The Effects of Teaching Text-Structure Strategies to Postsecondary Students with Learning Disabilities to Improve Their Reading Comprehension on Expository Science Text Passages

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Abstract

This study was conducted to determine the relative efficacy of text-structure strategy instruction compared to traditional instruction on the reading comprehension of 40 postsecondary students with learning disabilities (LD). Participants were randomly assigned to either a text-structure strategy condition or a traditional instruction condition. Participants completed pretests of prior knowledge, received instructional sessions using expository science passages, and completed immediate and delayed retell tests. Data analyzed with repeated-measures ANOVAs indicated that students in the text-structure strategy condition outperformed students in the traditional instruction condition on both immediate- and delayed-retell measures. Results are discussed in terms of the participant sample, the efficacy of strategy instruction, and type of text structures. Implications for future research are also discussed.

In 1988, approximately 1% of full-time college freshmen reported that they had learning disabilities (LD) (Henderson, 2001); this percentage increased to 6% in 2000. Madaus and Shaw (2006) note that although estimates of the number of postsecondary students with LD vary, all figures are conservative, in that they exclude part-time students and those in two-year degree programs. Clearly the population of students with LD enrolled in postsecondary institutions is increasing (Wagner, Newman, Cameto, Levine, & Garza, 2006). As the number of students with LD continues to increase in colleges and universities (Wagner, et. al., 2006), increased attention to these students' specific academic needs is essential (Allsopp, Minskoff, & Bolt, 2005; Vogel & Adelman, 1992).

Research tells us that LD manifests itself, not only throughout the school years (Heiman & Kariv, 2004), but throughout the life span (Gerber, et al., 1990). It has been well documented that postsecondary students with LD exhibit difficulties in phonological processing, word reading, and rate of reading (Trainin & Swanson, 2005), which is particularly detrimental to comprehension of authentic college-level texts (Warde, 2005). Historically, few students with LD (i.e., 2%) graduate from college (National Institute of Child Health and Human Development, 1999). When these students do graduate, they have significantly lower grade-point averages (GPAs), more withdrawals from courses, and more D grades (Vogel & Adelman, 1992) than their classmates without disabilities. On a more positive note, it is encouraging to note that employment outcomes for college graduates with LD match those of others in the U.S. workforce on variables such as salaries, employment levels and benefits (Madaus, 2006).

Data from the second wave of the National Longitudinal Transition Study-2 (NLTS2; Wagner et al., 2006) indicate that of all achievement indicators, the greatest score differences between youth with disabilities and their counterparts without disabilities

occurred on passage comprehension tests. Proctor, Prevatt, Adams, Hurst, and Petscher (2006) employed profile analysis with the Learning and Study Strategies Inventory (LASSI; Weinstein & Palmer, 2002) to compare college students with LD to various other subgroups of college students. Each subgroup with LD was found to score significantly lower than their classmates without LD on five of the 10 LASSI subtests, including anxiety, concentration, information processing, motivation, and finally, selecting main ideas and important information from text. Thus, postsecondary students with LD may need to improve their reading comprehension skills as well as use additional learning strategies to achieve academic success in higher education (Allsopp et al., 2005; Mull, Sitlington, & Alper, 2001; Trainin & Swanson, 2005).

Metacognitive Strategies

Recent meta-analyses of reading comprehension have provided increasing support for the cognitive/information processing paradigm (e.g., Gersten, Fuchs, Williams, & Baker, 2001; Proctor et al., 2006; Swanson, 1999; Talbott, Lloyd, & Tankersley, 1994) that students as active learners who use cognitive strategies. For example, students who actively apply cognitive reading strategies, such as text-structure strategies, improve their reading comprehension (e.g., Bakken, Mastropieri, & Scruggs, 1997). A specific focus on cognition also promotes metacognitive activity (e.g., Graves, 1986).

Metacognition is an active thinking process that may be described as "knowing how to know." Metacognitive skills include self-monitoring strategies in comprehension, active participation, and self-reflection to regulate one's learning (Chan & Cole, 1986). Students using metacognitive reading strategies evaluate the reading task demands in light of their skills for reading, including their ability to select, employ, and monitor strategy use (Deshler, Ellis, & Lenz, 1996). For example, skilled readers consciously adjust their reading speed, monitor their understanding of what they read, and ask and answer questions about the information as they read.

Unfortunately, students with LD typically do not use specific reading strategies spontaneously (Torgesen, 1986), or their use of reading strategies is limited (Worden, Malmgren & Gabourie, 1982). To increase the use of metacognitive skills, systematic instruction in specific reading strategies with a rationale for using the strategy appears effective for many students with LD (e.g., Fuchs, Fuchs, & Kazdan, 1999). Mastropieri, Scruggs, and Graetz (2003) stated that research-supported reading comprehension strategies for secondary students with LD may be divided into four different areas: (a) basic skills and reinforcement (e.g., corrective feedback, repeated readings); (b) text enhancements (e.g., spatial organizers, mnemonic illustrations); (c) self-questioning (e.g., summarizing, finding the main idea); and (d) text-structure (e.g., narrative or expository passages).

Text Structure

Text organization exists in both narrative and expository structures. For example, narrative texts include patterns of characters, events, goals, plots, and conclusions (e.g., Gurney, Gersten, Dimino, & Carnine, 1990; Idol, 1987). Specific structures within expository texts include main idea, antecedent and result, problem and solution, as well as compare-and-contrast text structures (e.g., Meyer & Freedle, 1984; Taylor, 1980). Expository texts explain concepts for academic content such as science.

As students progress through grade levels, they need to read expository texts far more often than narrative writing (Pugh, Pawan, & Antomarchi, 2000). Expository texts are more difficult to read than narrative texts (Saenz & Fuchs, 2002) because of high conceptual density, special terminology, multiple graphic ways of presenting information, and text structures that reflect the logic of the topic represented within the text (Pugh et al., 2000).

Text-Structure Strategies

Students with LD experience reading comprehension difficulties at the elementary level (Wong & Wilson, 1984), at the junior-high (e.g., Bakken et al., 1997), secondary (e.g., Horton, Lovitt, Givens, & Nelson, 1989) and postsecondary levels (Bacon & Carpenter, 1989; Wagner et al., 2006; Warde, 2005). Henderson (2001) reported that 45% of freshmen students with disabilities planned to attend college in hopes of improving their reading skills.

The use of text-structure strategies has been found to improve the reading comprehension of narrative as well as expository text passages for students at the elementary through secondary levels (e.g., Bakken et al., 1997; Idol, 1987; Smith & Friend, 1986). Further, they have been shown to be effective for postsecondary students in the comprehension of narrative-text passages (Bacon & Carpenter, 1989). However, to date, research has not been conducted to determine if text-structure strategies improve postsecondary students' reading comprehension of expository-text passages.

Postsecondary Students with LD

Section 504 of the Rehabilitation Act of 1973 protects postsecondary students with LD (Rothstein, 2000) who self-advocate for reasonable accommodations to improve access to content (Mull et al., 2001). While accommodations may be necessary, they may not be sufficient for postsecondary students with LD (Allsopp, et al., 2005) enrolled in academic courses such as science, history, foreign languages, health, art, and political science, which require reading with comprehension for successful acquisition of information (Mastropieri & Scruggs, 2004).

More than 15 years ago, (1992), Gajar lamented that only "meager research" had been conducted to identify effective reading comprehension strategies for postsecondary students with LD. Since that date, some literature has focused on the reading skills and specific problem areas of secondary students with LD (e.g., Archer, Gleason, & Vachon, 2003; Trainin & Swanson, 2005; Warde, 2005) as well as on research-supported interventions for secondary students with LD (e.g., Bryant, Goodwin, Bryant, & Higgins, 2003; Mastropieri et al., 2003). However, few interventions have been conducted to remediate the specific academic difficulties of postsecondary students with LD.

Allsopp, et al. (2005) recently described a model demonstration project that provided semester-long individualized strategy instruction relevant to specific coursework of 46 college students with LD at three postsecondary institutions. One-to-one strategy training for organizational skills, study skills, and/or reading comprehension strategies, as needed, addressed participants' needs for the academic demands specific to their coursework. Results indicated that students who employed the trained strategies independently demonstrated sustained academic improvement.

In the present study, we wanted to determine if text- structure strategies improved reading comprehension of expository text passages in science for postsecondary students with LD. Specifically, we wanted to know if the mean scores differed among pre-, immediate, and delayed measures for students who received text-structure strategies compared to students who received traditional instruction on main idea text passages. We also wanted to know if the mean scores differed among pre-, immediate, and delayed measures for students who received text-structure strategies compared to students who received traditional instruction on compare-and-contrast text passages. Last, we wanted to determine if the mean scores differed among the pre-, immediate, and delayed means for students who received text-structure strategies compared to students who received traditional instruction on the combined measures of all main idea and compare-and-contrast text passages.

Method

Participants

Forty postsecondary students with self-identified LD from a two-year private postsecondary institution in a midwestern state volunteered to participate in this investigation. It was explained that the volunteers would learn about interventions to enable them to improve their reading comprehension. Participating students gave permission for us to obtain data from the study as well as data from their existing academic records. Because we did not wish to place additional requirements upon the students, we did not require formal documentation of their LDs. However, participants were asked to describe classroom accommodations that they had received in high school. Student records provided further evidence of an LD diagnosis.

Demographic data collected from students' admissions records included race (optional), gender, and the approximate grade level when participants were first identified with LD (see Table 1). Additional demographic data collected from students' records included age, high school GPA, American College Test (ACT) composite score, college reading placement test score, college writing placement test score, and college math placement test score (see Table 2).

Twenty students were randomly assigned to either a text-structure strategy condition or a traditional instruction condition. *T*-tests on the demographic variables showed no significant differences between participant groups on any demographic variable.

Materials

The instructional and testing workbooks used in the study contained expository text passages selected from postsecondary texts about life and physical sciences written in either main idea or compare-contrast passages. To parallel prior research (e.g., Bakken et al., 1997; Gurney et al., 1990), we shortened the text passages to approximately 150 words each and kept them each at an eighth-grade readability level, as measured by the Flesch-Kincaid Readability Formula software. Science text passages were used since the majority of postsecondary students need to successfully complete two science courses to meet general education requirements.

Table 1

Frequencies and Percentages of the Categorical Demographic Variables

Variable	Text Structure Strategy Condition (n =20)		Traditional Instruction Condition (n =20)	
	f	%	f	%
Race				
Caucasian American	16	80	16	80
African American	3	15	3	15
Hispanic American	1	5	-	-
Middle East American	-	-	1	5
Gender				
Male	10	50	13	65
Female	10	50	7	35
Grade Identified with LD				
1	3	1	3	15
2	1	5	2	10
3	6	30	3	15
6	1	5	-	-
7	1	5	1	5
8	1	5	-	-
9	1	5	3	15
10	1	5	3	15
11	1	5	-	-
12	4	20	5	25

Table 2

Means and Standard Deviations of the Continuous Demographic Variables

Variable	Text Structure Strategy Condition (n =20)		Traditional Instruction Condition (n =20)		F-value
	M	(SD)	M	(SD)	
Age	19.30	0.66	19.02	0.51	1.001
High School-Grade Point Average	2.46	0.71	2.37	0.57	1.732
American College Test (ACT)	15.25	3.43	13.90	1.21	2.656
Reading Placement Test	13.05	4.73	13.65	2.76	2.677
Writing Placement Test	17.68	4.23	17.45	3.39	1.303
Math Placement Test	15.79	12.19	15.75	11.19	0.570

Note. The high school grade point average was based upon a 4.00 grading scale. Placement test data were not available for one of the 20 participants in the text structure strategy condition. T-tests were implemented to compare all demographic data; no significant differences were found between the two groups.

Scoring

Students each completed a pretest and two retells consisting of an immediate test and a delayed test. Four scoring methods were used to code the data: test strict, no test strict, test loose, and no test loose. *Test* and *no test* were levels of concept importance employed to determine whether or not the concepts appearing in the texts would appear on a teacher-made test. *Strict* and *loose* were levels employed to evaluate whether retells stated either literal information (i.e., strict) or inferential (i.e., loose) information.

To determine test-worthy concepts, 11 graduate students in special education who were also special education teachers read 10 expository science text passages and listed the key concepts. Concepts listed in 60% or more of the teachers' rankings were determined to be test-worthy concepts, and concepts listed in 59% or less of the teacher's rankings were determined to be concepts not important enough to be test worthy. A 60% standard was applied, as students in many college courses who achieve a 60% will pass the course. These standards were employed to score each individual student retell.

To determine scoring reliability, interraters practiced scoring individual student retells and compared their scores to those of the other interraters until consistent reliability was achieved. Through this comparison, the scoring procedures were refined for clarity. Interraters then practiced scoring individual student retells again, using the clarified scoring procedures, until 100% agreement was reached.

A four-step process was used to calculate each student's retell score. First, each student's retell was scored for test-worthy concepts "strict" related to literal comprehension (i.e., to grasp the nature, significance, or meaning) of the passage. The term *literal* was defined as consistent with the primary meaning of the term or expression (i.e., synonyms were acceptable; e.g., two = both, and sound = noise; word shifts were acceptable, e.g., new to newly, electric to electricity; and different word orders were acceptable, e.g., animal ignores it =

it is ignored by the animal). If the concepts stated in the student's retell literally matched the concepts determined by the interrators as test worthy, two points were given. Second, the concepts not worthy of being test-worthy concepts "strict" were scored employing the same procedures as for test-worthy concepts strict. Thus, literal retells, whether both test worthy or not, were awarded two points. Third, the test-worthy concepts "loose" were scored. If the student's concepts in the retell inferentially matched the concepts determined as test worthy, the student received one point for each concept. The term *inferential* was defined to indicate by association, suggestion, or reason (i.e., the student may have failed to retell the scientific term such as oligotrophic but shorten the term to the "o" lake or refer to the first lake identified in the passage). Finally, the not test-worthy concepts "loose" were scored employing the same procedures as for not test-worthy strict, also earning one point.

Design

The study employed an experimental design with random assignment of students to two conditions: text-structure strategy and traditional instruction. We shuffled the student sign-up sheets and then randomly placed the sheets in Condition One or Condition Two. Students were not informed whether they participated in the text-structure strategy condition or the traditional instruction condition. Regardless of the condition, students received the same expository passages for instruction.

Each student was pretested on the first day (Monday) followed by 30 minutes of condition-specific individual instruction. On the second day (Tuesday), each student received 30 minutes of condition-specific individual instruction. On the third day (Wednesday), each student completed an immediate test. One day then elapsed, and on the fifth day (Friday), each student completed a delayed test. In the text-structure strategy condition, students received direct instruction in two types of text-structure strategies, main idea and compare-and-contrast. In the traditional instruction condition, students received traditional instruction consisting of reading and answering questions about the content of the text passages.

Dependent Measures

All participants took a pretest, an immediate test, and a delayed test. Students completed an untimed pretest where they told everything they knew about the specific content of four expository science text topics that were on the immediate test. The immediate test employed four text passages with two main idea text-structure passages and two compare-and-contrast text-structure passages. The delayed test asked the students to recall what they had read about on the passages of the immediate test.

Pilot Testing

A first pilot study was implemented with four participants from the participant sample. The first pilot was conducted to determine the validity of the design and methods as well as the appropriateness of the materials and the procedures. The pilot test indicated the materials, including the text passages and the implementation scripts, were practical and the procedures were effective. However, it was determined that a longer study time was given to the text-structure strategy condition. Consequently, the study time for both conditions was adjusted to 3.5 minutes.

A second pilot study was conducted with two new participants. Materials were identical to those of the first pilot, but this time each participant was given 3.5 minutes study time, which resulted in equivalence of time between groups. Because an alteration was made during the first pilot study, data from the students who participated in the first pilot were not included in the final results of this study.

Pretest Procedures

Students completed an untimed pretest and were asked to tell everything they knew about the specific content of four expository science text topics. For example, they were asked to tell what they knew about kinetic energy and potential energy. This information was written down verbatim as well as tape-recorded. This was done to ensure that the results obtained on the immediate and delayed tests completed on the third and fifth days accurately measured students' comprehension of the expository science text passages, rather than any prior knowledge.

Instructional Procedures Common to Both Conditions

We used common instructional procedures in both the text-structure strategy intervention condition and the traditional instruction control condition. On the first day, each student completed the pretests and received 30 minutes of instruction on main idea passages. On the second day, each student again received 30 minutes of instruction on compare-and-contrast passages with a review of main idea passages. Implementation scripts included the instructional sequence, the presentation, and the practice phases to ensure all students received

the same condition-specific instruction. The scripts also regulated the time of instruction to ensure equal time on task for students in both conditions.

The instructional procedures followed a model of an effective instructional design by Mastropieri and Scruggs (2004). The order included (a) presentation and modeling of the strategy to be learned, (b) guided practice, (c) independent practice, and (d) retell and review. Prior to instruction on the second day, each student in both conditions also participated in a review of the content presented on the first day.

On each day, students participated in three phases - presentation of the material to be learned, guided practice, and independent practice. We taught students about expository texts and asked them to read eight text passages. The presentation phase included many opportunities for students' responses, retells, and think-alouds. Then the students studied the passages to help them to remember as much as they could about the text passage. In the guided practice phase, the students worked to identify, review, and study the text passages. Instruction was implemented through modeling, using think-alouds, and reviewing. In the independent practice phase, students read along and listened to two text passages. One text passage included written prompts and the other text passage included no written prompts. Students then practiced retells and reviewed the text passages independently.

Text-structure strategy condition procedures. Each day, students learned about expository texts and, more specifically, main idea text structures and strategies as well as compare-and-contrast text structures and strategies. Text-structure strategies for main idea text structures included asking students to underline the main idea and then write the important concepts that explain the main idea. For example, students asked questions and stated the steps of the strategy (e.g., what will I do now? I will underline the main idea in this text passage.), Text-structure strategies for compare-and-contrast text structures asked students to: underline the two primary ideas and then write what was the same and different about the two ideas. Last, the students studied what they wrote to help them to remember the text passage information.

Traditional instruction condition procedures. Each day, students learned about expository text passages via traditional instruction similar to instruction in science courses at the postsecondary level. The students read along and listened to the text passages as well as wrote answers to questions that followed the text passages. Students also answered aloud open-ended comprehension questions that followed the text passage.

Test procedures common to both conditions. Participants in both conditions received test procedures that followed an implementation script to ensure that all received identical testing protocols. Tests consisted of an immediate test and a delayed test. The immediate test, administered one day after the completion of instruction, employed four text passages. The first text passage (i.e., kinetic energy and potential energy) and the fourth text passage (i.e., oligotrophic lakes and eutrophic lakes) used compare-and-contrast text structure, whereas the second and third text passages (i.e., solar cells and habituation) used main idea text structure. The delayed test, which was administered two days after the immediate test, tested only the four topics from the text passages employed during the immediate test (i.e., no new text passages were read).

During the immediate test, students first read and then listened to tapes of each text passage. Second, they had 3.5 minutes to study independently. Finally, students were asked to retell, without prompts, everything they could remember about the text passage. All immediate tests were tape recorded, but not timed. Similarly, during the delayed test, students had to retell, without prompts, everything they could remember about the text passages they had read for the immediate test. We recorded all student responses with the delayed tests.

Instructional fidelity. To help ensure instructional fidelity, all instructional sessions were tape recorded and random reviews of five of the 40 tape-recorded instructional sessions were conducted. An independent person not involved with the research project listened to each tape and compared it with the instructional script. A percentage of agreements versus disagreements was calculated, and a 100% agreement was obtained.

Results

The data were analyzed using repeated-measures ANOVAs. The type of instruction received, either text-structure strategy or traditional instruction, served as the independent variable, and the number of points earned on the retell after instruction served as the dependent variable. The mean scores indicated that students in the text-structure strategy condition generally outperformed students in the traditional instruction condition on immediate and delayed tests. Results for the repeated-measures ANOVAs between groups suggested that on the delayed tests, students in the text-structure strategy condition significantly outperformed students in the traditional instruction condition on compare-and-compare text structures.

Main Idea Text Passages

Test interaction tests of the mean differences between the text-structure strategy and the traditional instruction conditions for the main idea text passage, solar cells, habituation, and the combination of both passages on immediate and delayed test were nonsignificant, $p > .05$, for each combination of concept importance, scoring method, and passage type (see Tables 3, 4, and 5).

Compare-and-Contrast Text Passages

The Treatment x Test interaction tests of the mean differences between the text-structure strategy and the traditional instruction conditions for the compare-and-contrast text passage, kinetic energy and potential energy on the immediate and delayed tests were also nonsignificant, $p > .05$, for each combination of concept importance, scoring method, and passage type (see Table 6).

The Treatment x Test interaction test was significant on immediate and delayed test mean differences for the combination of test-worthy concept importance, loose scoring method, oligotrophic and eutrophic lakes passage, $F(2,76) = 4.21$, $p = .02$ (see Table 7).

The Treatment x Test interaction test was not significant for not test-worthy concept importance and loose scoring method, oligotrophic and eutrophic lakes passage, $p = .05$, (the actual p value was .052; hence, the Treatment x Test interaction test was nonsignificant, $p > .05$).

The Treatment x Test interaction tests of the mean differences were significant, $p < .05$, for the combined compare-and-contrast text passages, kinetic energy and potential energy and oligotrophic lakes and eutrophic lakes, on immediate and delayed tests for the combination of test-worthy concept importance, loose scoring method, as well as not test-worthy concept importance, loose scoring method (see Table 8). The Treatment x Test interaction tests were nonsignificant, $p > .05$, for the combinations of test-worthy concept importance, strict scoring method and not test-worthy concept importance, strict scoring method.

The Treatment x Test interaction test of the mean differences between the immediate and delayed tests was significant for the combined compare-and-contrast text passages for the combination of concept importance of test-worthy and scoring method of loose, $F(2,76) = 5.73$, $p = .01$. Finally, the Treatment x Test interaction test on the immediate and delayed test means was also significant for the combined compare-and-contrast text passages for the combination of not test-worthy concept importance and loose scoring method, $F(2,76) = 4.11$, $p = .02$.

Main Idea and Compare-and-Contrast Text Passage

The Treatment x Test interaction tests were significant, $p > .05$, for the sum of the combined scores of all main idea and compare-and-contrast text passages for test-worthy as well as not test-worthy concept importance using the loose scoring method (see Table 9).

The Treatment x Test interaction test of the mean differences for the sum of the combined scores on all main idea and compare-and-contrast text passages on the pre-, immediate, and delayed tests was significant for the combination of test-worthy concept importance and loose scoring method, $F(2,76) = 3.30$, $p = .04$. The Treatment x Test interaction test of the mean differences for the sum of the combined score of all main idea and compare-and-contrast text passages on the pre-, immediate, and delayed tests was significant for each combination of not test-worthy concept importance and loose scoring method, $F(2,76) = 6.31$, $p = .00$. Finally, the Treatment x Test interaction test was approaching significance for the sum of the combined score of all main idea and compare-and-contrast text passages for the not test-worthy concept importance and strict scoring method, $p = .06$.

Students' Answers to Open-Ended Questions

Students also responded to two open-ended questions, "Can you tell me what kinds of passages we worked on?" and "Can you tell me what strategy we used to help our reading comprehension?" In the text-structure strategy condition, 8 of 20 students reported the structures of the passages they had worked on were main idea and compare-and-contrast text-structure passages. In the traditional instruction condition, none of the participants was able to report a specific structure of the passages. In the text-structure strategy condition, 20 of 20 students reported the strategy was a text-structure strategy where they underlined the main idea or the same and different ideas. In the traditional instruction condition, only 13 of 20 students were able to report using a reading strategy, consisting of reading text and answering questions.

Summary and Discussion

This study was conducted to determine the relative efficacy of text-structure strategy instruction compared to traditional instruction on the reading comprehension of postsecondary students with LD. Participants were

Table 3

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions for Main Idea Text Passage, Solar Cells

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.10	(0.45)	-0.22
Immediate	3.60	(2.11)	3.00	(2.71)	0.22
Delayed	0.40	(0.82)	0.30	(0.98)	0.10
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.10	(0.45)	0.25	(0.64)	-0.23
Immediate	5.50	(2.42)	5.10	(3.34)	0.12
Delayed	1.10	(1.37)	1.00	(1.78)	0.06
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.10	(0.31)	-0.32
Immediate	2.25	(1.41)	2.25	(2.40)	0.00
Delayed	0.80	(1.32)	0.50	(0.95)	0.32
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.20	(0.41)	-0.49
Immediate	4.25	(1.89)	3.75	(2.51)	0.20
Delayed	1.35	(2.03)	1.00	(1.49)	0.23

Note. Effect sizes around .20 are considered small, around .50 medium, and around .80 high (Cohen, 1988).

Table 4

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions for Main Idea Text Passage, Habituation

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	1.50	(2.14)	0.70	(1.17)	0.68
Delayed	1.25	(2.92)	0.00	(0.00)	--------
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	3.50	(1.82)	2.80	(1.88)	0.37
Delayed	1.10	(1.65)	0.70	(1.34)	0.30
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	1.85	(2.80)	1.75	(1.29)	0.08
Delayed	0.70	(0.70)	0.30	(0.66)	0.61
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	3.15	(1.69)	2.85	(1.46)	0.21
Delayed	1.15	(1.69)	0.65	(1.31)	0.38

Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

Table 5

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions for the Combined Main Idea Text Passages, Solar Cells and Habituation

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.45)	0.00
Immediate	5.10	(3.01)	3.70	(3.20)	0.44
Delayed	1.65	(3.30)	0.30	(0.98)	1.38
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.10	(0.45)	0.25	(0.64)	-0.23
Immediate	9.00	(3.52)	7.90	(4.42)	0.25
Delayed	2.20	(2.42)	1.70	(2.27)	0.22
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.10	(0.31)	-0.32
Immediate	4.10	(2.27)	4.00	(3.15)	0.03
Delayed	1.50	(2.12)	0.80	(1.32)	0.53
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.20	(0.41)	-0.49
Immediate	7.40	(2.80)	6.60	(3.30)	0.24
Delayed	2.50	(2.98)	1.65	(1.87)	0.45

Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

Table 6

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions with the Compare-and-Contrast Text Passage, Kinetic Energy and Potential Energy

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.40	(1.05)	0.30	(1.00)	0.10
Immediate	4.80	(3.33)	6.10	(5.00)	-0.26
Delayed	2.10	(2.20)	1.10	(2.00)	0.50
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.90	(2.00)	0.50	(1.82)	0.22
Immediate	6.90	(3.08)	7.00	(3.87)	-0.03
Delayed	3.70	(2.92)	1.65	(2.46)	0.83
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.20	(0.70)	0.00	(0.00)	--------
Immediate	2.80	(1.91)	3.70	(3.18)	-0.28
Delayed	1.45	(2.16)	0.65	(1.31)	0.61
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.50	(1.00)	0.05	(0.22)	2.05
Immediate	4.50	(2.28)	5.10	(2.86)	-0.21
Delayed	2.45	(2.48)	1.40	(1.79)	0.59

Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

Table 7

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions for Compare-and-Contrast Text Passage, Oligotrophic Lakes and Eutrophic Lakes

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	7.10	(4.52)	6.50	(4.58)	0.13
Delayed	3.50	(3.30)	2.30	(2.99)	0.40
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.00	(0.00)	0.00	(0.00)	--------
Immediate	8.75	(4.24)	8.70	(4.12)	0.01
*Delayed	6.30	(3.96)	3.15	(3.54)	0.89
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.05	(0.22)	0.00	(0.00)	--------
Immediate	2.70	(2.62)	2.10	(1.55)	0.39
Delayed	1.00	(1.21)	0.45	(0.76)	0.72
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.05	(0.22)	0.00	(0.00)	--------
Immediate	3.05	(1.57)	3.45	(1.85)	-0.22
Delayed	2.10	(1.74)	1.25	(1.16)	0.73

*$p < .05$.
Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

Table 8

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction Conditions for the Combined Compare-and-Contrast Text Passages, Kinetic Energy and Potential Energy and Oligotrophic Lakes and Eutrophic Lakes

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.40	(1.05)	0.30	(0.98)	0.10
Immediate	11.90	(5.96)	12.60	(8.26)	-0.08
Delayed	5.60	(4.52)	3.40	(3.19)	0.69
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.90	(2.00)	0.50	(1.82)	0.22
Immediate	15.65	(5.87)	15.70	(7.12)	-0.00
*Delayed	10.00	(5.91)	4.80	(3.82)	1.36
	Not Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.25	(0.72)	0.00	(0.00)	--------
Immediate	5.50	(3.75)	5.80	(4.21)	-0.07
Delayed	2.45	(2.93)	1.10	(1.89)	0.71
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.55	(1.00)	0.05	(0.22)	2.27
Immediate	7.55	(2.84)	8.55	(4.08)	-0.25
*Delayed	4.55	(3.71)	2.65	(2.48)	0.77

*$p < .05$.
Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

Table 9

Means and Standard Deviations for the Pre-, Immediate, and Delayed Tests for the Text-Structure Strategy and Traditional Instruction for the Sum of the Combined Score of All Main Idea and Compare-and-Contrast Text Passages

Test	Text Structure		Traditional		Effect Size (X_e-X_c/SD_c)
	Test-Worthy Concept Importance, Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.40	(1.05)	0.40	(1.39)	0.00
Immediate	17.00	(7.75)	16.30	(10.39)	0.07
Delayed	7.25	(6.32)	3.70	(3.45)	1.03
	Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	1.00	(2.10)	0.75	(2.27)	0.11
Immediate	24.65	(7.27)	23.60	(10.19)	0.10
*Delayed	12.20	(7.48)	6.50	(5.16)	1.10
	Not Test-Worthy Concept Importance-Strict Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.25	(0.72)	0.10	(0.31)	0.48
Immediate	9.60	(5.42)	9.80	(6.49)	-0.03
Delayed	7.25	(6.32)	3.70	(3.45)	1.03
	Not Test-Worthy Concept Importance, Loose Scoring				
	M	*(SD)*	*M*	*(SD)*	
Pre	0.55	(1.00)	0.25	(0.55)	0.55
Immediate	14.95	(4.66)	15.15	(6.77)	-0.03
*Delayed	12.20	(7.48)	6.50	(5.16)	1.10

*$p < .05$.
Note. Effect sizes around .20 are considered small, around .50, medium, and around .80, high (Cohen, 1988).

randomly assigned to either a text-structure strategy condition or a traditional instruction condition. Data analyzed using repeated-measures ANOVAs indicated that students in the text-structure strategy condition outperformed students in the traditional instruction condition on the sum of combined scores across all measures. However, effect sizes were negligible on the immediate measures, whereas they were extremely large (i.e., greater than 1.00 across all four scoring methods) on the sum of delayed retell measures. These findings suggest that instruction in text-structure strategies did improved reading comprehension for postsecondary students with LD, particularly on delayed recall measures for compare/contrast passages.

Reading Comprehension

The use of text-structure strategies in this investigation improved students' reading comprehension, with significant improvement on delayed recall on compare-and-contrast text structures. Effect sizes ranged from high medium (i.e., .69) to very large (i.e., 1.36) across the four scoring methods. We believe that students in the text-structure strategy condition could remember more information from the text page because they employed strategies that promoted metacognition. Students with LD who employed more metacognitive learning strategies achieved higher GPAs than those who did not (Trainin & Swanson, 2005). Thus, postsecondary students with LD who improve their metacognitive skills may improve their chances of completing postsecondary programs and successfully entering into the workforce (Madaus, 2006). This study extends previous research on students with LD by demonstrating the efficacy of instruction in expository-text-structure strategies. The most important aspect of this study is that it investigated the population of postsecondary students with LD who have been extremely underrepresented to date in reading comprehension investigations.

Text-Structure Strategies

Main idea text-structure strategy. Although students in the text-structure strategy condition obtained higher immediate and delayed test mean scores than the students in the traditional instruction condition, these scores were not significantly higher on main idea text structure passages. Effect sizes on the immediate tests were small, with three of four scoring methods ranging from .24 to .44; effect sizes on the delayed measures on main idea passages were also small, on three of four scoring methods ranging from .22 to .53. The only significant effect size for main idea passages on the delayed recall measures occurred with the strict scoring of test-worthy concepts.

Main idea text structure occurs when the first sentence states the main idea followed by supporting ideas and details. Main idea text structure is identifiable, yet often the most important supporting ideas related to the topic are not stated explicitly and may be confused with incidental ideas such as examples, definitions, or analogies. The deductive nature of main idea text structure presents challenges to students who have problems discriminating main ideas from incidental details. This finding supports previous research conducted by Worden et al. (1982). In the Worden et al. study (1982), postsecondary students' performance on main idea units of stories recalled was compared to the performance of third graders. However, the students who received main idea text structure strategy obtained higher mean scores when compared to students who received traditional instruction.

On the combined main idea text passages, solar cells and habituation, the immediate and delayed mean test scores of students in the text-structure strategy condition were higher than those of students in the traditional instruction condition. Again, these findings may be attributed to the main idea text-structure strategy, which required students to underline the main idea in the first sentence and then to paraphrase and write the supporting ideas and details. We gave students who participated in the text-structure strategy condition specific steps to follow for organizing and identifying important elements of the texts. Students in the text-structure strategy condition used their study time not only to recall, but also to implement the strategy steps. However, students in the traditional instruction condition used their study time simply to try to memorize the text.

Compare-and-contrast text-structure strategy. Results also indicated that students in the text-structure strategy condition achieved test scores significantly higher than those of students in the traditional instruction condition on the two delayed recall measures. These findings may be attributed to use of the compare-and-contrast text-structure strategy. Steps of this strategy instructed students to list the two concepts on their workbook pages and then to paraphrase and write what was the same and different about the two concepts.

Students in the text-structure strategy condition had to organize and identify similarities and differences between the concepts to complete the strategy task. Thus, they remembered the text passages by focusing on the structure of the passages rather than simply

rehearsing the text information, as did students in the traditional instruction condition. Moreover, when students in the text-structure strategy condition performed the retells, they began by identifying the two concepts that precisely matched the concepts ranked as most important by the interraters. The text-structure strategy enabled students to retell more information because the information was organized clearly and, thus, held more meaning for them.

Students' answers to open-ended questions. We asked students in both conditions open-ended questions before the delayed retells. Students in the text-structure strategy condition reported they learned a strategy to help them to comprehend text passages better. All students in this condition noted that the strategy was easy to follow and easy to use, and that they did not have to rely on basic memorization of the text passages. They believed that if they used the strategy, they could remember the text passages due to the organization the strategy provided to them.

In contrast, students in the traditional instruction condition could not report a specific organizational strategy that they could use in the future to improve their text comprehension. As the traditional instruction consisted of answering comprehension questions, students in this condition could only attempt to memorize the words of the text passages, instead of actually comprehending the meaning of the text passages.

Limitations

As noted in previous research, many students with LD have difficulty with reading (e.g., Bakken et al., 1997; Chan & Cole, 1986; Graves, 1986; Warde, 2005; Worden et al., 1982). This study suggests that postsecondary students with LD do improve their reading comprehension with text-structure strategy use. However, some limitations present in this study do affect generalization of these findings to other populations.

Adapted text passages. One limitation of this study is that the text passages averaged at 150 words with an eighth-grade readability level. This may limit generalization of the results, as most authentic college-level texts exceed 150 words and have readability levels at grade 12 and higher. Thus, postsecondary students are expected generally to be able to comprehend lengthy text passages written at difficult rather than controlled readability levels (Warde, 2005).

ACT scores. Another limitation relates to the ACT scores of the participants in this sample. These students had ACT scores lower than the national mean and would be considered at risk in college. Thus, these results may not generalize to other students with LD with higher ACT scores, who might not be at risk. Learning strategies are only effective for students who need them.

Instructional and study time. In addition, the study strictly controlled instructional time, with only two 30-minute instructional sessions that used scripts and a stopwatch across conditions. During the instructional presentation, students could not ask clarification questions, even if such questions occurred to them. In a typical postsecondary class, by comparison, students usually have the opportunity to ask questions and receive clarifications. Further, students in the study were limited to 3 1/2 minutes of independent study time whereas study time is a factor within the control of most postsecondary students. In fact, *Trainin and Swanson* (2005) found that students with LD often spent considerably longer on their schoolwork than their peers to compensate for their other academic deficits.

Individual instruction. The study provided one-to-one direct instruction based on an effective teaching model (Mastropieri & Scruggs, 2004). By comparison, most instruction in today's postsecondary classes delivers content through lectures and to large groups rather than individual students. Lecture models of instruction do not provide time for guided practice and independent practice of skills as did this direct instruction format. Thus, these results may not be generalized to instruction as presented in other postsecondary classes.

Voluntary participation. Finally, a further limitation of this study is that the participants were volunteers. Participation may have been motivated by students' desire to improve their reading comprehension and concern about their low academic performances (Henderson, 2001). Clearly, volunteers cooperated more and maintained a higher level of motivation than non-volunteers, and these factors may have enhanced the benefits of the strategy instruction.

Implications

Text-structure strategies. The results of this study confirm that postsecondary students with LD who received instruction in text-structure strategies outperformed students who received traditional instruction, thus extending previous text-structure strategy research conducted at K-12 grade levels, (e.g., Bacon & Carpenter, 1989; Bakken et al., 1997; Smith & Friend, 1986; Wong & Wilson, 1984) The use of text-structure strategies did improve these students' reading comprehension of expository texts.

A recent meta-analysis of reading comprehension research (e.g., Swanson, 1999) supports the cognitive/information-processing paradigm. Students in the present study who received text-structure strategy instruction demonstrated better long-term memory of science content than did students in the traditional instruction condition on delayed retell measures. Students in the traditional instruction condition who only rehearsed phrases from the text passages could not recall those phrases on the delayed measures, perhaps because they did not organize the meaning or access long-term memory.

Reading comprehension and expository texts. To succeed in college and beyond, postsecondary students with LD must improve their reading comprehension, particularly of expository text, which has been determined to be more difficult than narrative text (Pugh et al., 2000). Not only is expository text the most prevalent type of text at the postsecondary level, but students are also expected to read increasing amounts of text as they proceed through school (Deshler et al., 1996). This study employed expository text passages from science for both main idea and compare-and-contrast text structures, which closely represents the types of text experienced at the postsecondary level.

Students in the text-structure strategy condition also significantly improved their reading comprehension on delayed tests of retell. Because postsecondary students generally take fewer tests (e.g., midterms and finals) than students at lower grade levels, postsecondary students will benefit from a strategy that improves long-term comprehension rather than short-term rote memorization.

Recommendations

Additional research needs to address strategies to improve reading comprehension for postsecondary students. It is well documented that LD does not disappear with age (e.g., Gerber et al., 1990). As LD is not "cured", it is fairly certain that postsecondary students with LD exhibit the same characteristics as younger students with LD (e.g., Deshler, 2005); however, the nature of postsecondary institutions does not mirror K-12 environments. Most students with LD have specific accommodations in place in their K-12 environments. Although some students with LD may have access to accommodations in the postsecondary environment, the lack of research to determine effective interventions for this age group is insufficient to ensure the accommodations at the postsecondary level are appropriate.

This study suggests that postsecondary students would benefit from additional academic assistance such as instruction in reading strategies, which can be provided through tutoring or mentoring programs. Postsecondary institutions that provide this type of academic assistance might see better outcomes for postsecondary students with LD. This type of academic assistance could easily be through tutoring services or mentoring programs provided (see Alsopp et al., 2005). As more and more students with LD attend postsecondary institutions, their needs must be addressed to benefit them and to improve their graduation rates from postsecondary institutions.

This study demonstrated the efficacy of text-structure strategies with postsecondary students with LD. However, there are also other reading strategies that may be effective. We must identify additional reading strategies that might be useful for postsecondary students with LD, particularly those that focus on expository text. This study provided support that postsecondary students with LD can learn and apply a cognitive strategy to improve their retell of expository texts. Since most postsecondary textbooks are written using expository structures, further investigation in this area is warranted.

Although it may seem remedial to provide reading instruction to postsecondary students with LD, such reading instruction is necessary. It should include reading strategy, text structure, and reading text-structure strategies. In addition, it is not assumed that this relatively short amount of intervention can remediate postsecondary students' complex reading comprehension difficulties. However, this study confirms that reading instruction that includes strategy use can be extremely valuable. As indicated by the results, students in the text-structure strategy condition outperformed students in the traditional instruction condition. Moreover, this performance was greater in the delayed measures and can be attributed to the use of a reading strategy.

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