Comparison of One-to-One Embedded Instruction in General Education Classes with Small Group Instruction in Special Education Classes

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Abstract: A single subject alternating treatment design was used to compare the effectiveness of embedded and small-group instruction to teach vocabulary word definitions to four middle school students with developmental disabilities. Embedded instruction was implemented in the students’ general education classes. Students were taught to verbally define five vocabulary words drawn from the general curriculum. Instructional trials were distributed within and across the ongoing activities of the general education class. Instructional procedures included constant time-delay, differential reinforcement, and systematic error correction procedures. Small-group instruction was implemented in the students’ self-contained special education class. Students were taught to verbally define five vocabulary words drawn from the curriculum in their general education classes. Instructional procedures for small-group instruction were identical to those used during embedded instruction. The small-groups included the target student and two peers who were randomly selected from his or her special education class. Small-group instruction employed an intrasequential format with spaced-trials (Collins et al., 1991; Reid & Favell, 1984). Results suggest that embedded and small-group instruction were equally effective in promoting the acquisition and generalization of the target skill. Results are discussed in terms of future research and implications for supporting the inclusion of students with developmental disabilities in general education classes.

Embedded instruction has recently received attention as a strategy for providing instruction to students with development disabilities in general education classes (Johnson, & McDonnell, 2004; Johnson, McDonnell, Holzwarth, & Hunter, 2004; McDonnell, Johnson, Polychronis, & Riesen, 2002; Wolery, Anthony, Snyder, Werts, & Katzenmeyer, 1997). In embedded instruction, students are taught skills within the ongoing routines of the performance setting. Embedded instruction is similar to traditional discrete trial teaching formats in a number of ways. For example, the teacher systematically controls the presentation of instructional examples and implements instructional procedures designed to support the student’s acquisition of the target skill. It differs in that the instructional trials are distributed within or across activities rather than being presented in a massed-trial or spaced-trial format. This is accomplished by arranging the environment and tasks so that instructional trials are presented during natural opportunities such as during breaks in activities or when the student is in transition from one activity to another.

Johnson et al. (2004) used an embedded instruction format to teach three students
with developmental disabilities who were enrolled in general education classes. Each of the students were taught different skills including defining basic science concepts drawn from the general science curriculum, identifying sight words drawn from the general reading curriculum, and using an electronic communication device to make requests of classroom staff. For two students, embedded instruction was implemented by their general education teachers. Instruction was provided to the third student by a special education paraprofessional. The study used a multiple baseline across behaviors design to evaluate the effectiveness of embedded instruction. Results showed that embedded instruction led to acquisition of the target skills by all three students. In addition, general education teachers and the paraprofessional were able to reliably implement embedded instruction in the routines of the general education classes. Finally, teachers and the paraprofessional found embedded instruction to be an acceptable and effective strategy for meeting the needs of these students in their general education classes.

In another study, Wolery et al. (1997) taught general education teachers to use embedded instruction with three students with developmental disabilities who were included in typical elementary classes. Teachers used a constant time delay procedure to embed instruction for students within the lessons being provided to students in the class. These skills included reading sight words during language arts instruction, naming the days of the week on which selected activities occurred during opening activities, and categorizing specific foods within the appropriate food group during science class. Results showed that students learned the targeted skills and general educators were able to successfully implement embedded instruction within activities of the general education class.

While embedded instruction appears to be an effective strategy to meet the needs of students with developmental disabilities in general education classes, it is not clear whether it is as effective as other discrete trial instructional formats. For example, small-group instruction is frequently recommended as strategy for meeting the education needs of these students (Alberto, Sharpton, Sternberg, & Waylor-Bowen, 1994; Browder, 2001; Ryndak & Alper, 2003; Snell & Brown, 2000; Westling & Fox, 2004; Wolery, Ault, & Doyle, 1992). Research has consistently shown that it is effective in promoting acquisition of a variety of academic, communication, motor, self-help, and community living skills (Browder, Hines, McCarthy, & Fees, 1984; Collins & Stinson, 1995; Fickel, Schuster, & Collins, 1998; Kamps, Dugan, Leonard, & Daoust, 1994; Orelove, 1982; Schepis, Reid, & Fitzgerald, 1987; Wilson, Cuvo, & Davis, 1987). In addition, small-group instruction formats can be designed to promote observational and incidental learning by group members (Doyle et al. 1990; Hanley-Maxwell, Wilcox, & Heal, 1982; Keel & Gast, 1992; Farmer, Gast, Wolery, & Winterling, 1991; Parker & Schuster, 2002; Schoen & Ogden, 1995; Singleton, Schuster, & Ault, 1995; Stinson, Gast, Wolery, & Collins, 1991; Whalen, Schuster, & Hemmeter, 1996). Further, studies comparing small-group and one-to-one discrete trial instruction have found that the two strategies are equally effective (Benz, & Todd, 1991; Bourland, Jablonski, & Lockhart, 1988; Polloway, Cronin, & Patton, 1986; Reid & Favell, 1984).

There has been limited research comparing small-group instruction with instructional formats like embedded instruction in which instructional trials are distributed within and across ongoing activities of the performance setting. In one study, Chiara, Schuster, Bell, & Wolery (1995) used an adapted alternating treatment design to compare the effectiveness of small-group massed-trial instruction with one-to-one distributed-trial instruction with eight preschool children with developmental delays. Children were taught to expressively label pictures of people in various occupations, animals, and household objects. Data indicated that individual distributed-trial instruction format was slightly more effective for six of the eight children.

A key feature of embedded instruction is the distribution of instructional trials within and/or across instructional activities (McDonnell, 1998; Wolery, 2002). Although there is no commonly accepted definition of distributed-trial training, it is frequently characterized as the interspersing of instructional trials for one task among other training trials for other tasks during an instructional session (Bam-
bara & Warren, 1992; Hepting & Goldstein, 1996; Mulligan, Lacy, & Guess 1982; Rule, Losardo, Dinnebeil, Kaiser, & Rowland, 1998; Westling & Fox, 2004). In contrast, small-group instruction formats typically use massed-trial or spaced-trial presentation of stimulus materials (Alberto et al., 1994; Browder, 2001; Collins, Gast, Ault, & Wolery, 1991; Reid & Favell, 1984; Ryndak & Alper, 2003; Snell & Brown, 2000; Westling & Fox, 2004; Wolery et al., 1992). However, the spaced-trial strategy has been used the most frequently in research studies on small-group instruction (Collins et al., 1991; Reid & Favell, 1984; Wolery et al., 1992). In a spaced-trial format, trials are presented to the student individually with a brief rest period, pause, or noninstructional activity inserted between each trial during the teaching session (Mulligan, Guess, Holvoet, & Brown, 1980). The spaced-trial format is compatible with small-group instruction because it allows the teacher to present instructional trials to each group member individually in “round robin style.” In spite of its widespread use with students with developmental disabilities, there is no published research directly comparing small-group spaced-trial instruction formats with other distributed trial or embedded instruction formats.

This study was designed to extend the research base in this area by comparing the relative efficacy of one-to-one embedded instruction and a small-group spaced-trial instruction format with four middle school students with developmental disabilities. Specifically, we compared one-to-one embedded instruction implemented with each student in a general education class with small-group spaced-trial instruction implemented in the students’ self-contained special education class. Both instructional formats were implemented by the paraprofessional who supported each student in his or her general education class.

**Method**

**Participants and Setting**

Four students with developmental disabilities and the paraprofessionals who supported them in general education classes participated. Students were selected based on four criteria: (1) the student was enrolled in at least two general education classes each day at the onset of the study; (2) the student’s educational program focused on acquisition of skills that were part of the general education curriculum; (3) the parents or guardians of each student consented to their child’s participation; and (4) the student’s general education teacher agreed to allow the embedded instruction procedures to be implemented in their class.

**Students with disabilities.** Andrew was a 13-year-old seventh-grader who was enrolled in four general education classes during the day. His IQ was 55 as measured by the WISC III. Andrew had very good expressive and receptive language skills and was able to carry out complex conversations with his peers and teachers. The embedded instruction procedure was implemented in his science class that had 27 students. The general education teacher employed numerous instructional strategies including class lecture and discussion, in-class textbook assignments, and science labs. Andrew was supported in the class by a special education paraprofessional who provided him with the necessary response prompts, error corrections, and social reinforcement to complete regular class activities.

Aaron was a 13 year-old seventh-grader with Autism. His IQ was 73 as measured by the WISC III. He had very good expressive and receptive language skills and was able to carry out complex conversations with his peers and teachers. He participated in four general education classes each day. The study was completed in his health class that had 28 students. The general education teacher used a variety of instructional strategies including lecture and group discussion, small group activities, and independent seat work. Aaron received support to participate in the class from a special education paraprofessional. The paraprofessional’s primary responsibilities included providing prompts to help him stay on appropriate topics during discussions, and making the adaptations and accommodations necessary to allow him to complete written tasks or assignments.

Krista was a 14 year-old student with multiple disabilities in eighth grade. Her IQ was 55 as measured by the WISC III. She was able to engage in complex conversations with peers.
Krista was also visually impaired and used enlarged print to complete written work. She used a powered wheelchair to travel to locations in the school. She participated in four general education classes at the beginning of the study. Embedded instruction was implemented in her U.S. History class that had 29 students. The general education teacher’s primary instructional strategies included lecture and independent seat work. She received support from a special education paraprofessional who made the necessary adaptations and accommodations in the ongoing activities of the general education class to allow her to complete written tasks or assignments.

Ron was a 15-year-old ninth grade student with multiple disabilities. He had an IQ of 50 as measured by the WISC III. He had good expressive and receptive language skills and was able to engage in complex conversations with his peers and teachers. Ron used a powered wheelchair to travel to locations in the school. He was enrolled in five general education classes during the school day. The intervention was implemented in his general education science class that had 27 students. The general education teacher used numerous instructional strategies including class lecture and discussion, in-class textbook assignments, and science labs. Ron received support from a special education paraprofessional who provided him prompts to help him stay on task. In addition, the paraprofessional made the necessary adaptations and accommodations to allow him to complete written tasks or assignments.

Paraprofessionals. Three paraprofessionals implemented the embedded instruction and small-group instruction formats with the participating students. The first paraprofessional was a 19-year-old female who had two years of experience working in special education. She had completed high school and two district-sponsored inservice workshops on providing instruction and behavior support to students with disabilities. She provided support to Aaron in his Health class. The second paraprofessional provided support to Andrew and Krista. He was a 22-year-old male who had two years of experience working in special education. He had completed high school and had also completed a district-sponsored in-service workshops on general instructional strategies for students with disabilities. The third paraprofessional was 32-year-old female. She provided support to Ron in his Science class. She was a high school graduate and had 10 years of experience working as a paraprofessional in special education programs for students with developmental disabilities. She had participated in a number of district-sponsored inservice workshops on meeting the educational needs of students with disabilities.

Instructional Targets

Instructional targets were selected in cooperation with each student’s special and general education teachers. Students without disabilities in each of the general education classes targeted for the study were required to read and define key concepts and terms from a vocabulary list in the subject area (e.g., science, history). Based on this requirement, it was determined that students participating in the study would be taught to verbally define key vocabulary words. Each student’s general education teacher submitted a list of 20 vocabulary words from the general education curriculum. Vocabulary words were selected for instruction during a pretest in which students were presented with each word printed 3 × 5 flash cards and the verbal cue “What is the definition of the word ____?” Students’ responses were recorded as correct or incorrect. Ten words that the students could not verbally define were subsequently selected for instruction. Vocabulary words were randomly assigned to one of two sets consisting of five words. One word set was taught to the student using embedded instruction in the general education class. The second set was taught using small-group instruction in the students’ special education class. Table 1 presents the words and definitions taught to each student in each condition.

Dependent Measures

Dependent measures used to compare the efficacy of the two instructional formats were percent of correct responses during testing probes, percent of correct responses during
naturalistic probes, and number of instructional trials to criterion.

**Percent of correct responses during test probes.** Test probes were conducted regularly by the authors to obtain a direct assessment of each student’s acquisition of the definitions taught in the two instructional formats. Although the embedded instruction procedures were carried out in the students’ general education classes, test probes were conducted in the special education classroom in order to avoid potential disruptions by the probe procedures to the instructional activities provided to students without disabilities. Test probes were conducted with students during times when they were typically scheduled to be in the special education class. During the probes, one of the authors sat at a table in the classroom and presented the stimulus material to the student. Students were prompted to define each word in both word sets. These words were randomly presented once to the students on a 3 x 5 in. flash card. Students were not provided feedback about their performance, but they were praised for attending and staying on-task. Students’ responses were re-

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Contents of the Instructional Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Embedded Instruction Set</strong></td>
</tr>
<tr>
<td>Andrew</td>
<td></td>
</tr>
<tr>
<td>Atom—The smallest part of an element.</td>
<td>Cell—The basic unit of living things.</td>
</tr>
<tr>
<td>Molecule—A combination of two or more atoms.</td>
<td>Traits—Physical characteristics.</td>
</tr>
<tr>
<td>Element—Matter in which all atoms are the same.</td>
<td>Diffusion—The method by which substances move in and out of cells.</td>
</tr>
<tr>
<td>Compound—Chemical combination of two or more elements.</td>
<td>Mitosis—A cell’s nucleus divides in two.</td>
</tr>
<tr>
<td>Density—A measure of mass.</td>
<td>Heredity—Passing traits from parents to offspring.</td>
</tr>
<tr>
<td>Aaron</td>
<td></td>
</tr>
<tr>
<td>Environment—The physical surroundings.</td>
<td>Pessimist—Someone who looks for the bad.</td>
</tr>
<tr>
<td>Stress—The body’s response to change, pressure, and demands.</td>
<td>Consequences—The result of an action.</td>
</tr>
<tr>
<td>Optimist—Someone who looks for the good.</td>
<td>Goal—Something we want to accomplish.</td>
</tr>
<tr>
<td>Peers—People your age.</td>
<td></td>
</tr>
<tr>
<td>Krista</td>
<td></td>
</tr>
<tr>
<td>Citizen—A member of a country.</td>
<td>Health—Physical, mental, and social well-being.</td>
</tr>
<tr>
<td>Election—Choosing someone for office or deciding something by voting.</td>
<td>Civic—The study of being a good citizen.</td>
</tr>
<tr>
<td>Economy—The way a country runs its industry, trade, and finance.</td>
<td>Current events—Important events that are happening right now.</td>
</tr>
<tr>
<td>Civil Rights—Rights granted to all citizens.</td>
<td>Revolution—An uprising that changes the government.</td>
</tr>
<tr>
<td>Government—The control and administration of a country.</td>
<td>Boycott—Refusing to buy certain goods.</td>
</tr>
<tr>
<td>Ron</td>
<td></td>
</tr>
<tr>
<td>Ecosystem—All living and nonliving things in an area.</td>
<td>Suffrage—The right to vote.</td>
</tr>
<tr>
<td>Food Chain—A series of events one organism eats another.</td>
<td></td>
</tr>
<tr>
<td>Chemical Bond—The force that holds two atoms together.</td>
<td></td>
</tr>
<tr>
<td>Matter—Anything that has weight and takes up space.</td>
<td></td>
</tr>
<tr>
<td>Molecule—A combination of two or more atoms.</td>
<td></td>
</tr>
<tr>
<td>Ron</td>
<td></td>
</tr>
<tr>
<td>Ecosystem—All living and nonliving things in an area.</td>
<td>Biosphere—All living things.</td>
</tr>
<tr>
<td>Food Chain—A series of events one organism eats another.</td>
<td>Food Web—Overlapping food chains in an ecosystem.</td>
</tr>
<tr>
<td>Chemical Bond—The force that holds two atoms together.</td>
<td>Metabolism—The process by which cells turn fuel into energy.</td>
</tr>
<tr>
<td>Matter—Anything that has weight and takes up space.</td>
<td>Element—Matter in which all atoms are the same.</td>
</tr>
<tr>
<td>Molecule—A combination of two or more atoms.</td>
<td>Atom—The smallest part of an element.</td>
</tr>
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corded as either correct or incorrect. Percentage of correct responses was then calculated for each word group. During Baseline, test probes for each student were conducted on three consecutive school days. During intervention, test probes were conducted weekly throughout the duration of the study.

**Percent of correct responses during naturalistic probes.** Students’ ability to respond to materials typically used in the general education classroom was assessed using naturalistic probes. The probes were conducted by the paraprofessionals in the general education classroom during transition or breaks in classroom activities. Probe procedures were similar for all of the students except that the stimulus material varied for each student based on the general education class. Target words were presented to Andrew, Aaron, and Ron via classroom worksheets that were given to all students in the classes. These worksheets were used by the general education students to complete classroom assignments developed by the classroom teacher. Target words were presented to Krista via the “CVW” (clever vocabulary words) study guides. Students used these guides to study for U.S. history tests. During the probes, each of the target words was presented once to the student during the class session. The probe trials were distributed throughout the period. The paraprofessional would point to one of the target words on the stimulus materials and prompt the student to verbally define the word. No feedback was provided to the student about his or her performance. However, the student was praised for attending and staying on-task during the probe session. Students’ responses were recorded as either correct or incorrect. Percentage of words defined correctly was calculated for each probe session. During baseline, naturalistic probes for each student were conducted on three consecutive school days. During intervention, naturalistic probes were conducted weekly throughout the duration of the study.

**Trials to criterion.** Students’ rate of acquisition under both instruction formats was calculated by counting the total number of trials required for the students’ to achieve a performance criterion of 100% accuracy in defining the words in a set on two consecutive test probes. Total trials to criterion were established by counting the number of times the words were presented to a student across instructional sessions until he or she met the performance criterion.

**Experimental Design**

An adapted alternating treatment design was used to assess the effectiveness of embedded and small-group instruction formats (Holcombe, Wolery, & Gast, 1994). Experimental conditions included baseline, embedded instruction, and small-group instruction. Students received embedded instruction and small-group instruction each school day. For two of the students, small group instruction occurred in the morning when they were receiving instruction in the special education class and embedded instruction occurred in the afternoon in their general education classes. For the other two students, the time of embedded and small group instruction was reversed.

**Baseline.** Baseline data were gathered using the test and naturalistic probe procedures described above.

**Embedded instruction.** Each paraprofessional was provided with an embedded instruction script that delineated the steps of the instructional procedures. Procedures included constant time-delay, differential reinforcement, and error correction. Instructional materials consisted of the five words assigned to the embedded instruction condition printed on 3 × 5 inch flash cards. Paraprofessionals were instructed to present the word set an equivalent number of times to the student’s previous small-group instruction session. For example, if the student had received five presentations of the word set during the previous small-group instruction session, the paraprofessional would present the word group for the embedded instruction condition five times. This process was used to ensure that students received an equal number of instructional trials in each condition. Embedded instruction trials were presented to students during natural transitions or breaks in ongoing classroom routines.

In step one of the instructional procedure, the paraprofessional presented a flash card to and an instructional cue (i.e., “What is the definition of this word?”) to the student. The
paraprofessional then immediately modeled the correct definition (0 s delay). The student was expected to imitate the model provided by the paraprofessional. For example, when Andrew was presented with the flash card with the word “peers” printed on it and the instructional cue, the paraprofessional would immediately say “the definition of peers is ‘people your own age.’” Andrew was expected to repeat the model provided by the paraprofessional. If he imitated the model correctly he was praised.

If the student did not respond immediately to the model or did not correctly imitate the model, the paraprofessional would indicate that he or she made an incorrect response, repeated the initial prompt, and then said “say the definition after me.” The student was provided with feedback (e.g., “That is the definition of the word _____.”) when he or she imitated the model correctly during the error correction procedure. Instruction continued using a 0 s delay until the student correctly read or defined all the words in the word group with a model on two consecutive presentations.

The same instructional procedures were used during the second step of the embedded instruction. However, the paraprofessional delayed the presentation of the model for 3-s after the flash card was presented to the student. The student was praised if he or she correctly responded within the 3 second delay period. If the student gave an incorrect response, the paraprofessional implemented the error correction procedure.

Small-group instruction. The paraprofessional that provided embedded instruction to a student in his or her general education class also implemented small-group instruction with him or her in the special education class. Paraprofessionals were provided with an instructional script to guide their teaching behaviors for small-group instruction. Instructional procedures were identical to those used in the embedded instruction condition and included constant time-delay, differential reinforcement, and error correction. These instructional procedures were used with all members of the small-group. The stimulus material for the target student included the words assigned to the small-group instruction condition prior to the beginning of the study.

The other two students in the group were taught to either read five community-based sight words (e.g., Men, Women) or label five international symbols (e.g., Men, Women). These words or symbols were selected by the students’ special education teacher and were consistent with the goals and objectives included in their Individualized Education Program (IEP).

The small-groups included the target student and two peers who were randomly selected from his or her special education class. Small-group instruction employed an intrasequential format with spaced-trials (Collins et al., 1991; Reid & Favell, 1984). Instructional trials were presented to each student individually in round robin style. That is, the paraprofessional would provide each student with instruction using the procedures described above and then he or she would move to the next student in the group. The paraprofessional was instructed to intermittently praise the students who were not receiving instruction for attending and waiting quietly for their turn. The small-group instruction sessions were 20 min in length. This time period was scheduled because it matched the typical amount of time scheduled by the special education teacher to implement instructional programs with students in her class. The paraprofessionals were asked to present the word set to the target student at least three times during the 20 min small-group session. However, they were encouraged to provide more trials to the student if time allowed.

Paraprofessional Training and Procedural Fidelity

Prior to the implementation of the study, the paraprofessional staff was trained to implement the embedded and small-group instruction procedures during a one-hr training session. Training included a summary of the research on embedded instruction and small-group instruction, and a review of instructional procedures and data collection procedures. Paraprofessionals were provided with a specific instructional script for each of the instruction formats. The script outlined the specific steps for implementing the response prompting, reinforcement, and error correction procedures. One of the authors modeled the implementation of each script for the
paraprofessionals and then provided them feedback about their implementation of the scripts during role play. The role plays continued until the paraprofessionals could implement the steps of both scripts with 100% accuracy.

Paraprofessional training and feedback was continued during the first several training sessions in each condition. Training was carried out in each student’s general education classroom in the embedded instruction condition and the special education class in the small-group instruction condition. Training continued until each paraprofessional could implement the steps of the script in each condition with 100% accuracy on two consecutive sessions.

Fidelity data were collected on the paraprofessionals’ implementation of the instruction formats during 20% of all embedded instruction sessions and 20% of all small-group instruction sessions. Fidelity observations were conducted by one of the authors in the general education classroom during embedded instruction sessions and in the special education class during small-group instruction. Fidelity assessments were focused on the correspondence of the paraprofessionals’ teaching behaviors with the teaching steps outlined in the instructional scripts. If a paraprofessional implementation of a step of the instructional procedures matched those described in the scripts then the observer would record a “+.” The observer would record a “−” if the paraprofessional incorrectly implemented an instructional step. The level of procedural fidelity with scripts was calculated by dividing the number of steps implemented correctly by the number of correct plus incorrect steps and multiplying by 100. Mean fidelity across all paraprofessionals during embedded instruction sessions was 99.8% ranging from 90 to 100%. Mean fidelity across all paraprofessionals during small-group instruction was 100%.

Reliability

Interobserver reliability data on student performance was gathered during 95% of all testing probes. During the probes, one of the authors would observe the implementation of the test procedures with a student. The observer independently recorded whether the student’s response to stimulus material was correct or incorrect. Reliability was calculated by dividing the number of agreements between the individual implementing the probe and the independent observer, by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement was 100% across all observations.

Interobserver reliability data on student performance during naturalistic probes was conducted on 95% of all sessions. During the probes, one of the authors would observe the paraprofessional implementing the naturalistic test procedures. The observer would independently record whether the student’s response to the natural stimulus material was correct or incorrect. Reliability was calculated by dividing the number of agreements between the paraprofessional and the independent observer by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement was 100% across all observations.

Results

Performance During Test and Naturalistic Probes

Figures 1–4 show the percent of correct responses during the test and naturalistic probe sessions for each student in embedded and small-group instruction. Data indicate that the students learned to define the target words in both the embedded and small-group instruction conditions. In addition, the naturalistic probe data indicates that the students were able to define the words when presented using materials developed by their general education teachers.

Trials to Criterion

Data indicate there were no differences in the number of instructional trials students required to meet the performance criterion in both the embedded and small-group instruction formats. He received an average of 16.1 trials during instructional sessions under both conditions. The observer independently recorded whether the student’s response to stimulus material was correct or incorrect. Reliability was calculated by dividing the number of agreements between the individual implementing the probe and the independent observer, by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement was 100% across all observations.

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tion session in each condition. Krista reached criterion in each condition after being provided 615 trials. She was provided an average of 16.2 trials per session in the embedded and small-group instruction conditions. Finally, Ron needed 585 instructional trials to reach criterion in both conditions. He was provided an average of 15.4 trials per session in each of the two conditions.

Discussion
The purpose of this study was to compare embedded instruction implemented in students’ general education classes with small-group instruction implemented in their special education class. Data suggest that these strategies were equally effective in promoting the students’ acquisition of the target skills. In addition, students were able to generalize their responses to novel stimulus materials developed by their general education teachers for other members of the class. Our results are consistent with those of Chiara et al. (1995) who found that a one-to-one distributed trial instructional format was equally, or slightly more effective than a small-group massed-trial format for preschool children with disabilities.

Figure 1. Test and naturalistic probes for Andrew.
The present study extends the research in this area by comparing embedded instruction with small-group spaced-trial instruction. The small-group spaced-trial approach is frequently used by teachers because it allows instructional trials to be presented individually to group members in a "round robin style." Thus, the teacher can provide systematic instruction to students with different instructional objectives and who need different levels of instructional support. Results suggest that embedded instruction was as effective as the small-group format with the students participating in this study. This finding is important because it provides additional empirical support for the efficacy of instructional formats that distribute instructional trials within and across activities in the performance setting. Consequently, embedded instruction provides practitioners with an additional strategy to meet the unique educational needs of students when instruction in traditional discrete trial formats is not practical.

Results also suggest that embedded instruction carried out in general education classes was as effective for students in this study as small-group instruction carried out in their self-contained special education class. This finding is not surprising given that both formats employed the same empirically validated instructional procedures. Equally important, the paraprofessionals were able to reliably implement these procedures in both settings. These data provide additional evidence that carefully designing and implementing instruction is a more important factor in promoting student learning than where instruction is de-
Embedded instruction has several critical features that make it a desirable approach for supporting the participation of students with developmental disabilities in general education classes. First, as just discussed, embedded instruction can be designed to incorporate teaching procedures that have consistently been shown to enhance learning outcomes for students. Second, embedded instruction can be designed to accommodate the unique learning needs of the students and the characteristics of the instructional targets. The necessity of tailoring instruction to individual students is widely recognized as a fundamental principle of effective special education services. Finally, embedded instruction procedures allow students to receive consistent opportunities to learn specific skills within the ongoing activities of the general education class. In this study, the paraprofessional was able to provide students multiple instructional trials each day on the target skills across a variety of instructional activities. This is a positive finding given that some studies have suggested that general education teachers and researchers perceive discrete trial training strategies as incompatible with the typical organization structures of many general education classes (Billingsley & Kelley, 1994; Jackson, Rynak, & Billingsley, 2000). It seems
likely that the long-term acceptance of inclusive education programs will hinge upon the development of instructional approaches, like embedded instruction, that are both effective and “fit” with general education classes (McDonnell, 1998; Wolery, 2002).

Finally, data suggest that students were able to generalize target skills to a limited sample of materials (e.g. worksheets and other materials) found in the general education classes. This is important because generalization to non-trained stimuli and performance contexts is a well-documented problem for students with developmental disabilities (Horner, Dunlap, & Koegel, 1988; Snell & Brown, 2000; Westling & Fox, 2004). Additional research is necessary to more systematically examine the features of embedded instruction that effect students’ generalization of skills.

Several limitations of this study should be noted. First, the small number of students who participated limits generalizations about the relative effectiveness embedded and small-group spaced-trial instruction. Second, the study only measured the efficacy of these procedures in teaching discrete academic tasks, rather than more complex chains of behaviors. It is not clear whether behavior chains could be taught through the use of embedded instruction or what effect various trial distribution strategies might have on the acquisition and generalization of such behaviors. Finally, we did not directly assess the perceptions of paraprofessionals and teachers about the social validity of the two instructional formats. Previous research suggests that embedded instruction is readily accepted by these two groups (Johnson & McDonnell,
2004; Johnson et al., 2004; McDonnell et al., 2002) and anecdotal reports from paraprofessionals participating in the study were positive about the acceptability and utility of both formats.

Despite these limitations, results suggest that embedded instruction holds promise as a strategy for practitioners who are supporting students with developmental disabilities in general education classes. It also appears that these students can learn important skills when trials are distributed within and across typical activities in general education classes. This suggests that traditional reliance on massed-trial training formats may not be necessary to ensure that students receive systematic and highly effective instruction. Additional research is needed to compare embedded instruction with other discrete trial formats such one-to-one massed-trial instruction and small-group massed-trial instruction.

References


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