in 32 days. In the one-to-one massed practice condition, Sarah required 505 discrete trials to reach criterion. She received an average of 20.2 trials per instructional session and completed the training in 25 days. Andy required 255 discrete trials defining states of matter in the one-to-one embedded instruction condition. He received an average of 13.4 trials per instructional session and met criterion after 19 days. In the one-to-one massed practice condition, Andy required 342 trials with an average of 12.7 trials per instructional session. It took Andy 27 days to reach criterion. Toby required 245 discrete trials in the one-to-one embedded condition. The training was completed after 18 sessions with an average of 13.6 trials per instructional session. In the one-to-one massed practice condition, Toby required 245 trials per target stimuli and had an average of 13.6 trials per instructional session. He met criterion after 18 instructional sessions.

Social Validity

The social validity of the embedded instructional techniques was rated quite highly by both the special education teacher and the paraprofessional (see Table 3). Likert scale data indicated that both practitioners found embedded instruction to be a practical, efficient, and effective instructional technique. The data indicate that the prompting strategies were easy to use, met the unique instructional needs of the students, and allowed the students to participate more fully in the general education classroom (X=6, Strongly Agree). In addition, the

Table 3
Social Validity Data

	Embedded Instruction	Massed Practice
1. The response prompting strategy met the needs of the student	Mean – 6 Range – N/A	Mean – 6 Range – N/A
2. The response prompting strategy was easy to use	Mean – 6 Range – N/A	Mean – 6 Range – N/A
3. Using the response prompting strategy with the student did not take a lot of my time	Mean – 5.5 Range – 5-6	Mean – 5.5 Range – 5-6
4. The response prompting strategy was effective in promoting the student's learning	Mean – 6 Range – N/A	Mean – 6 Range – N/A
5. Using the response prompting strategy did not disrupt the educational program of students without disabilities in the class.	Mean – 5.5 Range – 5-6	Mean – 5.5 Range – 5-6
6. I will use the response prompting strategy again with students with severe disabilities.	Mean – 6 Range – N/A	Mean – 6 Range – N/A
7. The response prompting strategy would be effective for other students with disabilities in my class	Mean – 6 Range – N/S	Mean – 6 Range – N/S
8. The response prompting strategy allowed the student to participate more fully in the general education curriculum	Mean – 6 Range – N/A	Mean – 6 Range – N/A

data indicate that the response prompting strategy did not disrupt the educational program of the students without disabilities in the general education classes ($X=5.5$). Finally, the special education teacher and the paraprofessional indicated that the embedded instruction procedure would be effective for other students with disabilities and that they would use the teaching format again ($X=6$). Both the special education teacher and the paraprofessional commented that the response prompting procedures were effective in both settings and that the embedded procedures made students more a part of their general education classes. In addition, the paraprofessional noted that one of the students began to verbally communicate more often when the response prompting procedures were used.

Discussion

While embedded instruction appears to be a potentially useful strategy to provide systematic and individualized instruction to students with developmental disabilities in general education settings, there has been little research that demonstrates that it is as effective as other more traditional instructional strategies used in special education settings. The purpose of this study was to compare the relative effectiveness of one-to-one embedded instruction implemented in the general education classroom with traditional one-to-one massed trials instruction in a special education classroom. The data show that embedded instruction is an effective instructional strategy for students with developmental disabilities being served in general education settings. In addition, both the special education teacher and paraprofessional were able to implement the embedded instructional strategies with a high degree of fidelity. These findings are similar to other research that has suggested that embedded instruction is an effective instructional strategy for students with developmental disabilities in general education settings (Johnson & McDonnell, 2004; Johnson, et al., 2004; Reisen et al., 2003; Wolery et al., 1997). This finding is important as it provides additional empirical support for embedded instruction as an effective instructional strategy for students with developmental disabilities in general education settings.

While all four participants reached criterion under each experimental condition, embedded instruction was less efficient for two of the students. For Bill, the embedded instruction required 110 more discrete trials and six more instructional sessions than the massed instruction. For Sarah, the embedded instruction required 110 more discrete trials and seven more instructional sessions than the massed instruction format. The two instructional techniques were equally effective for the third student, Toby, who required the same number of discrete trials and instructional sessions in each instructional format. The embedded instruction was the most efficient instructional strategy for the fourth student. For Andy, the embedded instruction required 87 fewer discrete trials and eight fewer instructional sessions than the massed instruction. Additional research is needed to determine if these patterns would be replicated across other students and what factors influence the acquisition of the targeted skills in embedded and one-to-one massed trials.

There are a number of potential explanations for the differences in the outcomes of the respective instructional procedures. First, there may be characteristics of certain learners that lend themselves to more efficient instruction in each of the experimental conditions. For example, for Bill, the increased behavioral demands of the general

education setting may have served as an impediment to efficient instruction. It was observed that Bill had more difficulty attending to the embedded instructional strategy while in the general education setting. The embedded instruction often occurred during breaks and transitions within the routines of the general education class. As a result, it often took Bill several cues to attend to the instruction and not the noise and movement of his classmates. While similar behaviors were observed during the massed trials in the special education classroom, the instructional strategy could be used to mass all the trials into times when the classroom distractions were minimal.

Secondly, some discrete discrimination tasks, especially when the relevant dimensions of the discriminations are quite similar, may be more efficiently instructed using a massed trial schedule. It may be that the massed feedback given for errors in the massed trials results in better skill acquisition when the relevant stimulus dimensions are minimally different. For example, Sarah's targeted instructional set was the identification of 10 clothing necklines for her Teen Living class. While many of the discriminations had clearly different stimulus dimensions (e.g., turtle neck and v-neck), others had minimal differences (e.g. crew neck and round neck). With the embedded strategy, Sarah had no difficulty learning the target stimuli that had distinctive discrimination characteristics, it was only on the discriminations where there was minimal difference that the massed trials seemed to have been a more effective instructional strategy. Future research should investigate the embedded instructional procedures to identify the types of skills (e.g., discrimination tasks or chained tasks) that are most effectively taught using embedded instructional procedures.

There are a number of limitations of this study that should be noted. Primarily, the relatively small number of students who participated in the study limits the generalizations that can be made about the effectiveness of embedded instruction and massed trials to larger populations. In addition, the study only examined the efficacy of utilizing the instructional procedures when teaching academic tasks requiring discrete responses rather than more complex chains of behavior. There is a lack of research demonstrating that embedded instruction can be used to teach these more complex behaviors. Finally, the data do not give any indication as to the types of response errors made under each instructional technique. As a result, it is not clear if the types of errors found in each condition were identical.

In spite of these limitations, the results suggest that embedded instruction holds promise as an instructional strategy for practitioners who are supporting students with developmental disabilities in general education settings. It should be noted that other research

(Wolery et al., 1997) has demonstrated that general education teachers can be trained to deliver embedded instruction to students with developmental disabilities in inclusive general education classes. However, for the purpose of this study, special education personnel were used to deliver the instruction to ensure an equivalent comparison of the two instructional procedures. At this point, it remains unclear whether one-to-one embedded instruction or the more traditional one-to-one massed trial instruction is more effective, but the results suggest that reliance on massed trial training formats may not be the only effective way to ensure systematic and individualized instruction. Additional research is needed to determine what factors may influence the relative efficacy of these instructional strategies for students.

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