Teaching Test-taking Strategies to Improve the Academic Achievement of Students with Mild Mental Disabilities

Allison G. Kretlow, Ya-yu Lo, Richard B. White, and LuAnn Jordan
University of North Carolina at Charlotte

Abstract: This study examined the effects of teaching a test-taking strategy to 4 fourth- and fifth-grade students with mild mental disabilities on reading and math achievement. The intervention consisted of a direct and explicit instructional method using a mnemonic strategy. The participants’ acquisition and application of the test-taking strategy on reading and math probes were evaluated using a multiple probe across participants design. All participants demonstrated the ability to apply the strategy on probes during the intervention, 2-week maintenance, and generalization conditions. Significant gains in achievement were observed for all participants. Implications of teaching test-taking strategies to students with mild to moderate mental disabilities were discussed.

As achievement accountability measures continue to increase in the public education system, so do the expectations for students with disabilities. Current legislation enforces the need for students with disabilities to have access to the general education curriculum, and in turn for states to assess those students through standardized achievement measures. The No Child Left Behind Act (NCLB) of 2001 requires that all students in grades three through eight take state-wide achievement tests in reading and math (Goertz & Duffy, 2003). The NCLB Act in combination with the amendments to the Individuals with Disabilities Education Improvement Act (IDEIA, 2004), which states that all students must be included in state and district assessments, present challenges of test-taking to students with disabilities (Washburn-Moses, 2003).

The performance of students with disabilities on standardized achievement tests is at least, in part, responsible for states attaining what the federal government outlined in the NCLB Act as Adequately Yearly Progress (AYP). To meet AYP, schools must attain goals related to achievement for certain targeted groups of students, including students with disabilities. As a result, performance on standardized achievement tests has high stakes for students with disabilities. Additionally, school districts may use test scores of students with disabilities to decide placement, grade level promotion, or to determine whether or not a student graduates (Heubert & Hauser, 1999).

By the nature of their disabilities, many students in special education programs have difficulty demonstrating knowledge through standardized achievement tests. Specifically, students with disabilities have difficulty with cognitive and metacognitive task demands. They often need help to approach a learning activity (such as test taking), and require systematic methods of training to acquire thinking skills (Henley, Ramsey, & Algozzine, 2005). Students with disabilities also often have difficulty organizing information and responding to complex questions. For example, a student with a learning disability may have content knowledge (e.g., in math or science), but have difficulty demonstrating the knowledge in a standardized format. In other words, students’ lack of test taking skills may appear as academic deficiencies (Scruggs & Marsing, 1988).

In many states, students with learning disabilities (LD) and emotional and behavioral disabilities (EBD) have long been participating in standardized achievement tests with or without modifications and accommodations.

Correspondence concerning this article should be addressed to Allison G. Kretlow, 11027 Heritage Green Drive, Cornelius, NC 28031. Email: awgraves@uncc.edu
However, in accordance with the NCLB Act, more states now require students with mild mental disabilities to participate in state-wide testing programs. Many students with mild mental disabilities have traditionally been placed in more restrictive, separate settings (Henley et al., 2006) which may have led to less access to the general curriculum, and therefore less exposure to standardized test formats or test-taking strategies typically used in general education classrooms.

Prior research has shown the importance and effectiveness of teaching test-taking strategies to students with and without disabilities. Studies conducted with general education students demonstrate that students benefit from test-taking instruction that includes training on test formats, reasoning and deduction strategies, time management, practice, and coaching (Beidel, Turner, & Taylor-Ferreira, 1999; Bunting & Mooney, 2001; Kenny & Faunce, 2004; Towns & Robinson, 1993). Additionally, several research studies have found that students with LD (Lee & Alley, 1981; Scruggs, Mastropieri, & Tolfa-Veit, 1986; Winnery & Fuchs, 1993) and EBD (Hughes & Deshler, 1993; Scruggs & Marsing, 1988) outperformed students in control groups in achievement on content areas after being taught test-taking strategies.

One effective approach for applying test-taking strategies is the use of mnemonic learning, which has shown its efficacy in improving testing-taking skills and achievement of students with high incidence disabilities such as LD and EBD (Hughes & Deshler, 1993; Hughes & Schumaker, 1991; Mason, Snyder, Sukhram, & Kedem, 2006; Scanlon, 2002; Wehrung-Schaffner & Sapona, 1990). For example, Hughes and Schumaker taught a mnemonic test-taking strategy to 6 seventh and eighth graders with LD. Students were taught a sequence of cognitive and behavioral test-taking strategy steps using a first-letter mnemonic device (i.e., PIRATES: Prepare to succeed, Inspect the instructions, Read, remember, and reduce, Answer or abandon, Turn back, Estimate, Survey). Using a multiple probe across participants design, the authors measured the percent of items correct on 10 probes designed to measure students’ use of the test-taking strategy. All students scored at or above mastery criterion on all probe tests and maintained their mastery of the test-taking strategy after 3 to 11 weeks. Additionally, the generalization data showed that the students improved their performance on regular class tests by an average of 14% after the intervention was implemented. Similar results were observed in a systematically replicated study with 6 seventh- and eighth-grade students with EBD (Hughes & Deshler, 1993).

Empirical evidence supporting the efficacy of mnemonic strategy-based instruction for students with mental disabilities is relatively limited. Morin and Miller (1998) delivered mnemonic strategy instruction to teach multiplication facts and word problems to three 7th-grade students with mental disabilities. Students were first instructed how to compute multiplication facts, then were taught to use the mnemonic DRAW (Discover the sign, Read the problem, Answer, Write the answer) to complete multiplication word problems. Using a multiple baseline across subjects design, the authors evaluated students’ performance on 21 probes and reported that all students achieved mastery on all except four probes. Similarly, Mastropieri and Scruggs (1994) used mnemonic strategies to teach science and social studies content to students with mild mental disabilities who had not mastered the concepts after various methods of instruction (e.g., textbook materials, outlining, computer programs) from the special education teacher. Instruction on the mnemonic devices greatly improved all students’ mastery in naming state capitals and body parts.

Despite the positive outcomes of mnemonic-based instruction on test-taking strategies for students with and without disabilities, research is limited in two areas. First, the majority of studies contained teaching test-taking strategies to students with high incidence disabilities with limited evidence supporting the effects of strategy instruction for students with mental disabilities. As the demand of including students with mental disabilities in the state-wide and district-wide assessments increases, so does the need for strategy instruction for these students. Second, scarce research addressed test-taking instruction with elementary aged students. In order to prepare students for long-term standardized test tak-
ing experiences beginning at the elementary level, it is warranted to provide students with skills in their early schooling. The purpose of this study was, therefore, to address these issues by examining the effects of direct and explicit mnemonic test-taking strategy instruction on the reading and math achievement test scores of students with mild mental disabilities in grades four and five. Measurements were taken to evaluate the degree to which the participants applied the taught strategies to tests and improved their achievement test scores, both on practice probes and regular classroom tests.

Method

Participants

Four students with mild mental disabilities in grades four and five participated in this study. All participants had an IQ score falling between 60 and 72 on previously administered *Weschler Intelligence Scales for Children* (Weschler, 1991), which qualified them for special education in the educable mental disability (EMD) category based on the state guidelines. The participants’ achievement scores in reading and math were at least two grade levels behind their peers without disabilities on previously administered *Woodcock Johnson Test of Achievement* (Woodcock, McGrew, & Mather, 1977) and various classroom-based assessments including the *Brigance Diagnostic Comprehensive Inventory of Basic Skills-Revised* (Brigance, 1999) and Corrective Reading assessments (Englemann, Hanner, & Johnson, 1999).

Brandy was a 10-year-old female student in the fifth grade. She exhibited delays in cognitive ability, academic ability, and adaptive behavior when compared to her same age peers. She had a full scale IQ of 69, with relative strengths in memory and perceptual reasoning. Brandy demonstrated basic reading skills on an upper first grade level and reading comprehension skills on a mid-first grade level. Her math and writing skills were on an upper second grade level. Testing accommodations on Brandy’s Individualized Education Program (IEP) included testing in a separate setting, read aloud for math, reading aloud to self for reading passages, and multiple test sessions.

John was a 10-year-old male student in the fifth grade. He exhibited delays in cognition, academics, and adaptive behavior, and was diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD). John received medication for his ADHD; however, he continued to experience significant difficulty with focusing, and demonstrated frequent impulsive behaviors throughout the study. John had a full scale IQ of 61, with a relative strength in verbal comprehension. John read and comprehended on a late first grade level, and his math and writing skills were on a late second grade level, as measured by the *Woodcock Johnson Test of Achievement*. John received speech language therapy for articulation delays. Testing accommodations on John’s IEP included testing in a separate setting, read aloud for math, student reads aloud to self for reading, extended time, and multiple test sessions.

Sarah was a 9-year-old female in the fourth grade. She exhibited significant delays in cognitive ability, academic skills, and adaptive behavior. Sarah’s last psycho-educational evaluation was completed in preschool, in which she demonstrated a general cognitive ability score of 71, with relatively higher non-verbal skills. Based on the preschool evaluation, her academic skills were on a kindergarten level. However, Sarah’s teacher reported that based on curriculum based measurement, Sarah’s reading skills were on an upper second grade level, math skills on a lower first grade level, and writing skills on a lower second grade level. Sarah received speech language therapy for articulation delays. Testing accommodations on Sarah’s IEP included testing in a separate setting, read aloud for math, student reads aloud to self for reading, extended time, and multiple test sessions.

Amy was a 9-year-old female in the fourth grade. Amy was diagnosed with Velo-Cardial Facial Syndrome (VCFS), which is a genetic disorder associated with cleft palate, heart problems, speech delays, and learning difficulties. On a previous evaluation, Amy exhibited significant delays in cognition, academics, and adaptive behavior, with a full scale IQ of 71, making her eligible for special education as EMD. However, during the course of the study Amy completed a required triennial compre-
hensive evaluation, in which her category was changed from EMD to Other Health Impaired (OHI) due to the impact of VCFS on her learning. On the current evaluation, Amy demonstrated a full-scale IQ of 77, reading scores on an upper second grade level, and math and writing scores on a lower second grade level. Due to the VCFS, Amy demonstrates significant speech and language impairments. Her speech is often unintelligible; therefore she uses a combination of conventional speech and assistive technology to communicate. She used both speaking and a computer to interact with the researcher during the study. Testing accommodations on Amy’s IEP included testing in a separate setting, extended time, read aloud for math, student reads aloud to self for reading, and multiple test sessions.

Setting

The setting was a self-contained classroom (grades three to five) for students with mild to moderate disabilities. All students in the class functioned significantly below their peers in academics, intellectual ability, and adaptive skills. The classroom housed one special education teacher, one classroom teacher assistant, and eight students. Classroom instruction focused on each student’s IEP goals and objectives on their instructional level along with the state curriculum standards in reading, math, and writing.

Experimenter

The primary experimenter, trainer, and data collector (first author) for this study was a graduate student and exceptional children program specialist in a rural school district. The experimenter had been previously trained in learning strategy instruction and taught learning strategies to students with various high incidence disabilities during her two years of classroom teaching experience.

Data Collection Procedures

Dependent variables. Two dependent variables were measured in the study. The first dependent variable was the student achievement scores on reading and math multiple choice probes (i.e., achievement probes), as measured by the percentage of items answered correctly on the probes. Each probe had 20 items organized into four sections: (a) reading words, (b) reading and answering questions, (c) math problems, and (d) math word problems. The section on reading words included fill-in-the-blank items in which the students read sentences then supplied the missing word from four choices (e.g., “Every night I go to bed at a _____ time. My parents say that getting enough rest is very important. (a) certain, (b) several, (c) circus, (d) sure”). The reading and answering questions section included a passage followed by literal and non-literal comprehension questions. The math problems section included computation problems and numeration tasks (e.g., place value, numbers in standard form) and the final section, math word problems, included applied math problems involving various math skills (e.g., geometric shapes, interpreting tables and graphs). Each section had five questions. For each question, the participants were to choose the most appropriate answer from a choice of four. The first author constructed the probe items in the reading words, math problems, and math word problems sections of each probe by adapting practice end-of-grade exams items provided by the state. Passages in the reading and answering questions section of each probe were taken from five practice standardized tests (Coan, 2003) used by the classroom teacher. The test items represented skills taught throughout the reading and math curriculum on the state’s Standard Course of Study for each participant’s specified grade level. Probes were administered individually. The first author scored each student’s probe upon completion.

The second dependent variable was the percent of steps applied correctly on the pretest, five controlled practice tests, and the posttest, designed to measure students’ correct use of the test-taking strategy, as well as additional five advanced practice tests (i.e., achievement probes). The pretest, controlled practice tests, and posttest were directly retrieved from The Test Taking Strategy instructor’s manual (Deshler, Hughes, Mercer, & Schumaker, 1993). Each of the tests had four sections comprised of true/false items, multiple choice questions, fill-in-the-blank items, and one
short essay question. Items were either easy to answer (used to determine students’ deduction strategies, e.g., “In school, most students sit at: (a) a lounge chair, (b) a couch, (c) a desk, (d) a rocking chair”) or fictitious (used to determine students’ estimating strategies, e.g., “During the neoplenic period, the weather was (a) often unpredictable, (b) never cold, (c) always below freezing, (d) mostly temperate”). Using a checklist provided in the manual, the experimenter sat next to each student and placed a check next to the steps of the strategy the student completed correctly. Percent of the strategy steps applied correctly was calculated for each student.

Interobserver agreement. To establish interobserver agreement, the classroom special education teacher and the first author both scored 30% of the probes across conditions for each student. The two scorers’ recordings were compared item by item. The percentage of agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Interobserver reliability was found to be 100% on all selected probes.

Procedural reliability. To ensure procedural reliability, the special education teacher observed 30% of the instructional sessions. The teacher determined the accuracy with which the first author implemented the strategy by completing a procedural checklist to determine if the instructor (a) followed the script, (b) followed the instructional sequence outlined in the strategy, and (c) gave adequate repetition and corrective feedback as outlined in the procedures. The teacher was provided with a copy of the Test-Taking Strategy manual to follow during the observed sessions. Procedural reliability for each session was calculated by dividing the number of procedural items followed correctly by the total number of procedural items to be observed (i.e., 7) and multiplying by 100. Procedural reliability was assessed to be at 100%.

Social validity data. Social validity data were collected before the study began and again after the study was completed to measure the social importance of teaching test-taking strategies to students with mental disabilities and the perceived outcomes of the instruction. Using a consumer satisfaction questionnaire, parents of the participants, the classroom special education teacher, and one general education teacher provided their responses.

Experimental Design and Procedures

The experimental design was a single-subject multiple probe across participants design (Tawney & Gast, 1984). The initial baseline lasted a minimum of three sessions for all participants, or until baseline was stable. The training began with Brandy first, with the remaining participants in the baseline condition, during which a probe was given to each participant weekly. When Brandy demonstrated 80% accuracy on two consecutive probes during post-training, the training was introduced to John. The same criterion applied to Sarah and Amy in the subsequent order.

Baseline. During baseline, no test-taking strategies were taught. The participants received regular instruction in reading and math in the self-contained classroom. The participants were given achievement probes to complete daily for at least three days or until baseline was stable. The probes were administered individually by the first author in a separate setting (various quiet locations available in the school). Students were given an unlimited amount of time to complete the probes. Participants received all modifications listed on their IEPs, including read aloud for the math problems, reading aloud to themselves during reading passages, and extended time.

Intervention. The instructional procedures were developed based on The Test Taking Strategy by Deshler and colleagues (Deshler et al., 1993) and consisted of nine stages (see Table 1). Each participant received 12 instructional sessions, each lasting approximately 20 min. In the first stage, participants were given the pretest. Due to the advanced reading level of the pretest and participants’ IEP modifications, all questions were read aloud. The first author scored the pretests, and then gave individual feedback on the pretest to each participant. Participants then each wrote a goal stating what they wanted to learn and how they would improve by using the test-taking strategy. In stage two the first author described the test-taking strategy and the purpose of the test-taking strategy to participants.
In stage three participants were trained to apply the “PIRATES” first letter mnemonic test-taking strategy as listed below:

The first author modeled each step of the strategy on a sample test while enlisting a cognitive think aloud strategy. First, students were instructed to write the acronym “PIRATES” on the front top of their test page. Then, in the “P” step of PIRATES, “Prepare to Succeed”, students were taught to write their names on each page of the test and count the number of sections and types of questions on the test. Next, students learned to order the sections of a test by level of difficulty to help them determine where to start on a test. Participants were shown how to begin working on the test by starting with the section determined by the test-taker to be easiest (See Figure 1).

In step two of PIRATES, participants were trained to “Inspect the Instructions” by reading the directions on the test and underlining the words that tell the test-taker what to do. In step three, participants learned to “Read, Remember, and Reduce” by reading each test item and eliminating answer choices that were clearly incorrect. In step four, “Answer or Abandon,” the participants were trained to answer the question if they were sure of the answer, or abandon the question if they were unsure of the answer. Participants learned to mark abandoned items with a symbol (e.g., a star). Participants were taught to repeat all previous steps for all remaining test items in the section they were working on, then to go on to the section they indicated to complete next (based on order of difficulty). Participants were instructed to again “Inspect the Instructions” for the next section and continue the strategy for the remaining sections and test items. In step five, “Turn Back,” participants were trained to return to the beginning of the test, locate the symbol for abandoned items, and either answer, or “Estimate.” Participants learned several estimating techniques including: avoiding absolute words, choosing the longest answer, and estimating similar choices. In the last step, “Survey,” participants were instructed to look over all the test items to make sure they had answered each item, but not to change any answers unless they were certain it was incorrect.

During stage four, verbal rehearsal, participants repeated each step and sub-step of PIRATES using flash cards and fading prompts until they memorized it and had been individually checked for mastery using the checklist provided in the test-taking instructor’s manual. When participants reached 90% mastery on memorization, they proceeded to stage five of instruction, which involved participants’ ap-

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pretest</td>
<td>Students take pretest measuring strategy use.</td>
</tr>
<tr>
<td>2. Describe</td>
<td>Instructor gives purpose and rationale for strategy and briefly previews each step.</td>
</tr>
<tr>
<td>3. Model</td>
<td>Instructor directly and explicitly models each step of the PIRATES strategy.</td>
</tr>
<tr>
<td>4. Verbal rehearsal</td>
<td>Instructor leads students in verbal repetition of each step and sub-step of the strategy to aid memorization and acquisition.</td>
</tr>
<tr>
<td>5. Controlled practice</td>
<td>Students apply strategy to practice tests designed to measure strategy use.</td>
</tr>
<tr>
<td>6. Advanced practice and feedback</td>
<td>Students apply strategy to “real” tests.</td>
</tr>
<tr>
<td>7. Posttest</td>
<td>Students take posttest measuring strategy use.</td>
</tr>
<tr>
<td>8. Maintenance</td>
<td>Instructor evaluates whether students have maintained strategy use at the end of 2-week post training on tests designed to measure strategy use.</td>
</tr>
<tr>
<td>9. Generalization</td>
<td>Instructor teaches students to generalize strategy to other settings (e.g., different subjects or courses).</td>
</tr>
</tbody>
</table>
of the test-taking strategy to controlled practice tests. The first author scored the controlled practice tests and provided individual feedback to participants. Steps of the strategy were re-taught after each test if the participant failed to reach a 90% mastery level. Once participants reached 90% mastery on one controlled practice test, the training ended and participants proceeded to stage six.

In stage six, advanced practice and feedback, participants applied the test-taking strategy to five achievement probes. Once a participant completed all five probes, they completed the posttest (i.e., stage seven). During stage eight, the participants were evaluated at the end of 2-week post training to determine if they maintained the use of strategy. During stage nine, the participants were taught to apply the test-taking strategy to a variety of regular classroom tests.

- **Prepare to Succeed**
  - Put name and PIRATES on the test
  - Allot time and order sections
  - Say affirmations
  - Start in two minutes

- **Inspect the Instructions**
  - Read the instructions
  - Underline what to do and where to do it
  - Notice special requirements

- **Read, Remember, and Reduce**

- **Answer or Abandon**

- **Turn Back**

- **Estimate**
  - Avoid absolutes
  - Choose the longest answer
  - Estimate similar choices

- **Survey**

*Figure 1. “PIRATES” mnemonic test-taking strategy.*

**Results**

The intervention of teaching the test-taking strategies was effective for all students in that the instruction increased the percent correct correct.
by at least 10 points for each participant on both the tests measuring strategy application and the probes measuring achievement. All students reached 80% mastery on achievement probes and the tests designed to measure test-taking application.

**Strategy Application**

Results on the test-taking application showed that Brandy and John both memorized the steps of the test-taking strategy as demonstrated by verbal repetition in only two attempts. Sarah and Amy had some difficulty memorizing the steps of the test-taking strategy, taking them five and six attempts, respectively, to verbally repeat the strategy correctly. Both Sarah and Amy had lower verbal ability scores on previous evaluations among all participants, thus it is possible that their difficulty memorizing and repeating the strategy could be attributed to the lower verbal ability.

Data were also collected to determine the level of accuracy with which each participant applied the test-taking strategy prior to training, during training, and post training, as measured by percent correct on the pretest, controlled practice tests, advanced practice tests, and posttest. All participants reached mastery of 80% correct during controlled practice and advanced practice, and demonstrated significant gains from pretest to posttest in their test-taking ability. Results are presented in Table 2.

**Achievement Probes**

Achievement probes results (see Figure 2) also support the effectiveness of the intervention. Brandy obtained a mean percent score of 55 (range 50–60) on achievement probes during baseline and a mean percent score of 77.4 (range 55–90) during post-training sessions. Her lowest score, at 55 percent during the second post-training session, could be attributed to the level of reading difficulty of the probe. The first author observed her having difficulty reading the passages in the probe which negatively impacted her score, and adjusted the subsequent probes to match her instructional reading level. John obtained a mean percent score of 55 (range 55–65) on baseline probes and improved his score to 82.4 (range 80–84) during post-training. Similarly, Sarah and Amy demonstrated substantial improvements on achievement probes, from a mean percent score of 45.5 (range 35–55) and 49.1 (range 30–65), respectively.

---

**TABLE 2**

Percent Correct on the Acquisition and Application of Test-taking Strategies

<table>
<thead>
<tr>
<th>Test</th>
<th>Brandy</th>
<th>John</th>
<th>Sarah</th>
<th>Amy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>19</td>
<td>40</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlled Practice 1</td>
<td>83</td>
<td>86</td>
<td>88</td>
<td>89</td>
</tr>
<tr>
<td>Controlled Practice 2</td>
<td>75</td>
<td>92</td>
<td>72</td>
<td>85</td>
</tr>
<tr>
<td>Controlled Practice 3</td>
<td>81</td>
<td>–</td>
<td>86</td>
<td>79</td>
</tr>
<tr>
<td>Controlled Practice 4</td>
<td>86</td>
<td>–</td>
<td>92</td>
<td>81</td>
</tr>
<tr>
<td>Controlled Practice 5</td>
<td>93</td>
<td>–</td>
<td>–</td>
<td>90</td>
</tr>
<tr>
<td>Post-training (with feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Practice 1</td>
<td>100</td>
<td>100</td>
<td>86</td>
<td>79</td>
</tr>
<tr>
<td>Advanced Practice 2</td>
<td>93</td>
<td>100</td>
<td>71</td>
<td>93</td>
</tr>
<tr>
<td>Advanced Practice 3</td>
<td>93</td>
<td>100</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>Advanced Practice 4</td>
<td>93</td>
<td>100</td>
<td>86</td>
<td>93</td>
</tr>
<tr>
<td>Advanced Practice 5</td>
<td>93</td>
<td>100</td>
<td>86</td>
<td>83</td>
</tr>
<tr>
<td>Posttest</td>
<td>90</td>
<td>92</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>Post-training (without feedback)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>93</td>
<td>86</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>Generalization 1</td>
<td>86</td>
<td>58</td>
<td>55</td>
<td>83</td>
</tr>
<tr>
<td>Generalization 2</td>
<td>86</td>
<td>86</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>
Figure 2. Percent correct on the achievement probes.
during baseline to a mean percent score of 77.8 (range 60–85) and 84.4 (range 70–100), respectively, during post-training. All participants maintained a minimum of 80% correct on the maintenance achievement probe two weeks after the training was terminated.

Generalization data on achievement probes showed much variability for all participants. Specifically, Brandy scored a mean percent of 56 (range 33–73), John 66.3 (range 44–80), Sarah 57.5 (range 40–75), and Amy 64 (range 53–75) on their regular classroom tests.

Social Validity Data
Parents and the special education teacher of the participants felt that students with mental disabilities were not prepared to take tests and that they either had no or only limited knowledge of test formats, while the general education teacher felt that students with mental disabilities were somewhat prepared to take tests and had some knowledge of test formats. All of the respondents felt that students with mental disabilities would benefit from test-taking strategy instruction. Regarding the perceived outcomes, all respondents agreed that the participants were more prepared to take tests after being taught the test-taking strategy.

Discussion
To extend current research and practice limitation on the use of test-taking strategies with elementary-age students with mental disabilities, the primary purpose of this study was to examine the effects of teaching a direct and explicit test-taking strategy on the reading and math achievement of students with mild mental disabilities in grades four and five.

All participants demonstrated the ability to acquire and apply a comprehensive, mnemonic test-taking strategy. Specifically, the participants required five or fewer controlled practices during training to reach a 90% mastery criterion on their use of test-taking strategies. All participants achieved a minimum level of 80% criterion on all five advanced practices during post training, with the exception of Sarah and Amy for whom feedback was provided only once when they failed to reach the criterion (i.e., Advanced Practice 2 for Sarah and Advanced Practice 1 for Amy). Additionally, all participants maintained their acquisition of the test-taking strategy on the posttest, 2-week maintenance assessment, and two generalization measurements of regular classroom tests. These results are consistent with previous research in two ways. First, students with mild mental disabilities effectively learned and applied the test-taking strategy through use of the nine-stage instructional sequence found in other learning strategy research with students with LD or EBD (Ellis, Deshler, Lenz, Schumaker, & Clark, 1991; Hughes & Deshler, 1993; Hughes & Schumaker, 1991; Morin & Miller, 1998). Thus, this study provides additional support to the efficacy and usefulness of teaching mnemonic test-taking strategies for students with disabilities. Second, the results support previous research in that students with disabilities not only can apply a test-taking strategy to tests, but also can maintain the skill over time and generalize use of the strategy to other test-taking situations (Hughes & Deshler, 1993; Hughes & Schumaker, 1991).

Results on participants’ achievement probes demonstrated a functional relationship between the test-taking strategy instruction and percent correct on math and reading achievement tests. During baseline, Brandy and Sarah received 60% correct or lower on all of the achievement probes while John and Amy scored 70% correct or lower on their achievement probes. During post training and 2-week maintenance conditions, all participants scored higher than their baseline performance on all of their five achievement probes, with the exception of the second data point for Brandy. Therefore, an experimental control was apparent in this study, supporting previous research on the efficacy of test-taking instruction in improving students’ achievement scores (Beidel et al., 1999; Bunting & Mooney, 2001; Kenny & Faunce, 2004; Lee & Alley, 1981; Scruggs et al., 1986; Scruggs & Marsing, 1988; Towns & Robinson, 1993; Winnen & Fuchs, 1993) and maintaining positive achievement outcomes over time (Hughes & Deshler, 1993; Hughes & Schumaker, 1991). However, the generalization data for the achievement probes were inconclusive. Although all participants improved the mean percent correct on the generalization achievement probes by 1% to 15% compared to the
baseline probes, data were highly variable and an experimental control was not achieved due to the lack of generalization data prior to the intervention. The low and variable generalization achievement scores may result from the participants’ academic skill levels. Specifically, all participants applied the test-taking strategy with a high level of accuracy to the generalization probes, however they sometimes had low overall scores because the content knowledge was too difficult or unfamiliar, or the test materials were not matched to their instructional reading levels. It is important to note that a test-taking strategy is not intended to compensate for gaps in content knowledge or reading ability. This may explain why the participants did not generalize their achievement outcomes to regular classroom tests, a finding inconsistent with previous research conducted with students who have high incidence disabilities (Hughes & Deshler, 1993; Hughes & Schumaker, 1991; Lee & Alley, 1981). Future research is warranted to develop strategies in promoting generalization across types of achievement tests and to develop appropriate tests measuring general education content with lower reading levels.

Some limitations were noted in this study. First, a large portion of the test-taking strategy training used in the current study relied heavily on print. Although modifications were made to the materials, and accommodations were given during the sessions, participants’ success was still somewhat contingent upon their reading ability. In order for the test-taking strategy to be most effective, the training materials should be matched to the participants’ instructional reading level. The materials developed by Deshler and colleagues (1993) were intended to be used with adolescents with LD, thus the reading levels were too difficult for elementary students with mild mental disabilities. Because the participants benefited from the content of the strategy, it would be beneficial for the reading level of the training materials to be modified for elementary students. Future research should include using the same procedures, but with lower level readability. Second, generalization data were only available post intervention and were not measured during baseline or training, making it difficult to evaluate the extent to which the participants generalized positive achievement outcomes to regular classroom tests. Future research is needed to more systematically collect and evaluate generalization data throughout the course of the study. Finally, during the course of the study, Amy changed eligibility categories from Educable Mentally Disabled to Other Health Impaired. Although her IQ score was still in the borderline range, it is possible that she performed better than other participants due to a higher cognitive ability level, making her results difficult to compare to those of students with EMD.

Despite the limitations, this study offers important research and practice implications. The No Child Left Behind Act of 2001 and the Individuals with Disabilities Education Improvement Act (2004) state that students with mild mental disabilities must be exposed to and assessed on general curriculum grade appropriate standards. States most often assess students’ achievement through the use of standardized tests, thus it is critical that students with mild mental disabilities continue to be taught direct and explicit test-taking strategies. This study demonstrates that students who are identified as having mild mental disabilities can be taught effectively a comprehensive test-taking strategy which may consequently improve achievement. Teachers and educators working with students with mild mental disabilities may utilize test-taking strategy instruction as a promising and valid method for improving students’ test-taking skills and academic achievement. In addition, this study points to the need for modifications in teaching students with mild mental disabilities who have lower academic skills and more reading delays. Participants in this study received instruction in a one-on-one setting, with direct instruction, verbal rehearsal, cue cards and fading prompts used as instructional methods to teach the test-taking strategy. Complex wording in the training materials was simplified or read aloud to students. If students with mild mental disabilities are to be held accountable through high stakes, standardized achievement testing, appropriate modifications must be made to allow these students to fully demonstrate their competence. Similarly, it is vital that appropriate training and test materials are developed so that they match to students’ instructional
reading levels for the maximum outcomes. In short, with carefully designed instruction and appropriate test materials, students with mild mental disabilities can be supported to successfully participate and demonstrate their learning in standardized assessments.

References


Received: 15 November 2006
Initial Acceptance: 5 February 2007
Final Acceptance: 21 June 2007