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THE EFFECT OF TEST-WISENESS ON SELF-EFFICACY AND MATHEMATIC PERFORMANCE OF MIDDLE SCHOOL STUDENTS WITH LEARNING DISABILITIES

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THE EFFECT OF TEST-WISENESS ON SELF-EFFICACY AND MATHEMATIC PERFORMANCE OF MIDDLE SCHOOL STUDENTS WITH LEARNING DISABILITIES

A dissertation submitted in partial fulfillment of the requirements for the degree of Ph.D. in Education at Virginia Commonwealth University.

by

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Abstract

THE EFFECT OF TEST-WISENESS ON SELF-EFFICACY AND MATHEMATIC PERFORMANCE OF MIDDLE SCHOOL STUDENTS WITH LEARNING DISABILITIES

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Virginia Commonwealth University, 2011

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The purpose of this study was to investigate whether the Test-Taking Strategy would improve performance on math curriculum-based assessments of students with disabilities, and if students reported an increased sense of math self-efficacy as a result of learning the Test-Taking Strategy. The Test-Taking Strategy uses mnemonics to teach strategies to help students successfully navigate through assessments. This study used an experimental, single-subject, multiple-probe, multiple base-line design (Horner & Baer, 1978). The design featured multiple participants, and followed the design features of quantitative research (Horner & Baer, 1978,

McMillan, 2004, & Mitchell & Jolley, 2004). The Test-Taking Strategy did result in improved performance on CBA (math quizzes) for some of the students in this study. However, some students did not increase performance on math CBA (math quizzes). Findings also indicated most students did not report an increased sense of math efficacy. Results of this study and the impact of these findings are discussed.

CHAPTER 1. INTRODUCTION

Across the Commonwealth, many local education agencies (LEA) have set their goals to comply with the No Child Left Behind (NCLB) Act of 2001. One of the goals of this federal legislation is that all children achieve high academic standards and are proficient in reading and mathematics, as evidenced by state assessments. Virginia's academic standards, known as the Standards of Learning (SOL), measure student achievement through annual tests. Math assessments are given in Virginia in grades 3 through 8, and at the end of selected high school courses. Students with disabilities are not making the gains needed to be proficient on state math assessments in grades 6 through 8 as indicated in Table 1 (Virginia Department of Education, 2011). Currently, it appears that progress toward reaching NCLB goals may be hindered by students' performance in mathematics, and an instructional strategy to support math instruction is needed.

Statement of Problem

During the 2007-2008 school year, fewer than 70% of students with disabilities in grades 6 through 8 passed Virginia's math SOL test (Virginia Department of Education, 2009). Of the 15 school divisions in the state superintendents' region 1, only three divisions reported a greater than 70% passage on the 2007-2008 SOL in mathematics for students with learning disabilities in grades 6 through 8, (Virginia Department of Education, 2009). Moreover, the pass rate of math assessments for students with disabilities decline as they progress from one grade to

Table 1

Assessment Results by Subgroup Percentage Pass

Students with disabilities	2006-2007	2007-2008	2008-2009	2009-2010*
Grade 3	74	74	75	78
Grade 4	62	69	73	75
Grade 5	70	73	77	76
Grade 6	39	49	59	61
Grade 7	37	50	63	67
Grade 8	47	58	69	71
Algebra I	-	78	79	81

*By the time a student with a disability completes grade 8, he or she would have had 3 years of consecutive unsuccessful math performance. As Table 1 shows, this number has increased in 2009-2010, as students with disabilities are not making the same progress in the area of mathematics as their nondisabled peers in grades 6 through 8.

Source. Virginia Department of Education (2011).

another. By the time a student with a disability completes the eighth grade, he or she would have had 3 years of consecutive unsuccessful math performance; as presented statewide, students with disabilities reported a 65% passage on the 2007-2008 SOL in mathematics for grades 6 through 8. Although that number has increased over the past 3 years, students with disabilities are not making the same progress in the area of mathematics as their nondisabled peers in grades 6 through 8.

Purpose of the Study

The purpose of this study was to investigate the test-wiseness skills of students with learning disabilities to determine if a greater degree of test sophistication increased self-efficacy and math assessment performance (CBA). Test sophistication was determined based on fluent use and mastery of the Test-Taking Strategy (Hughes, Deshler, Ruhl, & Schumaker, 1993).

Rationale and Significance of the Study

By 2013-2014, all states must improve student performance to the “proficient" level on state tests according to NCLB. In order to meet these goals, local education agencies must focus their resources on practices that will yield sustainable results for all students. Based on the data, however, students with disabilities are struggling to make the same progress as their nondisabled peers. Across the commonwealth local education agencies have set their own goals to comply with the No Child Left Behind Act of 2001.

One of the goals of this federal legislation is for all children to achieve high academic standards and become proficient in reading and mathematics, as evidenced by state assessments. State data indicate students with disabilities are not making the gains needed to be proficient on state assessments. The significance of this present study lies in its implications as an intervention for student math performance improvement.

The Test-Taking Strategy could potentially help middle school students, and others, who are making moderate, but not proficient (high) scores on curriculum bases assessments. Current research suggests test-wiseness helps students to more efficiently navigate curriculum-based assessments by recognizing and utilizing cues in the test items, thus performing better on tests. This could potentially increase the pass percentage of students with disabilities in grades 6 through 8 in the commonwealth.

Literature/Research Background

Introduction

In reviewing the literature related to this present study, four major variables: mathematics instruction and students with disabilities, student efficacy, test-wiseness, and the Strategic Instructional Model® were researched. Each variable has evolved in empirical investigations and, as such, was examined separately while demonstrating the overall theoretical framework for this study and its connection to the topic. A comprehensive review of the literature is provided in Chapter 2.

Mathematics Instruction and Students with Disabilities

Research demonstrates the challenges students with specific disabilities have with arithmetic (Butler, Beckingham, & Novak Lauscher, 2005; Geary, 2004;). Estimates vary, but some speculate that between 5% and 8% of students with disabilities struggle with math in multiple grade levels, and have difficulty with computation, reading word problems and division (Butler et al., 2005). For students with disabilities, explicit, systematic instruction that involves extensive use of visual representations appears to be crucial (Gersten & Clarke, 2009). Based on the performance of students with disabilities in the Commonwealth of Virginia, students in Virginia struggle particularly in grades 6 through 8 (Virginia Department of Education, 2009).

Self-Efficacy

Students with a strong sense of efficacy tend to challenge themselves with difficult tasks, and become intrinsically motivated. Students, who are highly motivated, will put forth the effort in order to meet their commitments, and attribute failure to things, which are in their control, rather than blaming external factors (Bandura, 1986). When students believe in their ability to be successful at a task, it increases work performance in core content areas such as mathematics (Jones, Wilson, and Bhojwani, 1997). Perceptions of self-efficacy and attitudes of failure and success are characteristics adolescents with disabilities form before they reach high school (Jones, Wilson, and Bhojwni, 1997).

Test-Wiseness

Thorndike (1951) first introduced the concept of test-wiseness with a discourse on its influence on test reliability. Test-wiseness has widely been defined as an individual's ability to improve his or her test score by recognizing and utilizing cues in the test items, format or testing situation (Millman, Bishop & Ebel, 1965). Millman et al. (1965) further identified elements independent of test construction or test purpose (time-using strategy, error-avoidance strategy, guessing strategy, and deductive reasoning strategy) and elements dependent upon the test constructor or purpose (intent consideration strategy and cue-using strategy) that would affect performance on tests. Those elements are the foundation for many test-taking strategies in use today.

Strategic Instruction Model®

The Strategic Instruction Model® (SIM) is a research-validated literacy program that helps adolescents learn how to learn, it provides a means for them to achieve independence and success. The Strategic Instruction Model® has two programs to support instruction, the Learning Strategies Curriculum and Content Enhancement Routines. SIM consists of a Learning Strategies Curriculum that acts in response to students' with disabilities need for direct, explicit instruction. Learning strategies are student-focused activities. Conversely, Content Enhancement Teaching Routines that promote effective instruction in academically diverse classes are teacher-focused activities. Learning Strategy instruction focuses on helping students become active learners by teaching them how to learn and how to use what they have learned to solve problems and be successful.

The Test-Taking Strategy

The Test-Taking Strategy is designed to be used while taking classroom tests. Students follow seven steps in the strategy. Students allocate time, prioritize each section of the test, if there is more than one, carefully read and focus on important elements in the test instructions; recall information by accessing mnemonic devices; systematically and quickly progress through a test, make well-informed guesses, check their work, and take control of the testing situation. The emphasis is on teaching adolescents and adults who struggle with learning.

The literature reviewed in this study was to gather information about the areas of interest and to identify gaps in the literature. Information gained was used to answer the research questions of this study.

Research Questions

This research seeks to answer these questions:

1. What, if any, impact does direct training using the Test-Taking Strategy (TTS) have on student performance on math curriculum based assessments (CBA) for four middle school students with learning disabilities?

    a. How long does it take students with LD to master the TTS?

    b. Do students who have mastered the TTS consistently use it on math CBA when cued?

    c. Do students who have mastered the TTS consistently use it on math CBA without cues?

    d. When students apply the TTS consistently on math CBAs, without cues, does the TTS result in higher math CBA scores?

2. What perceptions do students have about their performance and self-efficacy on curriculum based math assessments, when The Test-Taking Strategy is used?

    a. Do students report increased self-efficacy related to math assessment when they have mastered The Test-Taking Strategy?

Methodology

Participants

The participants in this present study consisted of four seventh grade middle school students from a rural school division in central Virginia. Study participants are identified as having a specific learning disability, and/or demonstration of poor test performance. Study participants along with their classmates were taught the Test-Taking Strategy as a part of their instructional curriculum during science period and enrichment period. The building administrator selected the class which was taught the strategy. Study participants were selected based on their disability identification, enrollment in the class selected to be taught the strategy, and having provided assent and consent. Copies of the assent and consent form are provided in Appendix A.

Eight students and their parents, meeting the study criteria were invited to attend two scheduled informational meetings. Of the 8, 5 students gave assent to participate in the study. One student moved shortly after beginning the strategy leaving four participants. Of the four study participants, one is female and all are Caucasian between the ages of 13 and 14.

Procedures

The *Test-Taking Strategy Instructors' Manual* from was used to teach the strategy in the present study (Hughes, Schumaker, Deshler & Mercer, 1988). Materials outlined in the instructors' manual were used for strategy instruction, implementation of procedures, and evaluation of skill mastery. There are eight stages in this strategy. The researcher, who is a certified Strategic Instruction Model® Professional Developer, taught the strategy. The researcher taught the strategy through Stage 8 and collected data according to manual instructions to ensure fidelity of implementation for all students in the science and enrichment class. All eight stages will be discussed in detail describing its contents in subsequent chapters. Students in the science class were the same as those in the enrichment class. For the purposes of the study, additional data were collected on study participants only. The researcher collected data on study participants' performance on curriculum-based assessments (CBA) (math quizzes), and responses to statements on a Math Interest Inventory (MII). A multiple baseline design across individuals and phases of implementation was employed to analyze data.

Virginia Standards of Learning (SOL) released grade 7 mathematics tests were used as repeated measures in this study. Spring 2006, 2007, and 2008 released tests were modified to create new quizzes. The released tests were modified to reduce the number of items, and to fit in the time allotted for each study session. Study participants were given a math quiz each week during the study. Study participants' scores were recorded, entered into an Excel worksheet, graphed and analyzed.

The Mathematics Interest Inventory (Stevens & Olivarez, 2006) was given to determine if participants perceived an increased level of self-efficacy in math skills as a result of learning the Test-Taking Strategy. The inventory was a 27-item instrument in which students responded to statements on a scale of 1–*not at all like me* to 4–*very much like me*. Study participants' scores were recorded, entered into an Excel worksheet, graphed and analyzed. The responses were used to answer research question number 2.

A single-subject, multiprobe design was chosen over other designs because it is necessary to determine change over time in individual performance of students. A single prepost test would not provide the information needed to determine if students' test-wiseness affected math performance. By increasing the number of measures during the intervention, skill mastery in the Test-Taking Strategy and its impact on math and other content assessments was determined at the end of the eight stages of the strategy.

Summary

Recent legislation has required all students to demonstrate proficiency in the area of mathematics. An instructional strategy such as the Test-Taking Strategy may support students in improving test scores in mathematics. Students learn to efficiently navigate through curriculum-based assessments by recognizing and utilizing cues in the test items thus performing better on tests. Test-wise behaviors assist students in navigating through assessments by focusing on time management, guessing techniques, and excluding responses.

This present study investigated the effect of the strategy instruction on student performance in mathematics and self-efficacy. Identifying an instructional strategy to serve as an intervention for mathematics will allow classroom teachers to more adequately prepare students with disabilities for a variety of math assessments. Chapter 2 discusses the research studies around mathematics instruction and students with disabilities, self-efficacy, test-wiseness, and the Strategic Instruction Model®.

CHAPTER 2. LITERATURE REVIEW

Introduction

In reviewing the literature related to this study, four major variables: mathematics instruction for students with learning disabilities, student efficacy, test-wiseness, and the Strategic Instructional Model were researched. Each variable has evolved in empirical investigations and, as such, was examined separately while demonstrating the overall theoretical framework, test-wiseness, (Thorndike, 1951) for this study and their connection to the topic.

A comprehensive review of research related to mathematics, student efficacy, test-wiseness, and the Strategic Instructional Model® were conducted using several research databases including, ERIC, Dissertations Abstracts Online, Academic OneFile, JSTOR, LexisNexis Academic, LexisNexis Congressional, and PsycINFO. The literature review process also included the use of libraries, Googlescholar, dissertations, journal articles, and books. Once all the related literature was obtained, notes were taken using index cards, which allowed for easy organization and retrieval. Steps to review literature were followed according to recommendations of McMillian (2004).

Mathematics Instruction and Students With Disabilities

The demands on teachers are felt across all curriculum areas. In light of the increased emphasis toward using "scientifically-based research" as specified in No Child Left Behind Act of 2001 (NCLB), teachers of mathematics are challenged to identify strategies rooted in research that yield positive outcomes for students. Moreover, as students with disabilities are accessing the general education curriculum through the use of inclusive practices, the need to embed strategies to reduce deficits is critical to student success.

Research demonstrates the challenges students with specific disabilities have with arithmetic (Butler et al., 2005; Geary, 2004). Geary's (2004) work in the area of mathematics learning disabilities (MLD) emphasizes the many domains in which mathematical comprehension evolves. Whether poor achievement is due to inadequate instruction or an actual cognitive disability are often the questions heard when trying to find answers to why students with disabilities are not successful. Geary offers a more holistic approach by examining comprehension of math facts, processing skills, arithmetic knowledge, and procedural skills. Geary's study identifies memory, cognitive deficits, and procedural errors as causes of poor performance among students with mathematics learning disabilities.

The present study explored the use of specific procedures and routines for use when taking assessments. Test taking strategies are not a replacement for math skill. Students must have an understanding of the concepts they are being assessed on, and be able to demonstrate how to solve numerical problems. For many students with disabilities, the lack of understanding how to process through simple and complex math problems can lead to repeated failure if not addressed early in their school career. When these problems are not addressed, we can see failure across grade levels as evidenced in state Standard of Learning Assessments.

Estimates vary, but some speculate that between 5% and 8% of students with disabilities struggle with math in multiple grade levels and have difficulty with computation, reading word problems, and division (Butler et al., 2005). Butler et al. (2005) conducted case studies around strategic content learning (SCL) to identify a strategy that would support students' complete required tasks. SCL is a technique teachers use by asking probing questions to guide students through the steps of solving a problem. Students in this study strategically acquired math skills to self-regulate their learning in mathematics. Similarly, the Test-Taking Strategy teaches students a process were they are regulating how they approach tests. Specifically, the strategy addresses what to do when the student does not know the answers to questions, and to respond when they do not have the answer.

McLeod and Armstrong (1982) reported similar findings concerning types of difficulties students have as reported by their teachers. In their research study they administered a survey to teachers asking what tasks were difficult for students to complete. The results indicated that division and basic operations as areas in which students have the greatest amount of difficulty. They also found the lack of remediation techniques available for teachers to support students with disabilities as a major concern as well.

In their research brief on effective strategies for teaching students with difficulties in mathematics, Gersten and Clarke (2009) studied six aspects of instruction: visual and graphic depictions of problems, systematic and explicit instruction, student think-alouds, use of structured peer-assisted learning activities involving heterogeneous ability groupings, formative assessment data provided to teachers, and formative assessment data provided directly to students. They found that for students with disabilities, explicit, systematic instruction that involves extensive use of visual representations appears to be crucial and have the greatest effect on student performance. Consistently strong effects (1.19%) were found for systematic and explicit instruction. Similar results were found for student think-alouds (0.98%).

There is no question that students with learning disabilities struggle with mathematics. How instruction is delivered is critical for comprehension. Choosing the best delivery method based on the behaviors or weakness students exhibit is critical. Bryant, Bryant, and Hammill (2000) identified empirically validated behaviors consistent among students with identified weaknesses in mathematics. Those behaviors included having difficulty with word problems, the language of math, reaching unreasonable answers, misalignment of horizontal numbers in large numbers, and numbers written illegibly.

This is important to the current study because of its implications to math instruction and instructional strategies that yield positive outcomes for students. Having knowledge of behaviors types that are consistent with students with disabilities will allow teachers to take a proactive approach to instructional planning and implementation of techniques and strategies to remediate troublesome areas such as time management.

Student Efficacy

Students with a strong sense of efficacy tend to challenge themselves with difficult tasks and tend to be intrinsically motivated. Students, who are highly motivated, will put forth the effort in order to meet their commitments and attribute failure to things, which are in their control, rather than blaming external factors (Bandura, 1986). When students believe in their ability to be successful at a task it increases work performance in core content areas such as mathematics (Jones et al., 1997). For the purposes of this study, self-efficacy is defined as one's positive belief in his or her abilities, and positive feelings as individuals.

Perceptions of self-efficacy and attitudes of failure and success are characteristics adolescents with disabilities form before they reach high school (Jones et al., 1997). The present study investigated how middle school students felt about their ability to perform on curriculum-based assessments after being taught the Test-Taking Strategy. Students who believed they could solve problems did better than those who did not. Pajares and Miller (1994) found that belief affected choices students made, their effort to specific tasks, and level of perseverance. Students' belief about their ability to respond to questions is a useful predictor of actual ability to be successful on assessments (Pajares & Miller, 1994). Pajares and Miller (1994) measured the math efficacy, perceived usefulness of mathematics, math anxiety, math self-concept, and math performance of 350 undergraduates. They found men reported higher math efficacy than women did, and students' judgments about their capability to solve math problems were more predictive of their ability. Their findings strengthen Bandura's (1986) social cognitive theory. Part of good instruction is sound educational pedagogy. Bandura discussed the need for the environment to support student self-efficacy. Teachers can help by reducing stressful situations and lowering anxiety-surrounding events like exams or presentations (Margolis & McCabe, 2006).

Another study (Usher, 2009) further confirms the tenets of social cognitive theory. In Usher's study, eight middle school students reported varying levels of self-efficacy during semistructured interviews. He found students with high mathematics self-efficacy also reported having high levels of achievement in mathematics. Students with low mathematics self-efficacy reported having low levels of achievement in mathematics. The important point here is that the interpretations students make of their past successes and failures serve as an important source of information about their efficacy.

Test-Wiseness

Test-wiseness may be used to lower anxiety and build a level of efficacy for optimal test performance. Providing students with visual strategies in order to recall facts that have been previously taught may reduce stress and anxiety (Wigfield & Meece, 1998). Pajares (2002) suggested practical solutions to improve the motivation of struggling learners including strategies such as using peers as role models and teaching specific learning strategies such as the Test-Taking Strategy.

Thorndike (1951) introduced test-wiseness in the literature as a construct. He identified general test-wiseness as a possible source of variance in scores on a particular test. Thorndike (1951) further describes test-wiseness as "the general ability to comprehend instructions" (p. 578). Although identified as a possible source of variance by Thorndike (1951), Gibb's (1964) study demonstrated that test-wiseness can be measured. Future studies also demonstrate positive outcomes for students with disabilities (Hughes, Deshler et al., 1993).

Gibb (1964) contributed the first empirical study of test-wiseness. Using the work from Thorndike (1951) as his framework, Gibb went on to investigate the problem of cues (hints or visual indicators) in test items. Gibb characterized test-wiseness as a secondary cue response. Meaning, test-wiseness is related to how well a student is able to identify cues within the test questions and stems to accurately select the correct answer regardless of actual content knowledge. Gibb's work concluded that the use of secondary cues benefited students who used them with multiple-choice test items.

Moreover, Gibb (1964) suggested there is reason to believe test-wiseness skills cannot be generalized to support learners with varying levels of content knowledge. Gibb's test of test-wiseness was constructed using a 70-item test to examine the assumption that test-wiseness consists in part of the ability to detect and respond favorably to the presence of seven types of secondary cues in test items. Gibb's (1964) secondary cues include the following:

1. 'Clang' or alliterative associations be test-wiseness seen the stem and the correct alternative.
2. Incorrect alternatives that are grossly unrelated or bear an absurd relationship to the stem.
3. Inclusion of words such as 'all,' 'none,' 'never,' 'always,' 'every,' etc.
4. Correct alternatives that are clearly more precise in meaning.
5. Correct alternatives that are visibly longer than incorrect alternatives.
6. Grammatical cues, such as differences in number or tense of verbs or nouns.
7. One item 'giving away' the answer to another item occurring in a different part of the test (p. 34).

Using Gibb's (1964) empirical study to draw from, Millman et al. (1965) analyzed its components and developed what is used today as a framework for future empirical investigation Millman et al. (1965) characterized test-wiseness as a "subject's capacity to utilize the characteristics and formats of the test and/or the test taking situation to receive a high score" (p. 707). They expanded on the construct by asserting that test-wiseness is "logically independent of the examinee's knowledge of the subject matter for which the items are supposedly measures" (p. 707).

Millman et al. (1965) identified implications for testing and suggested that if the use of test-wiseness skills significantly makes a difference in test performance, it would be desirable to seek ways to reduce differences in test-wiseness among examinees in order to provide more valid estimates of actual abilities and achievement levels. Similarly, Roznowski and Bassett (1992) suggested teaching test-wiseness skills merely demonstrated how well students can use secondary cues to respond to test questions, rather than demonstrating mastery of content. Their work suggested that teaching test-wiseness skills might interfere with the validity of assessments.

Millman et al. (1965) identified test-wiseness principles (strategies) and divided the principles into two distinct groups: elements independent of the test constructor or test purpose (time-using, error-avoidance, guessing, and deductive reasoning); and elements dependent upon the test constructor or purpose (intent consideration, and cue-using).

They argued that teaching test-wiseness skills does not accurately assess what a student knows, rather his/her ability to use secondary cues to answer questions. While their assumption is worth mentioning, it goes out of the scope of this study. It did, however, lay the foundation for the future work of Hughes, Schumaker et al. (1988) who used those strategies to support students with disabilities. Their work will be discussed in detail later in this chapter. The work of Millman et al. (1965) is important in the overall education of students because it addresses assessment. Assessment and student performance drives instruction.

The use of test-wiseness is not limited to the field of education. Many businesses and organizations test individuals for the purpose of promotions. It has been argued that test-wiseness may reduce test bias. Houston's (2005) work revealed that having test-wiseness skills allowed examinees the ability to identify cues; it did not have a significant impact on learning or behavior measures.

In another study, Morse (1998) identified that depending on age, some of the test-wiseness skills are more difficult to employ than others. Skills such as memorizing the mnemonics and recalling the meanings were challenging for many students. This finding is of particular interest when determining when to teach test-wiseness skills. It also identified populations (students with autism) who have a particularly difficult time with steps in the Test-Taking Strategy. Morse's (1998) work suggests the use of the Test-Taking Strategy in secondary environments for optimal results. This finding is also supported by the study done by Hughes, Deshler et al., 1993).

Strategic Instruction Model®

The Strategic Instruction Model® (SIM) is used for strategy instruction in reading, test performance, math, studying, writing, and reading strategies (University of Kansas Center for Research on Learning, 2006). SIM was developed by the Institute for Effective Instruction as an integrated model of research-validated practices to address many of the needs of diverse learners, primarily focused on adolescents. It has been under development for 30 years at the University of Kansas Center for Research on Learning. The model counters the fragmented nature of the learning experience by creating a continuum of service delivery, in which all educators have clearly defined and coordinated roles (University of Kansas Center for Research and Learning, 2009). From the model, the Learning Strategies Curriculum was designed to enable students to cope effectively with instructional demands. The Learning Strategies Curriculum consists of three instructional strands as shown in Table 2. The Test-Taking Strategy falls under the expression and demonstration of competence strand (The University of Kansas, Center for Research and Learning, 2009).

Table 2

Learning Strategies Curriculum

Acquisition	Storage	Expression and demonstration of competence
Word identification	First-letter mnemonic	Sentences
Paraphrasing	Paired associates	Paragraphs
Self-questioning	Listening and note taking	Error monitoring
Visual imagery		Themes
Interpreting visual aids		Assignment completion
Multipass		Test taking

Research and all components of SIM adhere to four philosophical principles: (a) most low-achieving adolescents can learn to function independently in mainstream settings; (b) the role of the support-class teacher (special education) is to teach low-achieving adolescents strategies (e.g., use of mnemonics) that will enable them to be independent learners and performers; (c) the role of the content teacher (general education) is to promote strategic behavior (e.g., independent practice) and to deliver subject matter information in a manner that can be understood and remembered by low-achieving adolescents.

Finally, the fourth principle, adolescents should have a major voice in decisions about what strategies they are to learn and how fast they are to learn these strategies (The University of

Kansas, Center for Research and Learning, 2009). This allows students to self-advocate and be active contributors to their instruction. Based on individual needs, students may select which strategies they want to learn.

These tasks are accomplished by adherence to philosophical principles and test-wiseness interventions. The test-wiseness kinds of interventions, content routines and learning strategies were developed to address the performance gap, the gaps between what students are expected to do and what students are able to do.

Content Enhancement Routines

Teacher-focused interventions are directed at how teachers think about, adapt, and present their critical content in a learner-friendly fashion. Content Enhancement Routines are sets of inclusive teaching practices that help teachers carefully organize and present critical information in such a way that students identify, organize, comprehend, and recall it (The University of Kansas, Center for Research and Learning, 2009).

Learning Strategies

Student-focused interventions are designed to provide the skills and strategies students need to learn the content. The Learning Strategies Curriculum encompasses strategies for acquiring information from the printed word, strategies for organizing and memorizing information, strategies for solving math problems, and strategies for expressing information in writing-including on tests (The University of Kansas, Center for Research and Learning, 2009). For the purpose of this study, the Test-Taking Strategy was used to determine its impact on student performance on math curriculum-based assessments (CBA).

The Test-Taking Strategy

Hughes and Schumaker (1991) designed and evaluated the effects of teaching a relatively complex test-taking strategy to adolescents with learning disabilities. Their study provides evidence that students with learning disabilities can be taught a test-taking strategy. The strategy can be applied effectively on tests in classroom settings. Their study consisted of six middle school students between the ages of 13 and 17 enrolled in a resource class. Students were taught the strategy using the mnemonic PIRATES. The results indicated students were able to successfully master the test-taking strategy. A growing number of researchers have conducted studies of the effectiveness of the Test-Taking Strategy on a variety of populations (with and without disabilities).

Ritter and Idol-Maestas (2001) reported that heterogeneous groups made significant improvement in mastery of the strategy usage. Their study consisted of 56 sixth grade students. Students were taught a mnemonic to assist them in taking tests. The findings of Rittter and Idol-Maestas (2001) indicated that average and good readers can benefit from a test taking strategy when tests are given by the same individual who taught the strategy.

Hughes, Deshler et al. (1993), using a multiple-probe design, examined the use of the Test-Taking Strategy with students with emotional and behavioral disorders. Their study consisted of six students in eighth and seventh grades. All students were formally identified as having an emotional behavior disorder (EBD) (according to Florida guidelines). Using the PIRATES mnemonic, students were taught the strategy. During baseline, students' scores were reflective of their lack of knowledge about the strategy. However, once instruction began, students' scores increased demonstrating an increased knowledge about the strategy. This provided evidence that students with EDB could successfully acquire and maintain the skills of a test-taking strategy.

Songlee, Miller, Tincani, Sileo, and Perkins (2008) had similar results when they investigated the use of the Test-Taking Strategy with adolescents with autism spectrum disorders (ASD). Their study included four secondary students in 11th, 10th, 8th, and 6th grades. Strategy instruction took place after school. Prior to the study, the researchers met with the participants to provide an overview of the study and go over expectations (regular attendance, completion of consent/assent forms). Songlee et al. found that the students learned the strategy in 14 hours of instruction time, and students were successful in application of the steps. Due to the needs of students with ASD, the researchers recommended more instruction related to several strategy steps (allotting time and ordering of sections).

The Test-Taking Strategy helps students with a variety of learning difficulties to organize their work, set a reasonable pace to complete tasks, focus on positive test outcomes, and restructure how they approach test taking. These tactics can strengthen struggling learners' beliefs in their academic abilities, and increase their willingness to engage in academic tasks.

Summary

The literature related to test-wiseness has its roots in educational measurement (Thorndike, 1951). The use of such a construct to support student learning is very promising because it provides a framework for studying based on test construction and measurement practices. The seminal work of Millman et al. (1965) and Gibb (1964) supports the importance of structure in test taking.

The present study investigated the gaps in literature related to mathematics instruction and students with disabilities, self-efficacy, test-wiseness, and the Strategic Instruction Model®. Research demonstrates the use of test-wiseness skills or the effects of the Test-Taking Strategy instruction in adolescents with autism spectrum disorders (Songlee et al., 2008); adolescents with severe learning disabilities (Deshler, Alley, Warner, & Schumaker, 1981); college students (Holzer, Madaus, Bray & Kehle, 2009); younger students in elementary settings (Scruggs, White & Bennion, 1986); with language-based, text rich content (e.g., reading, history, language arts, science). However, there is little empirical research in the use of the Test-Taking Strategy in the area of mathematics with students with disabilities.

Definition of Terms

Test-Taking Strategy. The instructional model developed by researchers at the University of Kansas, Center for Research and Learning.

Test-wiseness. The ability to use cues within the content of the test question or stem to increase likelihood of identifying a correct response.

Self-talk. Speaking out loud to review facts, steps, and processes.

Strategic Instruction Model®. An integrated model of research-validated practices to address many of the needs of diverse learners, primarily focused on adolescent.

Content Routines. Teacher-focused interventions developed by the University of Kansas.

Learning Strategies. Student-focused interventions developed by the University of Kansas.

Efficacy. Self-efficacy is defined as one's positive belief in his or her abilities, and positive feelings about himself/herself as an individual.

CHAPTER 3. METHODOLOGY

Introduction

The previous chapter focused on a review of the literature related to mathematics instruction, student efficacy, test-wiseness, and the Strategic Instructional Model® (SIM). This chapter focuses on the study design, including rationale for design choice. It is followed by a description of the study participants, setting, instruments, data collection, and analysis of data. This chapter concludes with a summary of the methodology.

Research Questions and Design

This study used an experimental, single-subject, multiple-probe, multiple base-line design (Horner & Baer, 1978). The design featured multiple participants and followed the design features of quantitative research (Horner & Baer, 1978; McMillan, 2009; Mitchell & Jolley, 2004). It was the intent of this research to answer these questions:

1. What, if any, impact does direct training using the Test-Taking Strategy (TTS) have on student performance on math curriculum-based assessments (CBA) for four middle school students with learning disabilities? Subquestions investigate:

a. How long does it take students with LD to master the TTS?

b. Do students who have mastered the TTS consistently use it on other math CBA when cued?

c. Do students who have mastered the TTS consistently use it on other math CBA without cues?

d. When students apply the TTS consistently on math CBAs, without cues, does the TTS result in higher math CBA scores?

Another question of interest was:

2. What perceptions do students have about their performance and self-efficacy on curriculum-based math assessments, when the Test-Taking Strategy is used? An additional subquestion investigated:

a. Do students report increased self-efficacy related to math assessment when they have mastered the Test-Taking Strategy?

Selecting a design that uses repeated measures will answer these important questions. A single-subject design was most appropriate for this proposed study, because it allows for repeated measures over time, and as a population, students with learning disabilities are unique with different abilities (Kazdin, 1982, 2011; Kennedy, 2005). As such, serving as their own control group facilitates their specific instructional needs. Additionally, single-subject design rigorously evaluates the effects of intervention with each participant (Kazdin, 1982, 2011; Kennedy, 2005). The design proposed provided information regarding the research questions, and subquestions listed above.

Participants

The population for this study were Virginia middle school students with a learning disability. The sampling frame consisted of middle school students identified as having specific learning disabilities according to their IEP. The sample consisted of five seventh grade students receiving instruction in the Test-Taking Strategy, with documented assent and consent on file. One student moved shortly after the study began, leaving four study participants.

The participants of this study met the following criteria: (a) current special education diagnoses of specific learning disability; (b) enrolled in the class receiving strategy instruction, (c) average 60% on math assessments as reported by student grades reports, (d) difficulty taking tests as reported by teachers and parents, and (e) read on at least the fourth-grade level, as reported by school staff.

Assent and Consent

Following Virginia Commonwealth University, Internal Review Board procedures for obtaining assent and consent, the researcher advertised the purpose of the study to the parents of seventh grade students through written communication from the building administrator. The building administrator also followed up the letters by calling the eligible students' parents. He reminded them of the meeting date and time and invited them to attend. Assent and consent forms are presented in Appendix A. The announcement identified dates and times for meetings to provide detailed information about the study and its purpose. All applications were reviewed by the researcher, and the parents of applicants selected to participate were notified by mail. A subsequent letter to parents outlined specific logistics (location, time, and materials to be used).

Setting

Strategy instruction activities took place at a middle school in a rural school division in central Virginia. Strategy instruction, math quizzes (CBA) and the Mathematics Interest Inventory (Stevens & Olivarez, 2005) were all given in classrooms in the school building. The research site was chosen because the researcher had previously provided technical assistance to the school division related to math, its proximity to Virginia Commonwealth University, and an identified need for support in the area of mathematics by the building administrator. Students received the strategy instruction in the general education classroom. Strategy instruction took place during the instructional day, beginning September 2010 through March 2011.

Instruments

Three instruments were used to collect data for this study: the *Test-Taking Strategy Instructors Manual* (Hughes, Schumaker et al., 1988) was used to provide the Test-Taking Strategy; it was used as the intervention in this study. The Test-Taking Strategy has eight stages and teaches students how to utilize time management, guessing techniques, and how to approach the test instrument when unknown information is presented. The strategy uses the mnemonic PIRATES, and a sentence featuring additional submnemonics "If you PASS and RUN you'll score more points and ACE the test." A description of the stages and mnemonic are presented in Appendix B.

Math quizzes, developed by the researcher, were used as curriculum-based assessments (CBA). The math quizzes were developed by using released Virginia Standard of Learning math tests as a guide. The math quizzes consist of 10 questions, each assessing students' knowledge of computation and estimation; number and number sense; measurement and geometry; probability and statistics; and patterns, functions, and algebra. The quiz was a 2-page, double sided instrument that students were allowed to write on. Quizzes were given weekly to students to determine their performance during strategy instruction.

Mathematics Interest Inventory (MII) was given to measure changes in self-efficacy toward mathematics. The inventory is a 27-item, 1-page double-sided document. The inventory contains statements for which students were asked to rate how they felt about each statement. Statements were rated on a scale of 1 to 4. Four with the statement *being very much like the rater*, to 1 with the statement *not at all like the rater*. The MII was given three times during the course of the study. A sample is provided in Appendix C. Each instrument is described in detail later in this chapter.

Test-Taking Strategy

To answer research questions 1, 1a, 1b, 1c, and 1d the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988) was used to provide strategy instruction. The manual contains instructions for implementation, procedures, evaluation guidelines, scoring guidelines, data collection forms, charts, tests, and cue cards. During implementation, data were maintained on the participants' progress. Table 3 summarizes these instructional stages and the order in which they were taught.

Table 3

The Test-Taking Strategy Instructional Stages

Stages	Instructional stages
1	Pretest and make commitments
2	Describe
3	Model
4	Verbal practice
5	Controlled practice
6	Advanced practice
7	Posttest and make commitments
8	Generalization

Source. Hughes, Schumaker et al. (1988)

Curriculum-Based Assessment

The Commonwealth has identified academic standards, called the Standards of Learning (SOL), which measures student achievement. Annually, the SOL tests are given to public school students. SOL assessments measure student achievement in English, mathematics, science and history/social science. SOL assessments measure student achievement in English, mathematics, science and history/social science. Students are assessed in English and mathematics in grades 3 and 8, and at the conclusion of certain high school-level courses.

Virginia Mathematics Standard of Learning released tests for grade 7 from 2006, 2007 and 2008 were modified by the researcher and served as repeated measures that were given weekly during stages 1 through 8. These tests were modified to reduce the number of items and to allow for the amount of time given for strategy instruction. Eleven modified quizzes were created. Grade 7 released items were used as repeat measures because the strategy was taught to seventh grade students. This provided information for analysis of research questions 1b, 1c, 1d, and 2.

Mathematics Interest Inventory

The Mathematics Interest Inventory (MII) was developed to assess interest for the specific domain of mathematics. The Mathematics Interest Inventory developed by Stevens and Olivarez (2006) is shown in Appendix C. Items were developed based on a current literature review, language and behaviors relevant to fourth grade students and three factors, emotion, knowledge, and value. The inventory consists of 27 math interest items. In order to analyze research question 2, and 2a, the inventory was given to study participants three times during the course of the study. Students' responses were used to determine if they perceived an increased level of self-efficacy as a result of learning the Test-Taking Strategy.

Data Collection Procedures

Test-Taking Strategy

During Stage 1, data were collected using a pretest of students' current test-taking skills. Results were scored on a score sheet provided in the manual. All data were recorded on the individual student's progress chart, the researcher's management chart, and in Excel worksheets. During Stage 2 students were taught the strategy. During Stage 3, the researcher modeled how the strategy should be used when taking a test. No Test-Taking Strategy (TTS) data were collected in these two stages. During Stage 4, students verbally demonstrated mastery of the Test-Taking Strategy. The verbal practice checklist was used to record accuracy of steps identified. Students must achieve a mastery of 100% to move to Stage 5.

During Stage 5, data were collected on how successful students used TTS strategies on controlled practice tests. The results were recorded on the individual student's progress chart provided in the manual. During Stage 6, data were collected on how successful students use the strategy when taking other classroom assessments. Score sheets were used to record the results. During Stage 7, a posttest was given to collect data as a final measure of the students' test-taking skills. Student progress was recorded on progress charts.

Finally during Stage 8, maintenance tests were given and data were collected to ensure that students used the strategy. Table 4 provides a visual of data collection procedures throughout the study.

Table 4

Curriculum-Based Assessments

Question	Method	Data collection	Measure	Steps	Comments
1. What impact does direct training using the Test-Taking Strategy (TTS) have on student performance on math curriculum-based assessments for four middle school students with learning disabilities?	Single-subject, multiple baseline, multiple probes	Percentage of strategic responses performed on modified released 7th grade math SOL tests (math quizzes).	Performance of TSS on released grade level math SOL tests (math quizzes).	1. Administer TSS strategy. 2. Administer math quizzes. 3. Score quizzes, record results on Excel worksheet. 4. Analyze data.	
1a. How long does it take students with learning disabilities to master the TSS?	Single-subject, multiple baseline, multiple probes	Data of mastery for all eight stages.	Number of sessions to reach mastery for all eight stages.	1. Give pretest. 2. Teach eight stages. 3. Require students to meet mastery requirements. 4. Give posttest. 5. Record on graph paper, and create table of results. 6. Analyze data.	Stagger beginning of instruction for each student.
1b. Do students who have mastered the TTS consistently use it on math CBA (math quiz) when cued?	Single-subject, multiple baseline, multiple probes	Percentage of fluent use of strategy steps in stages 4 through 6 on math quizzes given.	Performance of TSS on math quizzes using advanced practice scoring sheet.	1. Administer math quizzes during stages 4 through 6 with cues from researcher to use strategy.	Consistent use means obtaining 85% or greater on TTS advanced scoring sheet.

Table 4 - continued

Question	Method	Data collection	Measure	Steps	Comments
				2. Score quizzes for fluent use of strategy steps. 3. Record data on Excel worksheet. 4. Analyze data.	
1c. Do students who have mastered the TTS consistently use it on math CBA (math quiz) without cues?	Single-subject, multiple baseline, multiple probes	Percentage of fluent use of strategy steps in stages 7 and 8 on math quizzes given.	Performance of TSS on math quizzes using advanced practice scoring sheet.	5. Administer math quizzes during stages 7 and 8 with cues from researcher to use strategy. 6. Score quizzes for fluent use of strategy steps. 7. Record data on Excel worksheet. 1. Analyze data.	Consistent use means obtaining 85% or greater on TTS advanced scoring sheet.
1d. When students apply the TTS consistently to math CBA (math quiz) without cues, does the TTS result in higher math CBA scores (math quiz)?	Single-subject, multiple baseline, multiple probes	85% of fluent use of strategy on math quizzes without cues. % of correct responses performed math quizzes.	Performance on math quizzes performing 85% of TSS strategic responses without teacher assistance.	1. Administer math quiz without cues to use strategy. 2. Score for fluent use of TSS and % correct on quiz.	Consistent use means obtaining 85% or greater on TSS advanced scoring sheet.

Table 4 - continued

Question	Method	Data collection	Measure	Steps	Comments
				3. Analyze data for consistent use of TTS and increase of CBA (math quiz). 8. Record data on Excel worksheet.	
2. What perceptions do students have about their performance and self-efficacy on curriculum-based math assessments when the Test-Taking Strategy is used?		Mathematics Interest Inventory	Responses to questions on Mathematics Interest Inventory.	1. Administer inventory before initiation of training. 2. Administer inventory after students complete Stage 8.	
2a. Do students report Increased self-efficacy (DV) related to math assessment when they have mastered the Test-Taking Strategy (IV)?		Mathematics Interest Inventory	Responses to questions on Mathematics Interest Inventory.	1. Administer inventory before initiation of training. 2. Administer inventory after students complete Stage 8.	

Curriculum-Based Assessments

The CBA (math quizzes) are representative of the content included in the actual SOL tests. Modified tests from 2006, 2007, and 2008 were used. The tests were modified by the researcher to provide a sampling of the various reporting categories, to reduce the number of questions, and to allow for the amount of time for strategy instruction. Participants were permitted to record answers on the quiz. The researcher created a score sheet to document student responses. The answer keys provided with the released tests were used by the researcher for scoring, along with the Test-Taking Strategy advance practice score sheet.

Mathematics Interest Inventory

The 27-item Mathematics Interest Inventory (MII) was given three times during the course of the study. Data were collected using an Excel spread sheet. Results were analyzed according to instructions provided by the developers.

Data Analysis

Visual inspection methods according to Kazdin (1982, 2011) and Kennedy (2005) were used to analyze data collected. Methods included the examination of graphs for patterns from which conclusion could be drawn and research questions could be answered. Patterns such as trend, level, and variability within each phase were examined. Each graph was also inspected for patterns between phases such as immediacy of effect and overlap. Performance difference between phases is an important aspect of visual analysis (Parker & Vannest, 2009). This was also captured when graphs were examined for effect size. Effect size was determined by calculating the ratio of data points above the effect line (phase B) with the total number of data points presented in both phases.

The Test-Taking Strategy

Tests were scored by the researcher using scoring evaluation information and scoring sheets provided by the instructors' manual. Students used their progress sheets to graph their progress across stages. Tests were analyzed for mastery at each stage. Stage 4 requires a mastery of 100%; Stage 5, 90%; Stage 6, 85%; Stage 7, 90%; Stage 8-phase 2, 85%; Stage 8-phase 4, 90%.

Curriculum-Based Assessment

Curriculum-Based Assessments (math quizzes) were analyzed in several ways. First scores from CBAs were analyzed for percentage correct. Tests were scored by the researcher, with a maximum possible score of 100%. Each weekly quiz was graphed and entered on an Excel worksheet. CBA (math quizzes) were also analyzed for fluent use of the Test-Taking Strategy after Stage 3. The researcher used the Test-Taking Strategy score sheet for advanced practice to score fluent use of the strategy on math quizzes. Data were analyzed for increases or decreases in use during the eight stages of strategy instruction. All data were plotted manually using graph paper prior to entry into an Excel worksheet.

Mathematics Interest Inventory

The Mathematics Interest Inventory was analyzed by comparing sum and averages for each student for each of the three times (phases) the inventory was given. Overall sums and averages were reviewed for decreases in negative valence ratings, and increases in positive valence ratings. Time was analyzed for each student for decreases and increases across each phase.

Internal Review Board

Approval from Virginia Commonwealth University's Internal Review Board (IRB) was secured prior to beginning any aspect of this study. The study was assigned the VCU IRB Protocol number HM12968. IRB approval was required because the research involved human subjects. The researcher completed the CITI training program for the Protection of Human Research Subjects and filed all appropriate paperwork with IRB office.

Summary

The methodology for this study was determined based on the questions proposed by this research. The single-subject design evaluated the effects of the intervention for each participant. The participants consisted of middle school students who had received instruction in the Test-Taking Strategy. The study took place in a rural middle school in central Virginia.

The *Test-Taking Strategy Instructors' Manual* (Hughes, Schumaker et al., 1988), a modified version of the Mathematics Interest Inventory (Stevens & Olivarez, 2005), and CBA (math quizzes) served as study instruments; data collection consisted of test probes, interest inventory responses and math CBA (math quiz) results. An analysis of the data was conducted using Kazdin's (1982) visual inspection model.

CHAPTER 4. FINDINGS

Introduction

In the previous chapter the methods of this study were discussed. This chapter will cover demographics of study participants; procedures and modifications of study instruments (the Test-Taking Strategy [TTS], curriculum-based assessment [CBA] and the Mathematics Interest Inventory [MII]); an analysis of the data collected; and answers to each research question. Finally, results of the investigation relevant to each of the two research questions, and subquestions will be illustrated in narrative, graph, and table formats for each study participant.

Procedures

The Test-Taking Strategy was taught to all students in a seventh grade science and enrichment class. The same students were in both classes that ran concurrently. As part of the Test-Taking Strategy instruction, data were collected on students' progression through the eight stages of the strategy. Additional data, specifically Mathematics Interest Inventory (MII) results, and CBA (math quiz) performance results were obtained from students who met the study criteria.

A single-subject, multiple probe across subjects research design was used to evaluate the impact of Test-Taking Strategy on (a) math curriculum-based assessment performance, and (b) mathematics self-efficacy. Results of this study were obtained through (a) reviewing data collected from student performance on curriculum-based assessments; (b) reviewing data collected from responses on an interest inventory, *My feelings about math*; and (c) reviewing data collected from students' Test-Taking Strategy progress charts.

After obtaining IRB approval, two informational meetings were held to provide an overview of the study procedures, explaining what the strategy was designed to do; to obtain volunteers to participate; obtain consent (parents) and assent (students); and answer questions from parents or students. Invitations were sent to the parent(s) of students identified has having a disability by the school in the science and enrichment class in which the strategy was taught. The building administrator sent out the informational letters, presented in Appendix D, and also called to remind parents of meetings. The building administrator was present for both meetings to explain why this particular instructional strategy was chosen to be taught during the science and enrichment period. The researcher also obtained support from the school division to conduct this research study.

Test-Taking Strategy Procedures

The procedures for data collection and implementation "what to do," for all eight stages were scripted, and were followed by the researcher according to the *Test-Taking Strategy Instructors' Manual* (Hughes, Schumaker et al., 1988). The scripted lessons for instruction are consistent across all eight stages containing goals, materials needed, how to prepare, how much time to allow, what to do, what is required for mastery, next steps, and troubleshooting suggestions.

Instructional sessions took place during a 6-month period. Sessions where held from 1 to 3 days per week during the science and/or enrichment period. Each session lasted from 30 to 90 minutes. On some days the researcher worked exclusively with study participants to collect study data (CBA and MII), on some days the researcher worked with the entire class on the Test-Taking Strategy, and other days the researcher worked half the period with study participants, and the other half with the entire class providing strategy instruction. This depended on the teacher's instructional schedule or school events on that particular day. The data collected answers to research question number 1a.

For the purposes of this study, the researcher divided the Test-Taking Strategy implementation into three phases; baseline, instruction/practice (intervention), and follow-up.

Phase 1: Baseline data collection. The researcher followed the scripted lessons and data collection procedures provided in the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988). During baseline, a pretest (Stage 1, Pretest and make commitment) was administered. Students were given 25 minutes to complete the pretest. The pretest was scored by the researcher, scores plotted on student progress charts, documented on the management chart, and feedback was given to each student individually or in small groups.

Feedback consisted of a review on how the student performed with regard to the test-taking skills sampled by the pretest. Students learned the success formula, a concept which illustrates how learning the Test-Taking Strategy along with effort equals success. The researcher was committed to doing her best to teach the strategy, and the students wrote statements committing to learn the strategy.

During this phase, 3 of the 4 students had baseline CBA scores below the recommended basal CBA score of 50% (Hughes, Deshler et al., 1993). The researcher determined, due to the nature of the study to measure the effect of the TTS on math CBA, to continue with these students. This modification will be discussed in Chapter 5.

Phase 2: Strategy instruction/practice. The researcher followed the scripted lessons and data collection procedures provided in the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988). Direct instruction was provided by describing (Stage 2) the strategy and providing a rationale for its use, characteristics of situations and times in which students would be able to apply the strategy. Students were introduced to the mnemonic PIRATES, which are the seven steps in the strategy, and the corresponding submnemonics. Appendix B describes the mnemonics and corresponding submnemonics.

One modification made by the researcher in Stage 2 was to teach students to look for where to respond first, and then identify what to do. It was discovered by the researcher that it was easier for students to determine what to do if they knew where they had to respond first. Once students were taught the seven steps, the researcher modeled how to use the steps on a test (Stage 3). Using scripted lessons and data collection procedures provided in the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988), the researcher provided students with an opportunity to verbally practice (Stage 4), practice with tests constructed by strategy researchers (Stage 5), and practice the strategy steps on class tests (Stage 6) at each stage reaching mastery levels identified by the study designers.

Phase 3: Follow-up. The researcher followed the scripted lessons provided and data collection procedures in the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988) and students demonstrated their comprehension of the strategy on a posttest(s) (Stage 7). The researcher followed the scripted lessons provided in the manual and reviewed steps to make sure students internalized the strategy through generalization. Maintenance probes (Stage 8) were used to serve as a final measure of the students' test-wiseness and internalization. Two modifications were made in Stage 8 related to mastery requirements.

During Stage 8, Phase 2, the researcher modified the criteria for mastery by allowing students to submit one instance of strategy usage rather than four. During Phase 3, the researcher collected one report of strategy use form rather than four as demonstration of mastery. Another modification was the amount of time used for strategy instruction. On some days scheduled sessions were cancelled due to the unusual number of weather delays and weather-related school cancellations. All of the modifications mentioned were done to allow for more time to collect math and efficacy data. Strategy instruction was not compromised due to the minor change in the number of items required to demonstrate mastery.

Data were collected using charts provided in the *Test-Taking Strategy Instructor's Manual* (Hughes, Schumaker et al., 1988). At the end of each session, students recorded the date each stage was completed and graphed the percentage points earned on each test on their progress chart (tests are not given in stages 2 and 3). In addition to recording strategy data on the forms identified in the manual, study participants' strategy data was graphed, and entered in an Excel worksheet.

Curriculum-Based Assessment Procedures

CBA (math quiz) were given to study participants every 7 to 10 days to determine their performance before during and after instructional strategy. Students were given the quiz in another classroom near the science class. Study participants were given the test and a pencil. Students were instructed to record their responses on their quiz. Students were given 25 minutes to take the 10-item quiz. Study participants were prompted to use the Test-Taking Strategy on their math quizzes after completing Stage 2 of strategy instruction. Usage prior to Stage 2 of strategy instruction was not feasible because the students had not been taught the strategy. Study participants were not prompted to use the Test-Taking Strategy on their math quizzes during follow-up.

Quizzes were collected and scored for percentage correct, and fluency of use of the Test-Taking Strategy. The Test-Taking Strategy score sheet for advanced practice was used to score for fluency of use. After quizzes were given, the researcher did not remediate, provide feedback or go over the quizzes with study participants because the focus of this study was to examine the effects of the intervention on performance, not to provide an additional intervention in the form of feedback or remediation. Quiz performance data were graphed and entered in an Excel worksheet. Results were used to answer research question number 1c. Quizzes were scored in two ways, the percentage correct and the fluent use of the TTS. The advanced practice and activation score sheet was used to determine usage of the Test-Taking Strategy fluency on quizzes.

Mathematics Interest Inventory Procedures

The *My feelings about math mathematics* interest inventory, presented in Appendix C was given three times during the course of the study: during baseline, during instruction, and follow-up. Study participants were given the inventory in another classroom near the science classroom. Study participants were given the inventory, a two-sided document and a pencil. They were instructed to describe how well each statement described them using a 4-point scale: 4, *very much like me*; 3, *sort of like me*; 2, *not much like me*; and 1, *not at all like me*. The study participants were given 30 minutes to complete the inventory. In most instances study participants finished in approximately 15 minutes.

To calculate a score for each inventory, the researcher added up scores from each statement for a total score. Then, each statement was color coded by category. Positive valance (intrinsic attractiveness) was coded blue, negative valance (aversiveness) was coded pink, and statements related to time (sequencing of events or duration spent on math-related tasks) were coded orange. Next, columns were created in an Excel worksheet for each category featuring the statement number and the rating given by the study participant. The ratings for each category were computed for sum and average. An example of the worksheet is presented in Table 5. The results were used to answer research question 2.

Reliability and Validity

Reliability

Curriculum-based assessments (CBA). The CBA (math quizzes) was developed using the state of Virginia SOL assessments. The SOL assessments were developed to measure student performance on state math standards. The math quizzes were developed by using 2006 and 2007 released math SOL seventh grade tests. Two questions were taken from each reporting category (computation and estimation; number and number sense; measurement and geometry; probability and statistics; and patterns, functions, and algebra) to form quizzes with 10 items. A total of 11 quizzes were created.

Each new quiz was identified by MRTS061 through MRTS063, MRTS071 through MRTS075, MRT081 through MRT083. The MRT denotes “math released test,” the first two

Table 5

Sample of Excel Responses to Math Interest Inventory (Alice)

Number	Positive valance	Number	Negative valance	Number	Time
1	3	2	1	3	2
4	3	5	4	6	2
7	3	8	2	9	3
10	4	11	2	12	1
13	3	14	2	15	2
16	4	17	1	18	4
19	3	20	4	21	1
22	3	23	4	-	-
24	2	25	2	-	-
26	4	27	3	-	-
Sum	32	Sum	25	Sum	15
Average	3.2	Average	2.5	Average	2.1485714

numbers denote the year of the released SOL test. Study participants earned 10 points for each question answered correctly. Study participants were asked to take a math quiz every 7 to 10 days depending on what else had to be covered instructionally or if the study participants were taking another performance measure (e.g., the MII). The modified quizzes were given weekly during instructional sessions. Participants received a different quiz during Stage 1 through Stage 7. During Stage 8, quizzes repeated starting with the first quiz administered. Study participants received the same instructions, and the same amount of time was given for each administration.

Test-taking strategy. The materials used to implement the Test-Taking Strategy were used according to the directions in the instructor's manual. The strategy was taught by a certified Strategic Instruction Model® Professional Developer. Strategy materials were reviewed by another certified Strategic Instruction Model® Professional Developer to verify they were prepared according to manual directions. Six samples (pretest, verbal practice checklist, controlled practice test, advanced practice test, posttest, and maintenance test) of strategy tests were scored by another professional developer to provide interobserver agreement. On the six samples, the raters agreed 98% of the time.

Mathematics interest inventory. The Perceptions of Math Study was conducted by researchers at Texas Tech University. From that study the Mathematics Interest Inventory, titled *My feelings about math,* was used to measure how students feel about math. Part of this research study was to examine the effect of test-wiseness on student efficacy. After a review of the literature on efficacy scales, specifically efficacy as it relates to math, the researcher contacted the developers asking for permission to use the Mathematics Interest Inventory (MII).

Permission was granted to use and modify the instrument as needed. The developers also provided information for recoding and calculating the scales.

Internal Validity

Threats to internal validity were systematically addressed during the planning and implementation of this study. Campbell and Stanley (1963) identify eight threats to internal validity. Maturation was addressed by using a multiple probe design rather than a continuous baseline. The relatively short baseline and intervention periods along with short session lengths also reduced the maturation threat. The purpose of this study was to indentify an intervention to support students with difficulty in mathematics and those who have difficulty taking curriculum-based assessments. Regression effects should be considered in this study because of the identified performance level of the participants. Another threat was selection bias. Of the eight eligible participants, only five volunteered to participate in the study. This study was limited to one class, in one school, in one school division, which limited the selection of possible participants. The final threat identified is attrition. The study began with five participants. One student moved from the area reducing the number of study participants to four.

Participant Demographics

The study participants all attended the same middle school in central Virginia. All four students were scheduled for the same science and enrichment class during the same period of the day. The ages of the participants ranged from 13-1 to 13-3 years. The mean age for the participants was 13-2 years. All four participants were Caucasian, of the 4, 1 was female. The participants were in the seventh grade and were receiving special education services.

Table 6 provides an overview of demographics and specific information about special education program specifics.

According to their Individualized Education Program (IEP) one student received services for math in a self-contained class, one received instruction in all collaborative classes, one received collaborative English, and one received services in a collaborative math class. All were identified as having a specific learning disability.

The researcher reviewed each student's grades for the first marking period as reported by their homeroom teachers. Grades were based on student performance on various classroom assignments. These assignments were grouped into four categories, homework, class work, tests, and quizzes. Two of the four students earned final grades in the low to mid-80s (grade of C), and two earned final grades in the low-70s (grade of D). Table 7 provides an explanation of the letter grades used by homeroom teachers.

Setting

This study took place during the school day during science and/or enrichment period. The classroom was equipped with a Smart Board, Elmo projector, and magnetic clips which allowed strategy posters to be hung. Each student had his or her own desk. Textbooks and other instructional materials rested on the floor beside each student desk. Both the classroom teacher and instructional assistant were present during some of instructional sessions.

When this study began neither the teacher nor assistant was trained to teach the Test-Taking Strategy. However, by the end of the study, the teacher and the instructional assistant were trained by the researcher to teach the strategy. Although they were both trained,

Table 6

Student Demographics and Special Education Information

	Alice	**Brandon**	**Charles**	**Donald**
Age	13	13	13	13
Disability categorical identification	SLD math	SLD	SLD math	SLD
Accommodations and modifications listed in individualized education program (IEP).	Use of a calculator, small group, directions read.	Calculator, hard copy of notes, word processor, clarified directions.	Preferential seating, small group, calculator.	Clarified directions, seating.
Gender	Female	Male	Male	Male
Ethnicity	White	White	White	White
School programs to support math.	Self-contained math		Small group, calculator	OT fine motor skills
Final grade for first marking period.	D	D	C	C
Final average for the first marking period.	73.8	71.1	82.94	85.48

Table 7

Middle School Grade Scale

A	93 - 110
B	86 - 92
C	75 - 85
D	70 - 77
F	0 - 69

neither assisted nor participated in the collection of data or strategy instruction. They both were trained as part of the school's professional development activities.

Effect Size

To provide greater evidence of the effect of the Test-Taking Strategy on performance on CBA (math quizzes), the nonoverlap method called percentage of nonoverlapping data (PND) was used to determine effect size of quiz performance of all study participants. Analysis procedures for PND were done according to Parker, Vannest, and Davis (2011) and Parker and Vannest (2009). Procedures are described in Table 8. "Nonoverlapping data as an indicator of performance differences between phases has long been an important part of visual analysis in single-case research (SCR)" (Parker & Vannest, 2009, p. 357). Effect size on quiz performance is provided for each study participant and will be discussed throughout this chapter.

Table 8

Computation Summary of Percentage of Nonoverlapping Data

Method	Procedure
Percentage of nonoverlapping data.	1. Single highest data point in Phase A (instructional phase) identified (Hi). 2. Transparent ruler helps identify Phase B data points above Hi. 3. Ratio of numbers of data points above Hi to Phase B total data points.

Research Question 1

What, if any, impact does direct training using the Test-Taking Strategy (TTS) have on student performance on math curriculum based assessments (CBA) for four middle school students with learning disabilities?

Alice

Alice is a 13-year old, Caucasian, female who currently receives services as a student with a specific disability in mathematics. She receives self-contained support for math, and spends the remainder of her instructional day in collaborative classes. Her accommodations and modifications include the use of a calculator, having directions read, and small group instruction. Her final average for the first marking period was a D (73.8).

Alice learned the Test-Taking Strategy by taking a pretest, participating in the description of the strategy, watching a demonstration of strategy application, verbally practicing steps, and demonstrating knowledge of steps through successful mastery of controlled, advanced, post, and maintenance tests. Alice earned a score of 39% on the pretest in Stage 1. Achieving a score at the mastery level of 90 would indicate that this particular strategy is not needed. Alice made two attempts before reaching mastery in verbal practice. Five attempts were made in controlled practice before mastery was met. During stages 7 and 8, Alice demonstrated mastery on the first attempt. Alice has demonstrated her ability to learn and reach mastery and comprehensive test taking strategy. Alice's performance on the Test-Taking Strategy is illustrated in Figure 1.

Math quizzes (curriculum-based assessments) were given every 7 to 10 days except during baseline. During instruction, Alice's scores on math quizzes appeared to steadily increase. During follow-up Alice's scores continued in an upward trend, with her highest

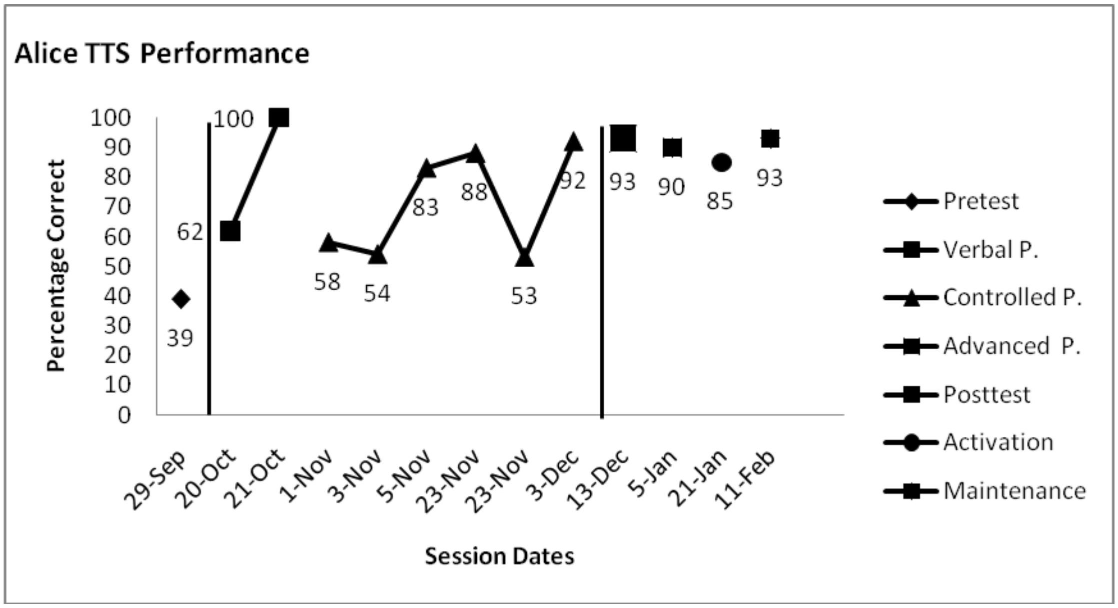

Figure 1. Alice's TTS performance.

score occurring on the last quiz given. Alice's average score during baseline was 15%. Her average score during follow-up was 52%, an increase of 36%. It would appear the intervention impacted Alice's performance on curriculum-based assessments. Alice's scores on the CBA (math quiz) are illustrated in Figure 2.

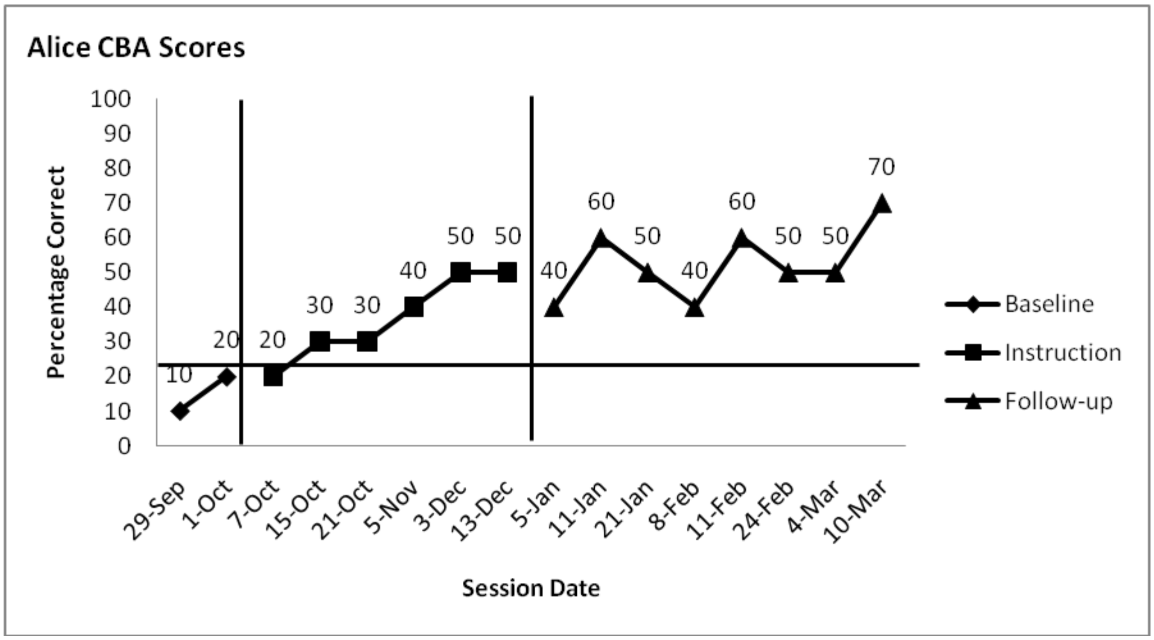

Figure 2. Alice's CBA scores and effect size.

A calculation of effect size using PND indicates a strong effect 0.928 or 93%. A strong effect implies that Alice's performance on math quizzes improved. When scores on TTS are compared to scores on quizzes, it appears that as Alice became proficient in strategy usage, her scores on quizzes increased. As Alice's progress in the TTS fluency increased, math quiz performance increased. This is presented in Figure 3.

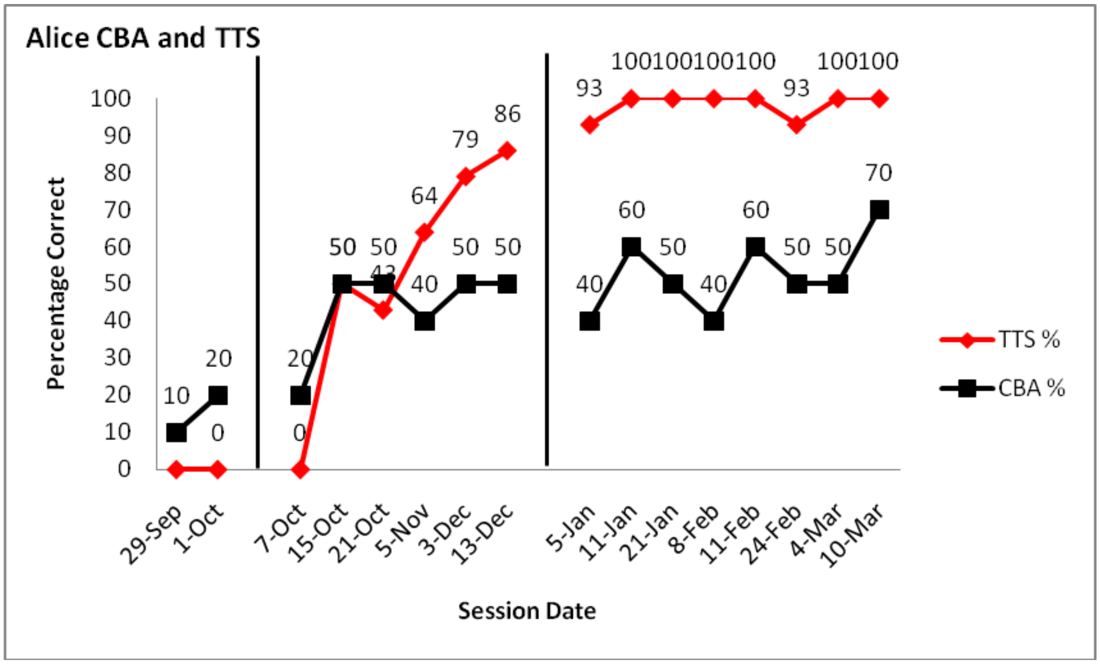

Figure 3. Alice's CBA and TTS compared.

Alice's math quiz percentage average during baseline was 15%; during instruction it was 36%, and her average during follow-up was 52%. Alice's average percentage of fluent use of strategy steps during baseline was 0%, during instruction it was 44%, and during follow-up it was 99%. Alice reached mastery of the TTS and her quiz performance showed improvement from baseline. Her performance on the last math quiz administered was 70%, a 60% increase from her baseline performance.

Brandon

Brandon is a 13-year old, Caucasian, male who currently receives services as a student with a specific disability in written language. He receives support for written language and processing. All of his core content courses are taught in a collaborative setting. His accommodations and modifications include the use of a word prediction software program, clarified directions, the use of a word processor, and a hard copy of class notes. His final average for the first marking period was a D (71.1).

Brandon learned the Test-Taking Strategy by taking a pretest, participating in the description of the strategy, watching a demonstration of strategy application, verbally practicing steps, and demonstrating knowledge of steps through successful mastery of controlled, advanced, post, and maintenance tests. Brandon earned a score of 38% on the pretest in Stage 1. Achieving a score at the mastery level of 90 would indicate that this particular strategy is not needed. Brandon made three attempts before reaching mastery in verbal practice. During the second attempt, his score dropped considerably. Four attempts were made in controlled practice before mastery was met. Mastery in Stage 6 was achieved in two attempts, while Stage 7 was reached on the first attempt. Activation and maintenance required three attempts before mastery was achieved. Brandon demonstrated his ability to learn and reach mastery a comprehensive test taking strategy. Brandon's performance on the Test-Taking Strategy is illustrated in Figure 4.

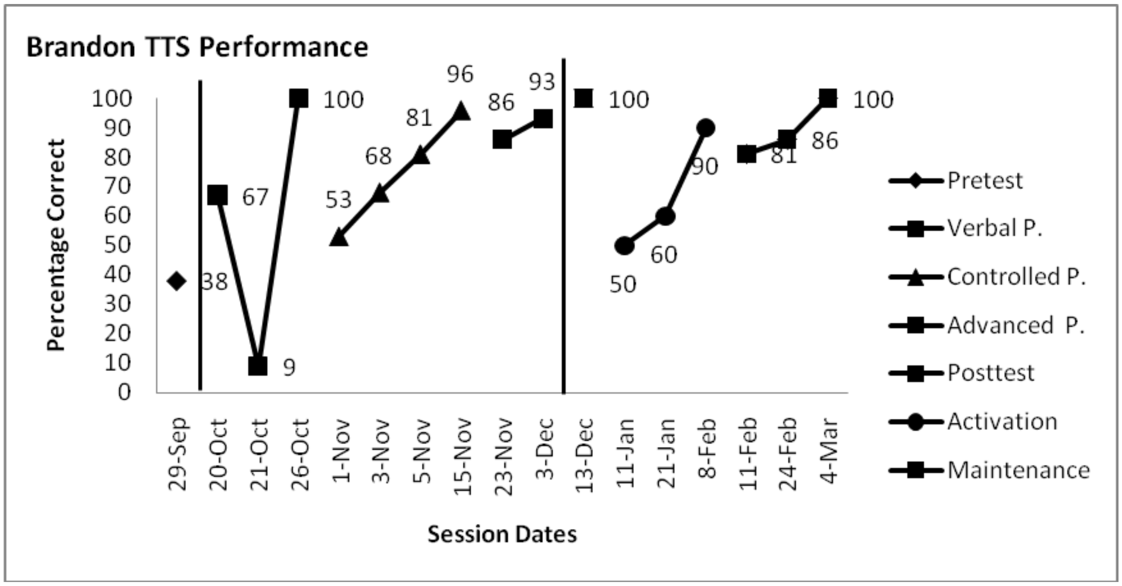

Figure 4. Brandon's TTS performance.

During instruction, Brandon's scores on math quizzes appeared to decrease. During follow-up, Brandon's scores continued in same trend as they did during instruction, with his highest scores occurring once during instruction and once during follow-up. His highest score was 40%. Brandon's average score during baseline was 25%. His average score during follow-up was 27%, an increase of 2%. It would appear the intervention did not impact Brandon's performance on curriculum-based assessments. Brandon's scores on the CBA (math quiz) are illustrated in Figure 5.

During instruction and follow-up, Brandon's scores on math quizzes appeared to be consistently low. A calculation of effect size using PND indicates a weak effect 0.125 or 12%.

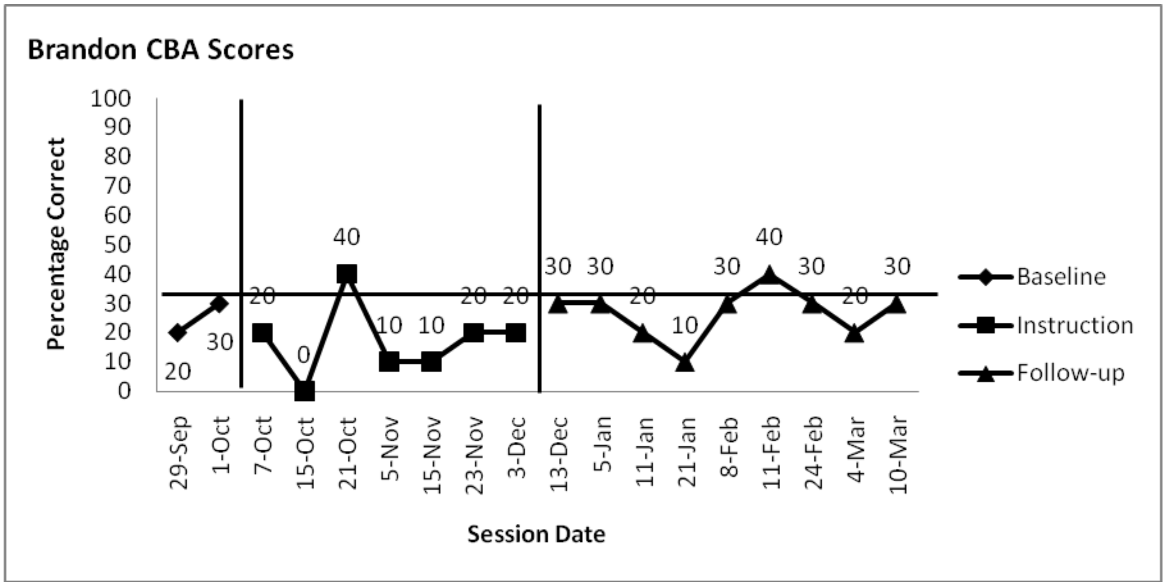

Figure 5. Brandon's CBA scores and effect size.

As progress in the Test-Taking Strategy fluency increased, quiz performance decreased over stages. When scores on the TTS were compared to scores on quizzes, it appeared that as Brandon became proficient in strategy usage, his scores on quizzes remained consistently low. This is presented in Figure 6.

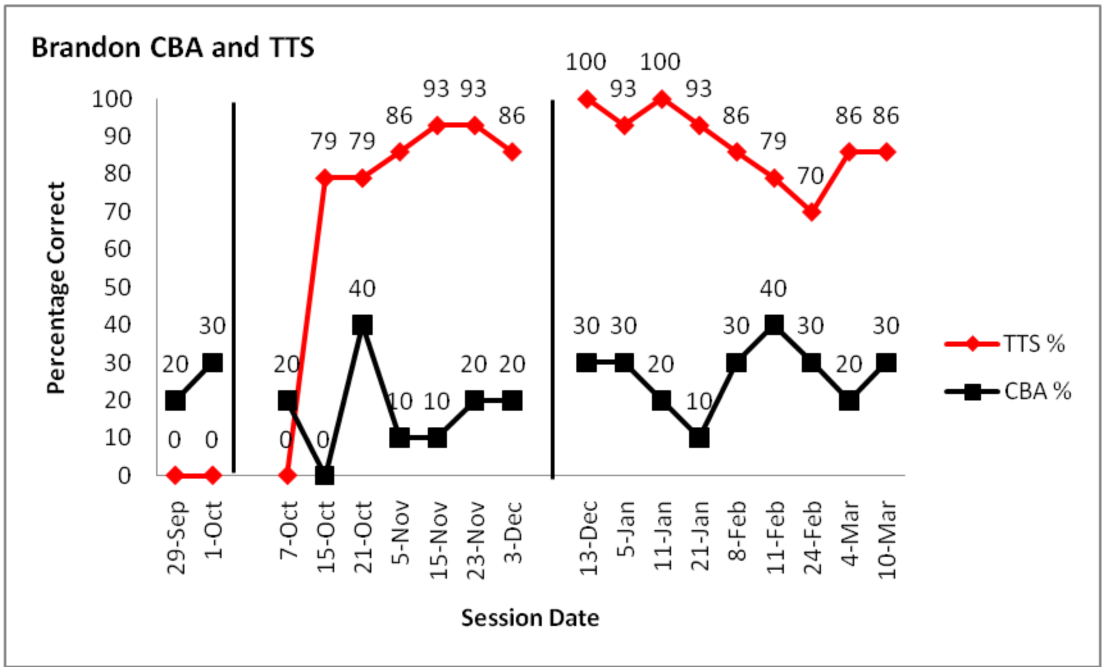

Figure 6. Brandon’s CBA and TTS compared.

As TTS instruction increased, Brandon’s performance on quizzes showed little improvement in both instruction and follow-up; however, Brandon’s percentage of fluent use of strategy steps increased. Brandon’s quiz percentage average during baseline was 25%; his average during instruction was 17%, and his average during follow-up was 26%. Brandon’s average percentage of fluent use of strategy steps during baseline was 0%, during instruction it was 73%, and during follow-up it was 89%. Although Brandon reached mastery of the TTS, his quiz performance did not improve from his baseline performance. Variability in performance is noted with overlap during baseline, instruction, and follow-up. Brandon's final quiz score of 30% was similar to his baseline score average of 25%, indicating little change.

Charles

Charles is a 13-year old, Caucasian, male who currently receives services as a student with a specific disability in math. He receives support for math in a collaborative setting, but all other core content classes are in the general education setting. His accommodations and modifications include the use of a calculator, clarified directions, and small group instruction. His final average for the first marking period was a C (82.94).

Charles learned the Test-Taking Strategy by taking a pretest, participating in the description of the strategy, watching a demonstration of strategy application, verbally practicing steps, and demonstrating knowledge of steps through successful mastery of controlled, advanced, post, and maintenance tests. Charles earned a score of 30% on the pretest in Stage 1. Achieving a score at the mastery level of 90 would indicate that this particular strategy is not needed. Charles made two attempts before reaching mastery in verbal practice. Four attempts were made in controlled practice before mastery was met. Mastery in Stage 6 was achieved in two attempts, while Stage 7 was reached on the first attempt. Activation and maintenance mastery were achieved on the first attempt. Charles demonstrated his ability to learn and reach mastery a comprehensive test taking strategy. Charles's performance on the Test-Taking Strategy is presented in Figure 7.

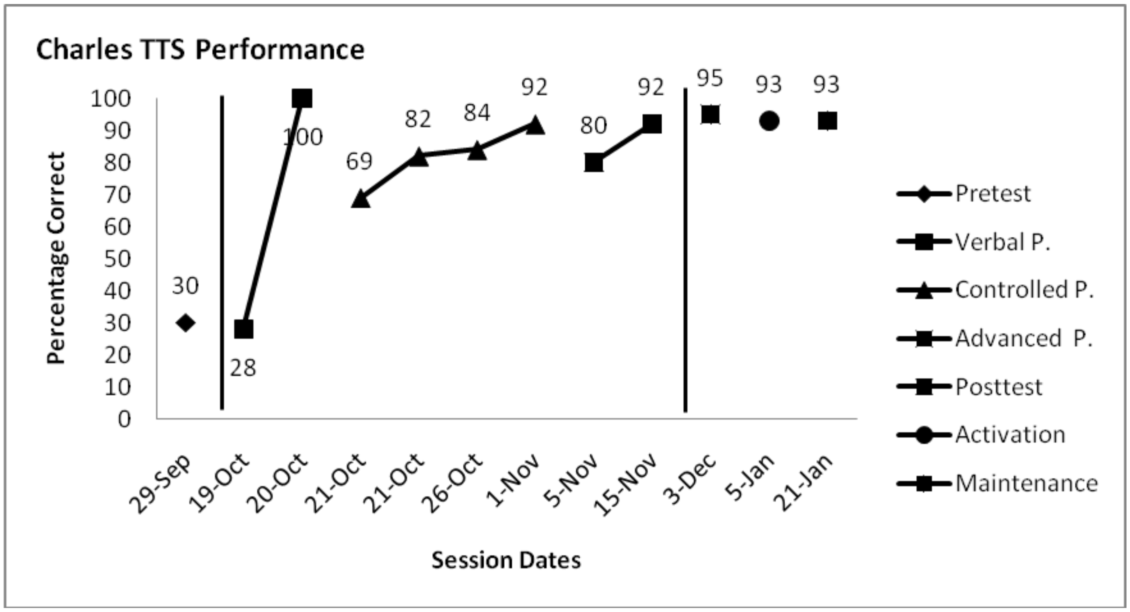

Figure 7. Charles' TTS performance.

During instruction, Charles' scores on math quizzes appeared to increase. During follow-up, Charles' scores continued in the same trend as they did during instruction, with his highest scores of 80% occurring once during instruction and once during follow-up. Charles' average score during baseline was 45%. His average score during follow-up was 65%, an increase of 20%. It would appear the intervention did impact Charles' performance on curriculum-based assessments. Charles' scores on the CBA (math quiz) are illustrated in Figure 8. During instruction and follow-up, Charles' scores on math quizzes appeared to take an upward trend. A calculation of effect size using PND indicates a strong effect 0.882 or 88%. When scores on TTS were compared to scores on quizzes, it appeared that Charles became proficient in strategy usage, his scores on quizzes increased. This is illustrated in Figure 9. As TTS strategy instruction increased, Charles' scores on quizzes increased compared to baseline during instruction and follow-up. Charles' percentage of fluent use of strategy steps increased. Charles' quiz percentage average during baseline was 45%, average during instruction was 63%, and average during follow-up was 65%. Charles' average percentage of fluent use of strategy steps during baseline was 0%, during instruction it was 74%, and during follow-up was 89%. During the end of instruction, there was an increase in performance for one probe. Charles' final quiz performance was 20% higher than his baseline performance.

Donald

Donald is a 13-year old, Caucasian, male who currently receives services as a student with a specific disability in math written expression. He receives support for written expression in a collaborative setting, but all other core content classes are in the general education setting. Donald also receives support from an occupational therapist to address his significant visual

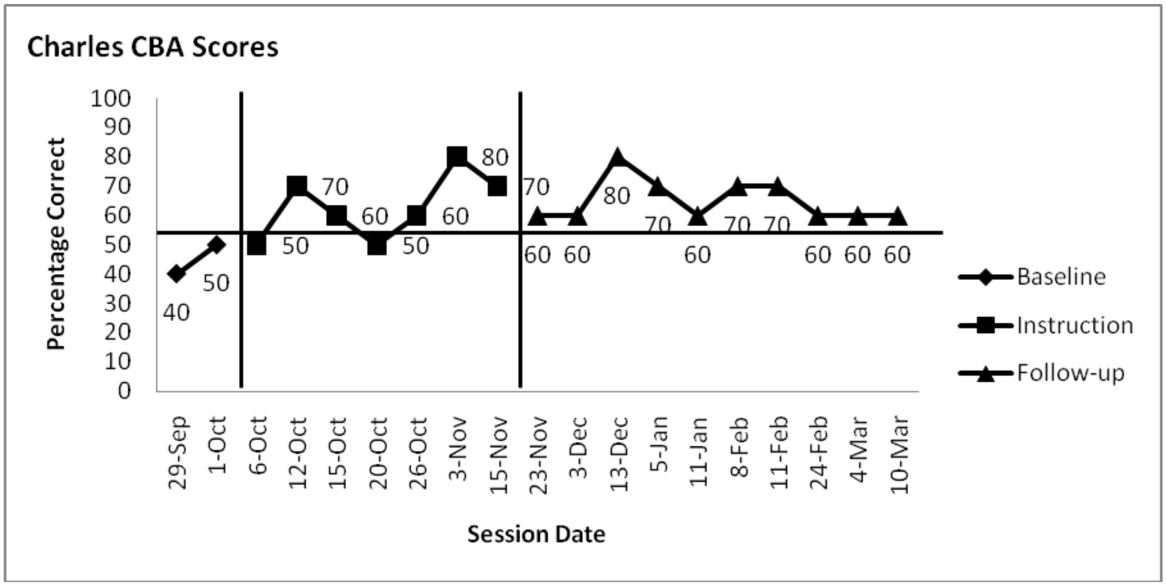

Figure 8. Charles' CBA scores and effect size.

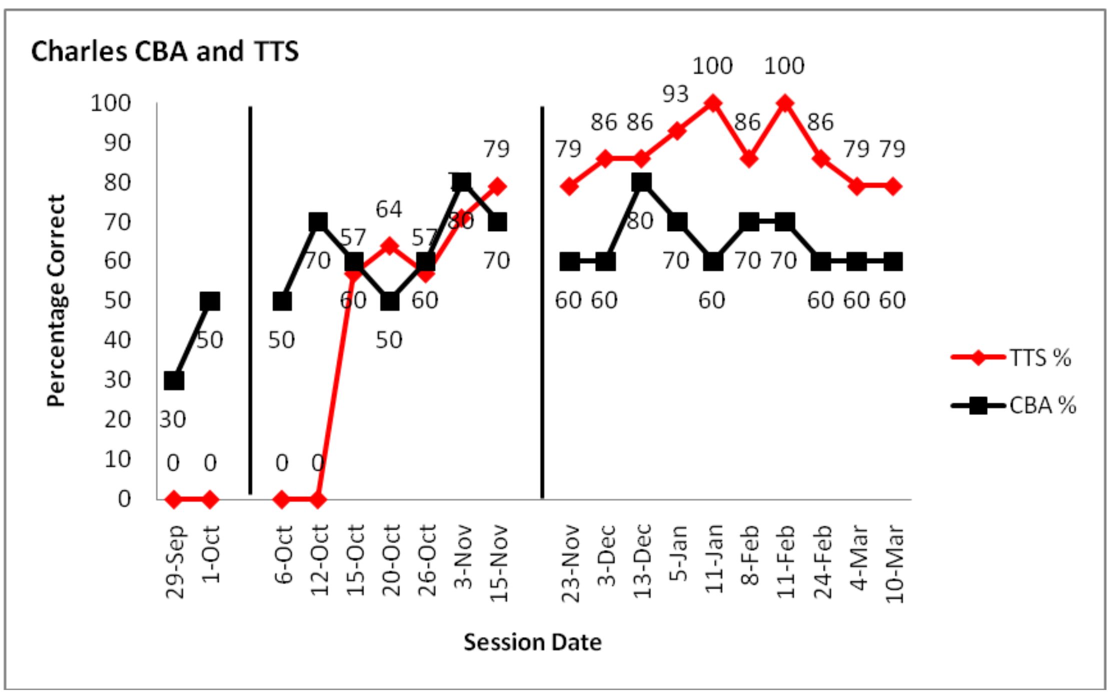

Figure 9. Charles' CBA and TTS compared.

processing deficit with written tasks. His accommodations and modifications include the use of word processor, pencils and pens with finger grips, colored overlays to separate written text, preferential seating, and clarified directions. His final average for the first marking period was a C (85.48).

Donald learned the Test-Taking Strategy by taking a pretest, participating in the description of the strategy, watching a demonstration of strategy application, verbally practicing steps, and demonstrating knowledge of steps through successful mastery of controlled, advanced, post, and maintenance tests. Donald earned a score of 47% on the pretest in Stage 1. Achieving a score at the mastery level of 90 would indicate that this particular strategy is not needed. Donald made two attempts before reaching mastery in verbal practice. Three attempts were made in controlled practice before mastery was met. Mastery was met in subsequent stages during the first attempt. Donald demonstrated his ability to learn and reach mastery a comprehensive test taking strategy. Donald's performance on the Test-Taking Strategy is presented in Figure 10.

During instruction, Donald' scores on math quiz scores were consistent with his performance during baseline. During follow-up, Donald's scores continued in a consistent manner. Donald's average score during baseline was 75%. His average score during follow-up was 80%, an increase of 5%. It would appear the intervention did not impact Donald's performance on curriculum-based assessments. Donald's scores on the CBA (math quiz) are illustrated in Figure 11. During instruction and follow-up, Donald's scores on quizzes appeared to be consistently high. A calculation of effect size using PND indicated a weak effect 0.266 or

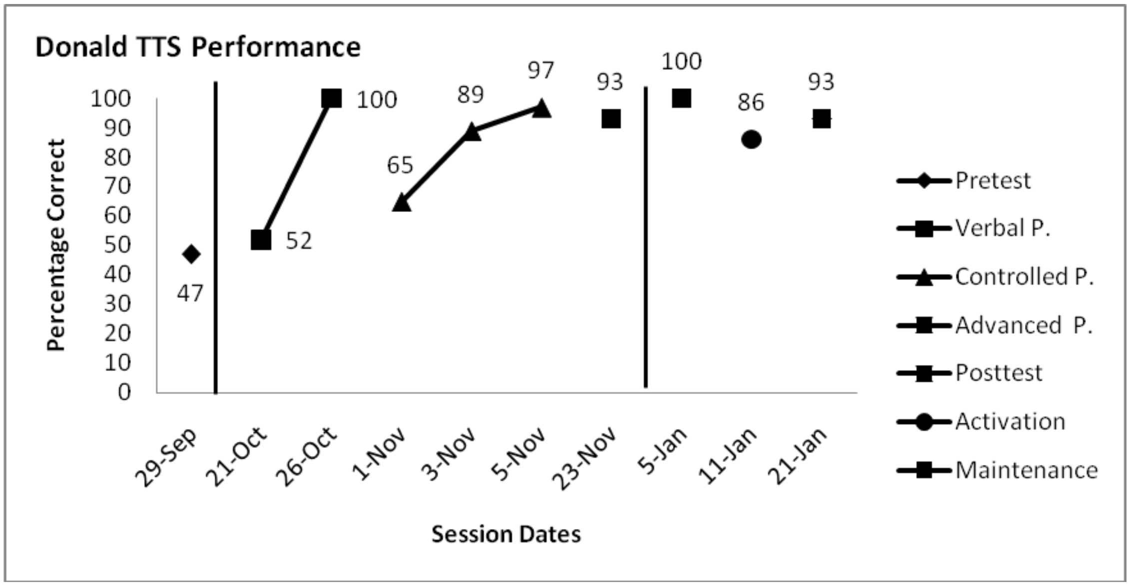

Figure 10. Donald's TTS performance.

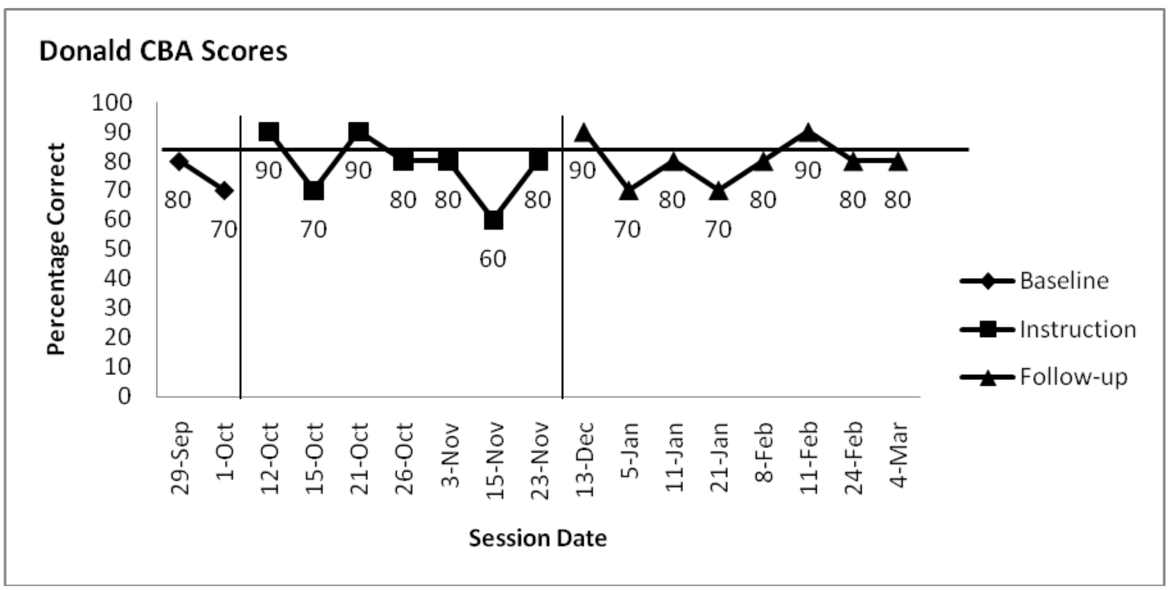

Figure 11. Donald's CBA scores and effect size.

26%. When scores on TTS were compared to scores on quizzes, it appeared that becoming proficient in strategy usage did not impact Donald's scores on quizzes. This is presented in Figure 12.

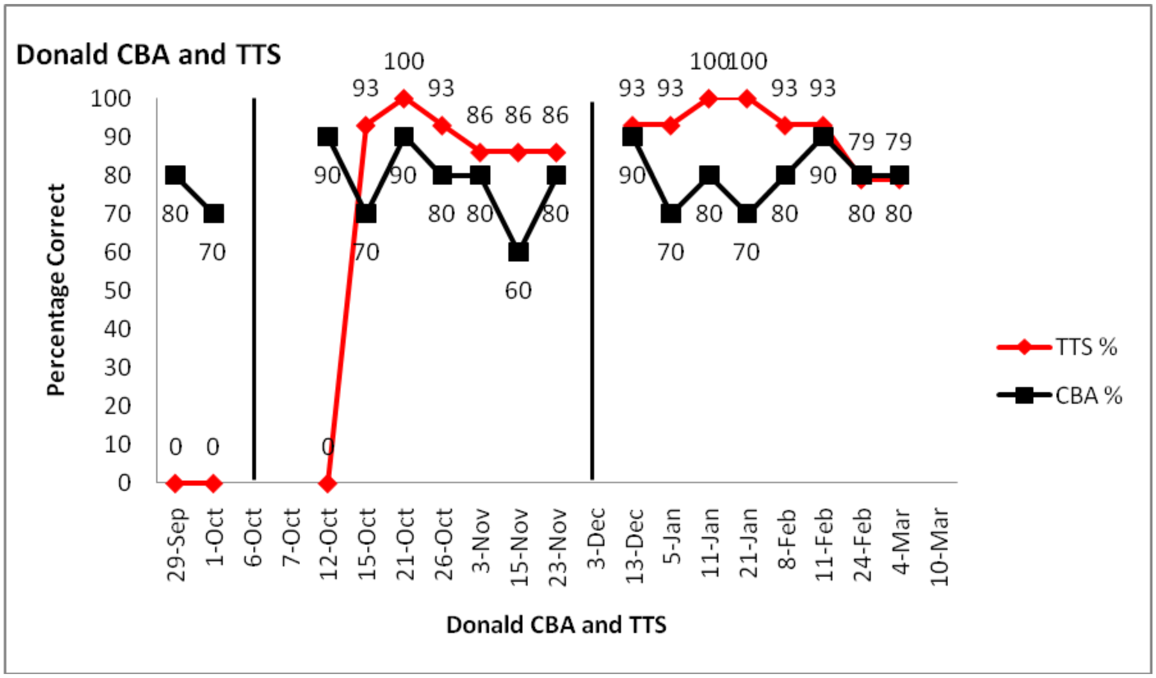

Figure 12. Donald's CBA and TTS compared.

As TTS instruction increased, Donald's scores on math quizzes remained the same as baseline scores. Donald's percentage of fluent use of strategy steps increased. Donald's quiz percentage average during baseline was 75%, his average during instruction was 78%, and his average during follow-up was 80%. Donald's average percentage of fluent use of strategy steps during baseline was 0%, during instruction was 78%, and during follow-up was 91%.

Research Question 1a

How long does it take students with LD to master the TTS?

The number of sessions it took each student to reach mastery during each stage of strategy instruction is presented in Table 9. Students with learning disabilities in this study took an average of 21.5 sessions to master the TTS. Sessions ranged from 90 to 180 minutes. Several conditions occurred during strategy instructions, which are factors in the amount of time it took for skill acquisition for this group of students.

Table 9

Number of Test-Taking Strategy Sessions to Reach Mastery by Student and Phase

Phase	Alice	Brandon	Charles	Donald
1	2	2	2	2
2	3	3	3	3
3	1	1	1	1
4	3	4	2	4
5	7	4	3	3
6	1	2	3	2
7	1	1	2	3
8	4	7	4	2
Total	22	24	20	20
Average sessions to mastery	21.5			

Those factors included instruction, which was provided by a certified professional developer who is proficient in the strategy and its usage. As a result, it may take someone who is not a professional developer longer to implement. Strategy instruction did not occur daily. Classroom teachers have more time to implement when they embed time in their instructional day. Generally, implementation can be achieved with fidelity in fewer days when instruction can occur more frequently.

Finally, the researcher had competing responsibilities with the limited time allowed (e.g., conducting curriculum-based assessments, and administering the MII). Implementation of the Test-Taking Strategy can take up to 6 months depending of frequency of instruction; how quickly student progress to mastery; and the amount of interruptions in instruction due to student absences, school closings, fire drills, and other changes in the instructional schedule.

Research Question 1b

Do students who have mastered the TTS consistently use it on math CBA with cues?

To answer research question 1b, data were reviewed from study participants' Test-Taking Strategy (TTS) fluency scores on math quizzes. When study participants took a quiz during stages 7 and 8, they did not receive cues from the researcher to apply the strategy. When study participants achieved a fluency score of 85% or greater on all the probes given, then consistent use was noted. Failure to do so would indicate nonconsistent use. Quizzes were scored using the TTS score sheet for advanced practice and activation. Table 10 represents Test-Taking Strategy scores received by each student, and represents consistent strategy usage by each student. This score does not represent quiz scores. Although all four students mastered the TTS, only Donald consistently used it on math quizzes when given cues. This criteria for consistent use was described earlier. Alice used the strategy steps consistently in 1 out of 5 attempts (2%). Brandon used the strategy steps consistently in 4 out of 6 attempts (67%). Charles did not reach

Table 10

Consistent Use of Test-Taking Strategy on Math Quiz With Cues

	TTS score (85% = mastery)	Used consistently with cues
Alice	50, 43, 50, 79, 86	No
Brandon	79, 79, 86, 93, 93, 86	No
Charles	57, 64, 57, 71, 79	No
Donald	93, 100, 93, 86, 86, 86	Yes

mastery of the strategy steps usage when cues were given. However, it is important to note that consistent use isn't the only indicator of progress. This point will be discussed further in Chapter 5.

Research Question 1c

Do students who have mastered the TTS consistently use it on math CBA without cues?

Students were not given verbal cues by the researcher to use the TTS during math quizzes in stages 7 and 8 (follow-up). Quizzes were scored using the TTS score sheet for advanced practice and activation. Table 11 represents TTS scores received by each student using the score sheet, and represents strategy usage. The scores do not represent quiz scores. For the purposes of this study, consistent use meant reaching a mastery of 85% on all quizzes during stages 7 and 8. Brandon, Charles, and Donald did not consistently use the TTS without cues. However,

Table 11

Consistent Use of Test-Taking Strategy on Math Curriculum-Based Assessment Without Cues

	TSS score (85% = mastery)	Used consistently with cues
Alice	93, '100, '100, '100, '100, 93, '100, '100	No
Brandon	100, 93, '100, 93, 86, 79, 79, 86, 86	No
Charles	79, 86, 86, 93, '100, 86, 79, 79	No
Donald	93, 93, '100, '100, 93, 93, 79, 79	Yes

Alice consistently used the TTS without cues from the researcher. All four students' consistent use of the strategy increased when they were not given cues by the researcher. Although Brandon, Charles, and Donald did not use the TTS consistently without cues, how frequently they did use it is important to note. In Brandon's case he used the TTS consistently in 7 out of 9 attempts (78%). In Charles' case he used the TTS consistently in 7 out of 10 attempts (70%). Finally, in Donald's case, he used the TTS consistently in 6 out of 8 attempts (78%). Consistent use is not the only indicator of progress. That point will be discussed further in Chapter 5.

Research Question 1d

When students apply the TTS consistently to math CBAs without cues, does the TTS result in higher math CBA scores?

Alice's quiz grades averaged 42% during the course of the study with a noticeable change over time. Alice consistently used the TTS strategy without cues and evidenced a higher math CBA score. Although Alice's CBA average was low, an increase in her CBA scores was noted over time. Brandon's quiz grades averaged 22% during the course of the study with little change over time. Charles did not consistently use the TTS without cues, but he did evidence a higher CBA score. Charles' quiz grades averaged 62% during the course of the study with a moderate change over time. Donald's quiz grades averaged 79% during the course of the study with little change over time. Consistent use of the TTS did not result in a higher quiz score for three students in the study, as presented in Table 12; however, two students did report higher overall CBA scores.

Research Question 2

What perceptions do students have about their performance and self-efficacy on curriculum based math assessments, when the Test-Taking Strategy is used?

Table 12

Consistent Use of Strategy and Curriculum-Based Assessments Average

	Consistent use of TTS	CBA average
Alice	Yes	42
Brandon	No	22
Charles	No	62
Donald	No	79

Research Question 2a

Do students report an increased self-efficacy related to math assessment when they have mastered the Test-Taking Strategy?

To answer research questions 2 and 2a, The Mathematics Interest Inventory (MII) was given three times during the course of this study. The MII was used to assess the students' attitudes toward mathematics. Students responded to 27 statements using a Likert scale, and indicated if the statements were: 4 *very much like me*, 3 *sort of like me,* 2 *not much like me,* or 1 *not at all like me*. The statements fell into three categories. Positive valence (intrinsic attractiveness toward mathematics), negative valence (aversiveness toward mathematics) and time (sequencing of events or duration spent on math related tasks). The sums and averages were computed for each student over three probes. The results are illustrated in Table 13. All four students mastered the Test-Taking Strategy and reported varying degrees of self-efficacy. A discussion of the findings will be covered in Chapter 5.

Alice

Alice's intrinsic attractiveness towards math was reported as 3.2 in October. A slight decrease of 2.8 was reported in December. In February Alice reported 3.3, which was similar to her feelings about math in October. Alice's positive valence increased only slightly although she had a significant increase in her math performance during the course of the study. Alice's positive valence did not increase even though her performance on math quizzes improved. Alice's negative valence remained neutral throughout the study, 2.5-2.7. It was not like Alice to spend a lot of time on math-related activities, as indicated by a rating of 1.85 in February. Alice's overall results are illustrated in Figure 13.

Table 13

Mathematics Interest Inventory Results

	Positive valence	Negative valence	Time	Positive valence	Negative valence	Time	Positive valence	Negative valence	Time
Date		**10/1/10**			**12/13/10**			**2/8/11**	
Alice - Sum	32	25	15	28	25	12	33	27	13
Alice - Average	3.2	2.5	2.14	2.8	2.5	1.71	3.3	2.7	1.85
Date		**10/1/10**			**11/23/10**			**2/11/11**	
Brandon - Sum	23	25	13	25	23	12	17	36	12
Brandon - Average	2.3	2.5	1.85	2.5	2.3	1.71	1.7	3.6	2
Date		**10/1/10**			**11/23/10**			**2/8/11**	
Charles - Sum	25	27	14	24	23	15	23	28	17
Charles - Average	2.5	2.7	2	2.4	2.3	2.14	2.3	2.8	2.42
Date		**9/21/10**			**11/23/10**			**2/8/11**	
Donald - Sum	36	14	16	38	12	17	37	11	14
Donald - Average	3.6	1.4	2.28	3.8	1.2	2.42	3.7	1.1	2

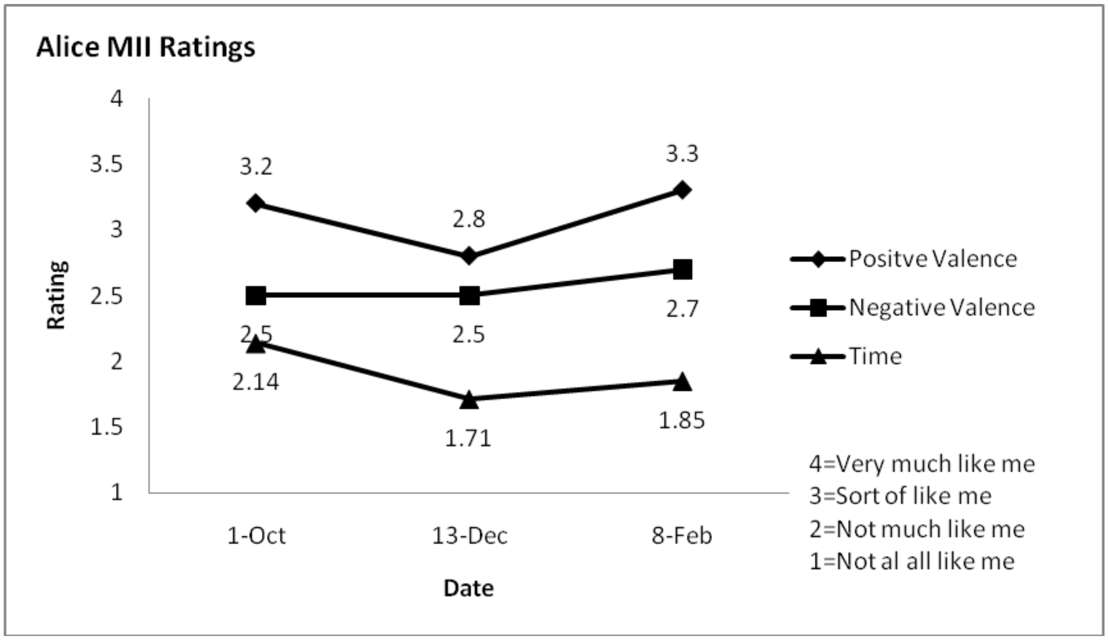

Figure 13. Alice's MII ratings.

Brandon

In October, Brandon reported a positive valence of 2.3 which increased slightly to 2.5 in November. It appeared that an intrinsic attractiveness towards math is somewhat like Brandon. However, in February, Brandon's positive valence dropped significantly to 1.7. In October, Brandon reported a negative valence of 2.5 which decreased slightly to 2.3 in November. It appeared that Brandon's aversiveness toward mathematics was neutral at that point. However, in February, Brandon's negative valence (aversiveness toward mathematics) increased to a 3.6, a significant increase. Regarding time, Brandon consistently reported not spending a lot of time on math activities. Brandon's overall ratings are illustrated in Figure 14.

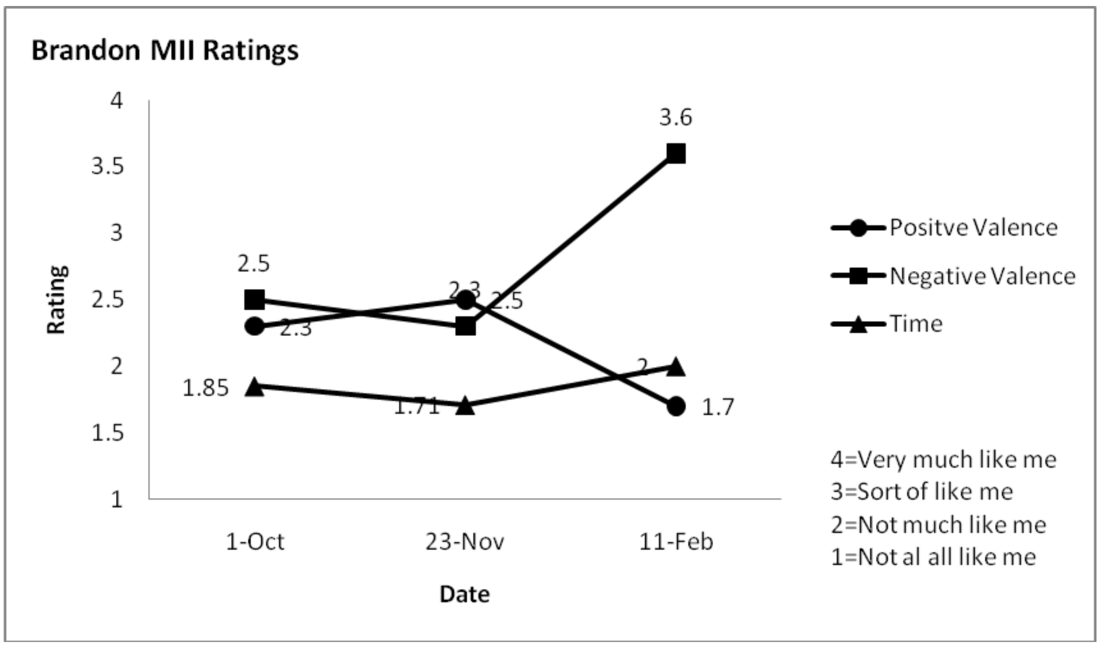

Figure 14. Brandon's MII ratings.

Charles

In October, Charles reported a positive of 2.5, which decreased 1 point over the subsequent probes. This indicates a neutral intrinsic attractiveness towards math during the course of the study. Charles reported a negative valence of 2.7 in October. In November his negative valence drop slightly to 2.3. However, in February his negative valence was reported at 2.8. This indicated his aversiveness toward mathematics remained fairly neutral during the course of the study. Regarding time, Charles consistently reported not spending a lot of time on math activities. Charles' overall ratings are illustrated in Figure 15.

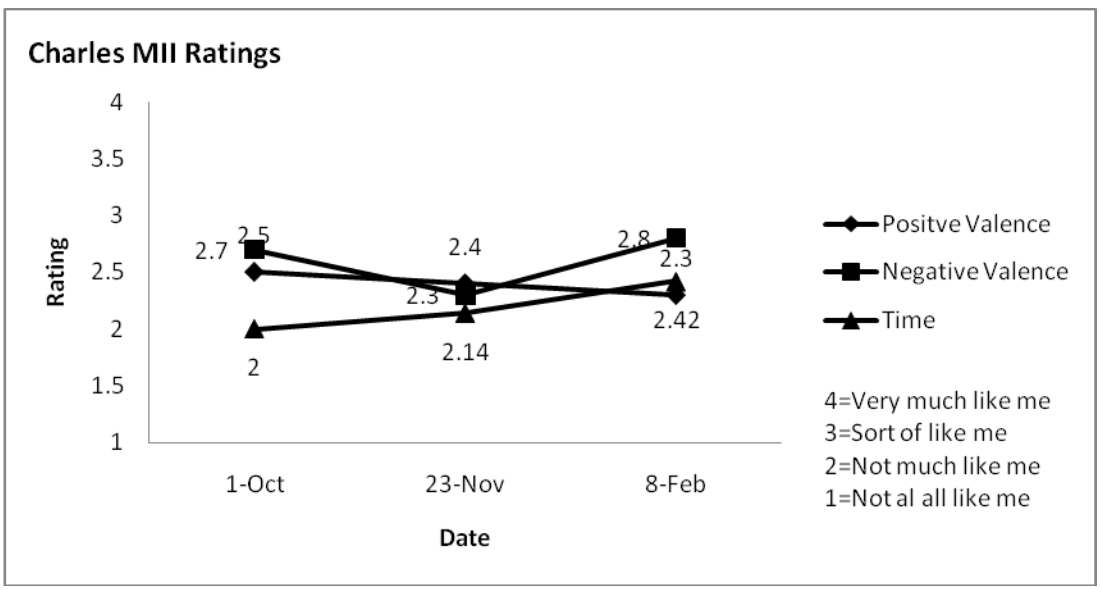

Figure 15. Charles' MII ratings

Donald

In September, Donald reported a positive valence of 3.6, in November, 3.8, and in February 3.7. Donald's responses strongly indicated his attractiveness towards math throughout the study. He reported a negative valence of 1.4, 1.2, and 1.1, a decrease over time, indicating an aversiveness towards math was not like him at all. Regarding time, Donald reported 2.2, 2.4, and 2 indicting he did not spend a lot of time on math-related tasks. Donald's overall ratings are illustrated in Figure 16.

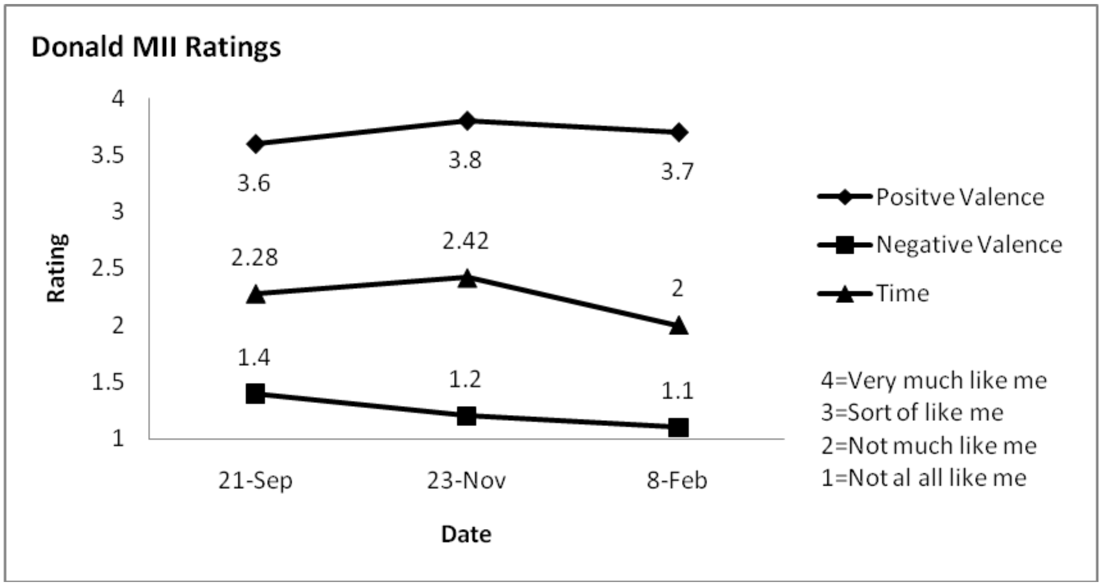

Figure 16. Donald's MII ratings.

Summary

The Test-Taking Strategy impacted the students' performance differently. Alice showed improvement on quizzes during instruction and follow-up. Alice's quiz performance increased by 32%. Brandon's improvement was minimal over instruction and follow-up. Brandon's performance during instruction and follow-up was consistent with his baseline performance indicating minimal impact of the Test-Taking Strategy (TTS) on quiz performance. Brandon's quiz performance increased by 14%. Charles' performances on quizzes were moderate, and an increase from baseline performance to follow-up was noted. Charles' quiz performance increased by 25%. The TTS had minimal impact on Donald's quiz performance. Donald's quiz performance was consistent throughout all three stages. Donald's quiz performance increased by 5%. The Test-Taking Strategy did affect the performance of some students on math curriculum-based assessments.

The rate at which students with disabilities reach mastery of the TTS can vary depending on the student, the instructor, the amount of time allocated to teach, and the opportunities to demonstrate mastery. At a minimum, one should expect to spend at least 22 days to get students through Stage 7. Stage 8, generalization, can take up to 5 months. Stage 8 will take the longest because it must be ensured that students do not forget the steps of the strategy, and it also must be ensured that students continue to use the TTS correctly. This can only occur when probes (tests) are given over time, and monitored for mastery of the strategy. The manual recommends probes are given a month apart in the maintenance phase of Stage 8.

Consistent use of the TTS once mastered varied from student to student. Consistent use was noted when a score of 85% was achieved on the TTS score sheet. Mastery of the strategy was not an indicator of consistent use. Alice was the only student who used the strategy consistently without cues from the researcher. Consistent use of the strategy was not an indicator of increased quiz performance for all students' during follow-up. Alice consistently used the strategy and her performance did increase from baseline performance. Brandon did not consistently use the strategy and his performance showed minimal increase. Charles did not consistently use the strategy and his performance did increase from baseline performance. Donald did not consistently use the TTS and his performance on quizzes remained consistent with baseline performance.

The effect of self-efficacy was measured by using the Math Interest Inventory. Most of the students' responses to questions were consistent during all three probes. One student's negative valence increased. Another student's positive valence, negative valence and time average scores remained the same. In most cases, if a student had a high level of intrinsic attractiveness towards math it remained.

CHAPTER 5. DISCUSSION

Introduction

This study was designed to evaluate the effect of the Test-Taking Strategy, a learning strategy part of the Learning Strategies Curriculum, developed by researchers at the University of Kansas Center for Research on Learning for adolescents with learning disabilities on self-efficacy and mathematic performance of middle school students with learning disabilities. Data were collected using strategy data collection tools, curriculum-based assessments, and a mathematics interest inventory. The research questions explored student performance on math curriculum-based assessments, acquisition of the learning strategy intervention, and self-efficacy over a period of 6 months. The research questions were presented with the findings summarized and analyzed for the four participants. Contributions of this study to the literature, limitations of the study, and implications for future research will be discussed in this chapter.

Relevance of the Study

Mathematics is an important life skill. Students with disabilities struggle to be successful in this critical content area. Identification of a strategy that would impact performance in mathematics would be of benefit to students, teachers, and school divisions because of its potential for positive academic outcomes.

Findings

The TTS did result in improved performance on CBA (math quizzes) for 2 of the 4 participants in the study. One student's performance on math quizzes did not improve, while another student's math performance was high prior to the intervention and remained high throughout the study. For the purposes of data analysis, this student was considered an outlier.

Alice

Alice's math score increased by thirty-two percent over the course of the study, a significant improvement. However, her intrinsic attractiveness towards math only changed moderately (from 3.2 to 3.3) despite her improvement in math performance. Alice requires additional content support in the area of mathematics to work in conjunction with her test-taking strategies to increase her quiz performance scores further. Although Alice has mastered the TTS strategy, her lack of content knowledge is evident in her quiz scores.

Nevertheless, she experienced the highest increase in her math CBA scores of all students in the study. Thus, it is likely that the TTS assisted Alice in more effectively demonstrating her mathematics knowledge, but did not address her need for increased mathematics content information. Therefore, the TTS eliminated her confusion when taking a test, but did eliminate the impact of her lack of mathematical skills. Alice reported her math grades continue to be below average; however, she recognized her own improvement since the beginning of the school year.

Charles

Charles' math score increased by 20% over the course of the study, a significant improvement. Charles' self-efficacy changed moderately during the course of the study. He remained neutral in his responses during all three probes. The MII failed, however to capture the significant changes that Charles, himself, reported. There was a noticeable change in the way he carried himself as the sessions progressed. As time went on, Charles moved from being reclusive to becoming a leader in the sessions. His swagger and pride in his success in math was noticed by the researcher and his peers in the group. He reports that he is applying the PIRATES strategy to content areas now and has moved from receiving Ds and Cs to all As and one B on his current report card. Charles is very happy about his progress. He attributes his current grades to using PIRATES. The significance of this change cannot be understated. A young man who previously considered himself a near failure at school, now has a world of opportunity opened because of his current success.

Brandon

On the other hand, Brandon's participation and use of the TTS did not result in a significant improvement in math scores. Brandon's math scores increased 14% over the course of the study, a minimal improvement. His intrinsic attractiveness toward mathematics decreased slightly from 2.3 to 1.7, while his aversiveness toward mathematics increased from 2.5 to 3.6, which is significant. Despite reaching mastery, Brandon's math performance did not increase. His attitude about math changed negatively. Brandon needs additional math support in conjunction with his use of the strategy. Despite his success at mastering the TTS, Brandon's lack of content knowledge was a significant barrier to improvement. The significant shift from neutral to negative feelings toward math might be attributed to his inability to experience improvement in his performance on math quizzes with the TTS strategy.

Donald

The TTS did not affect Donald's math performance. His positive valence scores were 3.6, 3.8, and 3.7. Donald likes math and, according to his performance on curriculum-based assessments, does well on math assessments. Donald's negative valence scores were 1.4, 1.2, and 1.1. Donald did not have an aversiveness toward mathematics. Regarding time, Donald was consistent throughout in this area as well. He indicated a score of 2.3, 2.4, and 2.6. Donald indicated that he did not spend a great time on math-related tasks. Donald's performance would indicate that he did not need the strategy to improve math performance. His performance on the pretest was an indicator of his lack of knowledge of the strategy steps. Once he mastered the strategy steps, they did not help with his performance. Donald does not appear to have difficulties with math content. His MII results indicated he liked math, was neutral regarding the amount of time he spent, and he did not have negative feeling about math tasks. Donald is an outlier. Although he was referred for participation in the study, it appears that he did not require remediation in mathematics. Thus, it is difficult to determine whether or not the TTS would have helped him in another content area. According to informal reports by his teacher, Donald's main educational challenge is attendance. He may experience academic challenges due to poor attendance. Thus, it is reasonable to exclude the findings related to his participation in the study from overall consideration of the effectiveness of the TTS on math-based CBA.

Key Findings

There is a need for strategies that can increase students' ability to be successful on mathematics CBA. However, the use of test-taking skills alone will not solve the problem of poor performance on math assessments. Good test-taking strategies begin with good content instruction. A good math strategy would include instruction in the content that focuses on taking concepts from abstract to representative to the concrete. Good strategies to use when taking math assessments might include instruction on time management and instruction that teaches students how to read graphs or tables accurately, and how to use the information they contain to solve mathematical problems.

The Test-Taking Strategy was designed for use with language-based, text-rich content. The primary focus of this study was to determine if the strategy steps would support students in mathematics. An important finding was the applicability of each the strategy steps on math quizzes and assignments developed by the researcher. A few steps were not applicable, and are discussed.

In the first step, prepare to succeed, students were allowed to write on the testing materials. However, if the student was taking a computer-based test, or the teacher did not allow writing on testing materials, this step would not be applicable. Allotting time and order to a section is applicable only if the test has sections. If the test does not have sections, the student could determine how much time he or she wanted to spend on each question or question type.

The last step, estimate, presented the most challenges. The strategy teaches students to guess using the mnemonic ACE when they don't know the answers. The math quiz responses did not include absolutes, long or detailed choices. This eliminated two of the guessing techniques suggested. Suggestions for appropriate guessing techniques, and math specific test-taking strategies will be discussed in future directions for research. All eight steps along with their requirements are found in Appendix B. It is important to note that questions on tests used during Stage 6 were developed by the researcher to include what to do and where to do it.

A review of other school assessments reveled that many teachers did not word their informal assessments in this manner.

Implications of the Present Investigation

The TTS was a successful strategy and might have resulted in improved mathematics performance on CBA for 2 out of the 4 students included in this study. Of the two for whom the strategy was not successful, it could be argued that one student, Donald, did not need the strategy due to his already high performance on grade level math CBA. Thus, school divisions seeking to improve the performance of their students on math CBA would do well to consider adding the TTS to other math specific content strategies to assist students with learning disabilities in demonstrating their knowledge on math CBAs. After all the TTS does not address the need for increased content knowledge. It does, however, increase students' ability to demonstrate the knowledge they possess on assessments.

Another implication found in this study is related to instructional time. Math content supervisors and lead math teachers might consider including in math instruction the additional time to provide remediation to students who struggle with mathematics. The focus of this study was to determine if curriculum-based assessment (CBA) performance increased as a result of the intervention (Test-Taking Strategy). The researcher did not teach or remediate math skills. Feedback was not given on math scores or student performance. Feedback was only given when appropriate on the use of the strategy. Direct, purposeful instruction must occur in the content classroom. Some teachers are hesitant to devote the time needed to teach the strategy given the demands on an already full schedule. Time to reach mastery may take up to 6 months. Teachers considering the use of the Test-Taking Strategy should carve out time in their schedule to allow for instruction, and plan for how that instruction would look given their other curriculum demands. Reinforcing content instruction is another implication of this study for math teachers. For some students, while the TTS did address issues of organization and time management, it did not address mathematics specific content or guessing strategies. For example, teaching students to use columns and identify how problems can be divided into sections when solving problems may reduce miscalculations when numbers are not in the correct place value. Additionally, teaching students how to solve the problems they know, and to skip the ones they are not sure of, is a valuable strategy. This technique saves time and allows the student to immediately respond to the known items, and reduces the tendency to persevere on unknown problems.

Another implication is the cost to have teachers trained on learning strategies through the Center for Research on Learning at the University of Kansas (KU). The study participants learned the strategy as part of their instructional curriculum through a technical assistance agreement with a state technical assistance provider who is a certified SIM Professional Developer. There was no cost to the division in which the study occurred or the school. There may be financial implications if that level of service is not available in other localities and states.

Response to Intervention

The present study did not examine Response to Intervention (RtI); however, the implications for its usage as a Tier 2 intervention are noteworthy. Response to Intervention (RtI) is based on federal law, and it evolves out of the experience of practitioners and researchers in both general and special education.

The purpose of Tier 2 is to provide supplemental support to struggling students in the general education classroom who have not met the benchmarks established for academic performance in Tier 1. A student in Tier 2 continues to receive the core curriculum and instruction in the regular classroom (Tier 1), but also receives additional interventions that supplement Tier 1 instruction and intervention (Virginia Department of Education, 2007). Once a student has received core curriculum and instruction, a consideration can be made to add TTS as a supplement.

Universal Design for Learning

All students need to access the general education curriculum. Universal design for learning (UDL) provides equal access to learning, not simply equal access to the information provided (Council for Exceptional Children, 2005). The TTS may not have been designed to include UDL principles, but its lesson format supports the principles. The TTS represents information in multiple formats and media, provides multiple pathways for students' actions and expressions, and provides multiple ways to engage students' interests and motivation. The TTS could be a very helpful strategy to divisions seeking strategies to address the needs of learners in Tier 2 interventions and to satisfy UDL requirements in federal legislation.

Limitations of the Present Investigation

Limitations found in this study include, size, instrument design, time and strategy implementation. The study was restricted to students scheduled for science and enrichment with one teacher. Of the 25 students in the class, 8 students met the eligibility criteria for the study. However, the number of subjects in this study was small due to the number of parents who gave consent. Albeit small, the number of subjects was sufficient for the single-subject design that was used.

Another limitation was the math quiz used. The quiz contained multiple-choice items only. Whether the Test-Taking Strategy would be effective with other formats of math CBA, such as word problems, is a consideration for future research. Another limitation is the amount of time needed to implement the Test-Taking Strategy with fidelity. One of the reasons the researcher selected this school was because the building administrator had planned for a learning strategy to be taught to several classes. This ensured that the researcher would have time to take a class through all eight stages.

The limitation is the guessing strategies used in the Test-Taking Strategy. The guessing techniques were developed for use on CBA only. Students were told during maintenance/follow-up not to use the guessing strategies on standardized tests because the designers of those types of tests do not include the cues upon which the guessing strategies are based. Students were reminded the best strategy for taking a test is to be prepared by studying. Guessing techniques appropriate for standardized assessments is a consideration for future research.

The final limitation to this study is related to the procedures used by the researcher. The researcher decided to make three modifications to the protocol developed by Hughes, Deschler et al (1993). Nevertheless, 2 of the 4 students in this study responded as expected to the TTS. Therefore, the researcher determined that this was not a significant threat to the external validity of the study.

Future Directions for Research

Although findings of the current study aid our understanding of the impact a test-taking strategy can have on math CBA performance, the present investigation can be expanded upon and several avenues for future research can be identified. As has already been discussed, the small sample size of the current study may have affected the findings, and a larger sample size may have increased power to detect effects of the instruction. Additionally, future research might include the investigation of instructional strategies to improve math performance in addition to test-taking strategies. Empirical research on instructional strategies to improve math skills may potentially improve mathematic ability, while test-taking strategies focus on organizational techniques, guessing strategies, and question analysis. An investigation of specific strategies to teach skill deficits may beneficial to students, parents, teachers, and school divisions.

The focus of this study was to determine if the strategy increased performance on math CBA and self-efficacy with the strategy as the only intervention. The researcher did not provide remediation or feedback on math performance other than providing the percentage correct to the student. Regarding efficacy, there were not planned or structured activities to discuss how students felt about math. Some students did share how they felt after taking a math quiz, but the inclusion of a more structured plan to address efficacy should be considered for future research. There is a need for TTS *and* content strategy for math.

The study investigated the use of the TTS on a multiple choice test format. Future investigation may be helpful in its use with math assessment in a different format. Math assessment traditionally consists of word problems which require the examinee to solve the problem and scribe the answer. Techniques to support students are responding to different types of mathematical problems, such as the use of mnemonic devices to help students remember problem-solving steps. Strategies to address guessing techniques for math, such as using the process of elimination and backsolving to help students reduce the possible number of choices, would further increase the applicability of the TTS for math. Finally, when applying the R (read, remember, reduce) step to a test-taking situation, there may be math-specific strategies that can be added to the TTS itself. For example, when applying *read,* if student could learn to associate math vocabulary to math operations. Then they would be able to identify the formulas to apply to problems. Secondly, when applying the *remember* strategy, students could learn mnemonics for various mathematical formulas to apply them appropriately. Lastly, when reducing potential answers, students could be taught to carefully read graphs and charts as well as apply mathematical logic to eliminate distracter options. Refining the TTS to apply more directly to math will make it a stronger strategy to address the challenges that middle school students face.

Finally, future research might investigate the phenomenon of poor performance of students with disabilities in grades 6 through 8. Data indicate the drop in performance during middle school but little research discusses the factors that contribute to this or ways to address the problem. Many speculate it may be the change in the demands of the math curriculum. Future research might focus on causes and offer suggestions for improvement.

Summary

The study investigated the use of the TTS on student math performance on CBA (math quizzes) and student self-efficacy. As an intervention, the Test-Taking Strategy impacted student CBA performance, and student self-efficacy or feelings about math. Students with disabilities struggle with many subjects in school. However, interventions such as the TTS when used in conjunction with content instruction can benefit most students. The TTS was designed to improve student performance on classroom assessments.

Learning how to compensate for skill deficits is a strategy students will learn over the course of their school career. The identification of strategies to support students is one thing that practitioners and researchers in the field can offer to students. Students with disabilities are as different as the hues on a color wheel. As such, strategies to support them need to be just as varied.

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APPENDIX A

YOUTH ASSENT FORM

TITLE: THE EFFECT OF TEST-WISENESS ON SELF-EFFICACY AND MATHEMATIC PERFORMANCE OF MIDDLE SCHOOL STUDENTS WITH LEARNING DISABILITIES

VCU IRB NO.: HM 12968

This form may have some words that you do not know. Please ask someone to explain any words that you do not know. You may take home a copy of this form to think about and talk to your parents about before you decide if you want to be in this study.

What is this study about?
The purpose of this study is to find out if learning a test taking strategies helps you do better on math tests, and to find out how you feel about math before during and after learning the strategy.

What will happen to me if I choose to be in this study?
In this study you will be asked to apply the Test-Taking strategies you learn in school to math quizzes, and you will be asked how you feel about taking math tests.

If you decide to be in this research study, you will be asked to sign this form. Do not sign the form until you have all your questions answered, and understand what will happen to you.
If you are in this study, your responses to math questions and an interest inventory will be examined by a researcher.

Will you tell anyone about my participation in the study?
No one will be told that you are participating in the study. Your identity will not be shared with anyone.

Do I have to be in this study?
You do not have to be in this study. If you decide to be in this study, you can leave at any time.

Questions
If you have questions about being in this study, you can talk to the following persons or you can have your parent or another adult call:

Phyllis Haynes
804-827-1408

Do not sign this form if you have any questions. Be sure someone answers your questions.

Assent:
I have read this form. I understand the information about this study. I am willing to be in this study.

Youth name printed Youth signature Date

Name of Person Conducting Informed Assent Discussion / Witness, printed

Signature of Person Conducting Informed Assent Discussion / Witness Date

Principal Investigator Signature (if different from above) Date

PARENTAL CONSENT FORM

TITLE: THE EFFECT OF TEST-WISENESS ON SELF-EFFICACY AND MATHEMATIC PERFORMANCE OF MIDDLE SCHOOL STUDENTS WITH LEARNING DISABILITIES

VCU IRB NO.: HM 12968

This consent form may contain words that you do not understand. Please ask the study staff to explain any words that you do not clearly understand. You may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

PURPOSE OF THE STUDY

The purpose of this research study is to find out if a test taking strategies improves performance on math quizzes and tests, and to determine how middle school students with learning disabilities feel about math after participation in the Test-Taking Strategy instruction. Your child is being asked to participate in this study because he/she will be learning the strategy as a part of the curriculum in the fall at JEJ Moore Middle School.

DESCRIPTION OF THE STUDY AND YOUR CHILD'S INVOLVEMENT

If you decide to give permission for your child to participate in this research study, you will be asked to sign this consent form after you have had all your questions answered and understand what will happen to your child.

In this study, first your child's progress chart from The Test-Taking Strategy will be reviewed by a researcher. Next, your child will be asked to take a quiz to determine how he/she uses the strategy on a modified version of the Virginia Standard of Learning 7th grade math test. Finally, your child will be asked to take a Mathematics Interest Inventory which asks questions about how he/she feels about math.

The study involves learning The Test-Taking Strategy which can take up to twenty days depending on the pace of the individual student. The Test-Taking Strategy takes between 35-45 minute instructional sessions over a period of 7 days, with generalization taking between 5-10 minute instructional sessions once weekly over a period of four months. All students in the 3rd period class will participate in the Strategy instruction.

Students who elect to participation in the study will also complete the Mathematics Interest Inventory four times during the course of the study, complete modified Mathematics Standards of Learning Quizzes weekly over a course of 8 weeks. It will take each of the participants approximately 30 minutes to complete the SOL Quizzes each week beginning in the second week of instruction. The collection of documents evidencing mastery of the skills learned may take up to three months, depending on the pace of the individual student. The duration of the study may take up to four months depending on the pace of the individual student. The study will be completed by the end of the first nine weeks of school.

COMPENSATION

For participation in the study, students will receive one twenty-five dollar VISA gift certificate. Compensation will be given at the end of the first nine weeks of school.

RISKS AND DISCOMFORTS

Sometimes taking tests are stressful for some students. Some students may become anxious when taking math quizzes. Some students feel uncomfortable sharing their feelings.

BENEFITS TO YOUR CHILD

No benefits to your child for taking part in the study.

COSTS

There are no costs to you for allowing your child to participate in this study.

CONFIDENTIALITY

Potentially identifiable information about your child will consist of a progress chart, modified released Standards of Learning quizzes, interest inventories, and student answer sheets. Data will be collected for research purposes only. Your child's data will be identified by ID numbers and birthdates, not names, and stored separately from any other school-related records in a locked file cabinet at the researchers work address. All personal identifying information will be kept in password protected files and these files will be deleted after study results are analyzed. Other records, forms, charts, pre-post test, student folders will be kept in a locked file cabinet for six months after the study ends and will be destroyed at that time.

As a part of the instructional curriculum, your child's work will be treated like any other document used during instruction. What I find from this study may be presented at meetings or published in papers, but your child's name or the school's name will not ever be used in these presentations or papers.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

You do not have to give consent for your child to participate in this study. If you choose for your child to participate in the study, you may withdraw him/her at any time by contacting Phyllis Haynes at 804-827-1408.

QUESTIONS

In the future, you may have questions about your participation in this study. If you have any questions, complaints, or concerns about the research, contact:

Office for Research
Virginia Commonwealth University
800 East Leigh Street, Suite 113
P.O. Box 980568
Richmond, VA 23298
Telephone: 804-827-2157

You may also contact this number for general questions, concerns or complaints about the research. Please call this number if you cannot reach the research team or wish to talk to someone else. Additional information about participation in research studies can be found at http://www.research.vcu.edu/irb/volunteers.htm.

CONSENT

I have been given the chance to read this consent form. I understand the information about this study. Questions that I wanted to ask about the study have been answered. My signature says that I am willing to give my child permission to in this study. I will receive a copy of the consent form once I have agreed for my child to participate.

____
Name of Child

____
Participant name printed *Participant signature* *Date*

____
Name of Parent or Legal Guardian
(Printed)

______________________________ ____________
Parent or Legal Guardian Signature Date

____
Name of Person Conducting Informed Consent
Discussion / Witness
(Printed)

______________________________ ____________
Signature of Person Conducting Informed Consent Date
Discussion / Witness

______________________________ ____________
Principal Investigator Signature (if different from above) Date

APPENDIX B

PIRATES

If you **PASS** and **RUN**, you'll score more points and **ACE** the test.

Step 1:	**P**repare to succeed
	Put your name and PIRATES on the test
	Allot time and order to sections
	Say Affirmations
	Start within 2 minutes
Step 2:	**I**nspect the instructions
	Read instructions carefully
	Underline what to do and where to respond
	Notice special requirements
Step 3:	**R**ead, Remember, and Reduce
Step 4:	**A**nswer or abandon
Step 5:	**T**urn back
Step 6:	**E**stimate
	Avoid absolutes
	Choose the longest or most detailed choice
	Eliminate similar choices
Step 7:	**S**urvey

Source: Hughes, C., Schumaker, J., Deshler, D., Mercer, C. (1993). *The test-taking strategy*. Lawrence, KS: Edge Publishing.

APPENDIX C. MATH INTEREST INVENTORY

Directions: Below is a set of questions concerning your feelings about math. Please us to describe how well each statement describes you. For items that describe you well, circle a 4 to indicate the statement is "very much like me, " For statements that do not describe you at all, circle a 1 to indicate the statement is "not at all like me." Use the numbers in between to indicated statements that might describe you a little bit, or are not like you at all the time.

		Very much like me	Sort of like me	Not much like me	Not at all like me
1.	I like to an answer questions in math class.	4	3	2	1
2.	I am wasting my time on math.	4	3	2	1
3.	I work more math problems than what I have to.	4	3	2	1
4.	I like math.	4	3	2	1
5.	I am bored when working on math.	4	3	2	1
6.	I spend many hours working on math.	4	3	2	1
7.	I am interested in math.	4	3	2	1
8.	I would rather be working on something else besides math.	4	3	2	1
9.	I work on math in my spare time.	4	3	2	1
10.	Knowing a lot about math is helpful.	4	3	2	1
11.	I give up easily when working on math.	4	3	2	1
12.	I want to talk about math with my friends.	4	3	2	1
13.	I feel good when it comes to working on math.	4	3	2	1
14.	When working on math, I want to stop and start working on something else.	4	3	2	1
15.	I spend more time than most of my classmates working on math.	4	3	2	1
16.	I want to know all about how to do math problems.	4	3	2	1
17.	I am always thinking of other things when working on math.	4	3	2	1
18.	I prefer easy math over math that is hard.	4	3	2	1
19.	I feel excited when a new math topic is announced.	4	3	2	1
20.	I get mad easily when working on math.	4	3	2	1
21.	I am too involved in math.	4	3	2	1
22.	I want to learn more about math.	4	3	2	1
23.	I have difficulty paying attention when working on math.	4	3	2	1
24.	I choose to work on math.	4	3	2	1
25.	I spend as little time as possible working on math.	4	3	2	1
26.	I want to know all about math.	4	3	2	1
27.	I struggle with math.	4	3	2	1

Source: Texas Tech University Perceptions of Math Study

APPENDIX D

Information Letter from Administrator

Date

Parents of
Address
City, Virginia

Dear Parent of _________________,

My name is Phyllis L. M. Haynes, and I am a doctoral student at Virginia Commonwealth University pursuing a Ph.D. in Education. Drs. John Kregel and Colleen Thoma, serve as my dissertation chairs. My dissertation is titled: The Effect of Test-wiseness on Self-efficacy and mathematic performance of middle school students with learning disabilities. I am investigating the use of The Test-Taking Strategy with middle school students with and without disabilities, and self-efficacy.

I am investigating the use of an instructional strategy called 'The Test-Taking Strategy' with middle school students with disabilities. Your child may qualify for this study. You are receiving this letter from Mr. ____ because the school believes that you may be interested in your child participating in the study. It is possible that other teachers and students will recognize your child as a person with a learning disability as a result of participation in this study. I will safeguard your child's private educational information by putting in place special procedures to protect confidential information. A copy of the consent form, detailing these procedures will be given to you during the informational meeting.

The *Test-Taking Strategy* is designed to be used while taking classroom tests. During the Test-Taking Strategy instruction, students will learn to allocate time and priority to each section of the test, carefully read and focus on important elements in the test instructions, recall information by accessing mnemonic devices, systematically and quickly progress through a test, make well-informed guesses, check their work, and take control of the testing situation. The emphasis is on teaching adolescents and adults who struggle with learning.

As a part of the instructional curriculum at ______Middle, I will be teaching your son or daughter The Test-Taking Strategy in the Fall of 2010. This instruction will take place during your child's 3rd period block. (You will receive a letter from ____, building principal, which explains the instructional strategy to be taught).

You and your child are invited to attend an informational meeting on _______ from
______ in the library of _______ Middle School to learn about a research study opportunity for those students learning The Test-Taking Strategy.

Please direct any questions or comments to:

Phyllis L. M. Haynes
VCU School of Education
Office of Doctoral Studies
P.O. Box 842020
Richmond, VA 23284-2020
(804) 827-1408
plhaynes@vcu.edu

Sincerely,

Phyllis L. M. Haynes, Doctoral Candidate
Virginia Commonwealth University

Vita

Phyllis Lynette Manuel Haynes was born on September 3, 1966, in Brooklyn, New York, and is an American citizen. After earning her undergraduate degree from Virginia State University, she earned her Master's in Education from Old Dominion University. Phyllis is a Strategic Instruction Model Professional Developer in the area of learning strategies. Currently, she works as a program specialist for the Virginia Department of Education's Training and Technical Center at Virginia Commonwealth University.