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The Effects of Strategic Notetaking on the Recall and Comprehension of Lecture Information for High School Students with Learning Disabilities

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This investigation examined the effects of strategic notetaking on the recall and comprehension of high school students with learning disabilities (LD) or educable mental retardation (EMR). Twenty-six students with high incidence disabilities (LD or EMR) were randomly assigned by grade and disability to either an experimental or control group. Using strategic notetaking, students in the experimental group were taught to independently take notes while viewing a videotaped lecture. Students who were taught strategic notetaking scored significantly higher on measures of immediate free recall, long-term free recall, comprehension, and number of notes recorded than students in the control group who used conventional notetaking. The limitations of the research and implications of this technique for classroom application are discussed.

Notetaking during lectures serves two fundamental purposes: it aids student understanding of lecture points and it serves to preserve lecture information, in the form of notes, for later study. Researchers (Aiken, Thomas, & Shennum, 1975; Bretzing & Kulhavy, 1979; DiVesta & Gray, 1972; Kiewra, 1984) have long demonstrated that student notetaking during lectures is advantageous for increasing comprehension and improving later recall of information. For example, students who took notes increased their attention to lecture material (Kiewra, 1987), were actively engaged in lectures (DiVesta & Gray, 1972), paraphrased and elaborated on lecture information (Suritsky & Hughes, 1996), sought to clarify their understanding of confusing points (Ruhl & Suritsky, 1995), and increased their test performance of lecture material (Peper & Mayer, 1986).

Taking notes not only allows students to become actively involved in lectures; notes also serve as a written document that aids students during review and preparation for tests (Henk & Stahl, 1985). This aspect is particularly important for secondary students with LD because research by Putnam and others (Putnam, Deshler, & Schumaker, 1993) has shown that in secondary content classes almost half of a student's grade was derived from test scores. Moreover, according to these researchers, teachers reported that "their lectures were the major source of information on which test questions were based" (p. 340). Because lectures are the primary mode of learning in secondary classes and notetaking serves such a vital link between acquiring information and earning high grades (Putnam et al., 1993), it is essential that students with LD become proficient notetakers.

Despite the importance of listening comprehension and notetaking in secondary classes for students with LD, these students often exhibit deficits in written language and other related areas (Schumaker & Deshler, 1984). In the area of written language research and students with LD (Graham & Harris, 1993; Hughes & Smith, 1990), a preponderance of evidence suggests that written language is one of the most difficult academic areas for students to master. From the simplest writing skills, such as spelling, punctuation, and legible writing (Hughes & Smith, 1990; Poteet, 1979), to higher level strategic skills, such as detection of writing errors and planning for writing (Ellis & Colvert, 1996; Graham & Harris, 1993), researchers have consistently documented written language deficits in students with LD. Not only do these lower level skills in themselves interfere with notetaking, low level skills also interfere with higher level strategic processing. For example, in 1992 when Suritsky interviewed students with LD, they reported that lower level skills such as spelling and handwriting often slowed down their writing speed, which further added to their problems of keeping up with the lecturer. On a higher, metacognitive level Suritsky (1992) noted that students often reported that they took notes in a verbatim fashion, an impossible method for even the most proficient, nondisabled student. Moreover, when asked what strategies should be used to take better notes, few students reported effective and efficient techniques.

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In addition to these written language deficits closely associated with notetaking, Suritsky (1992) and Hughes and Suritsky (1994) reported additional deficits in the area of notetaking skills. From Suritsky's (1992) research, students with LD reported that they had difficulty deciding what information was the most important to record and they reported difficulty paying attention to the lecturer. In quantifiable terms, Hughes and Suritsky (1994) confirmed student's self-reports. For example when compared to their nondisabled peers, students with LD overall produced fewer units of recorded information (i.e., more incomplete notes) and even when given *explicit* instructor cues about important information, recorded fewer of these "cued" lecture points. For most students with LD, the overall effects of missing cued information and recording incomplete notes has immediate repercussions not only for their understanding of lecture information, but also for later effects on remembering and recalling information for tests.

As suggested by the literature, a number of approaches (e.g., providing students with notetakers, modifying the lecture style of the speaker, etc.) can be taken to help students with LD compensate for their notetaking deficits. First, instructors could provide students with notetakers who would record notes for them. Although this method is commonly used for students with LD, its main drawback is that these students assume a passive learning mode during the lectures, thereby missing the benefits of being actively involved in lectures (Ruhl et al., 1990). In addition, students who assume this passive mode of learning may ask fewer questions about confusing information (Ruhl, Hughes, & Gajar, 1990) and may encode few units of information to long-term memory because they are not actively processing information (DiVesta & Gray, 1972). Second, instructors could modify their method of presentation, such as speaking at a slower rate, pausing more frequently during lectures, providing students with outlines or copies of their notes, and providing more verbal and nonverbal cues for important lecture points (Suritsky & Hughes, 1996). Although these techniques would be helpful for all students, general education teachers are often reluctant to make changes in their teaching or presentation mode (McIntosh, Vaughn, Schumm, Haager, & Lee, 1993; Schumm & Vaughn, 1991). In fact, most general education teachers often have to cover vast quantities of information in order for students to smoothly transition to more advanced courses (Bulgren & Lenz, 1996; Schumm & Vaughn, 1991; Schumm, Vaughn, Haager, McDowell, Rothlein, & Saumell, 1995), an effort that would be hampered by having to slow down their presentation modes. Third, a more efficient approach to notetaking would be to teach students with LD notetaking strategies and techniques. Teaching these "student approaches" would be initially time intensive for teachers; however, these techniques can be used over a long period of time and often will generalize to multiple settings, such as general education classes, making the initial time investment worthwhile. In addition, these student approaches would not require general education teachers to make many adjustments in their lecture style or content.

A review of the literature has revealed few student notetaking techniques and strategies to enhance the skills of students with LD. Of the strategies offered for students with LD, Suritsky and Hughes (1996) have suggested two specific learning strategies: AWARE and LINKS. According to Suritsky and Hughes (1996), an investigation of the AWARE strategy found that it was effective at increasing the number of cued lecture points in notes and overall completeness of notes for nine college students with LD.

Other notetaking techniques have been reported in the literature and two, the columnar format and guided notes, have been empirically investigated and found to be effective for students with LD. The columnar format has been suggested by Saski, Swicegood, and Carter (1983) as a possible method to improve the notetaking skills of students with LD during lectures. However, this technique was not empirically assessed during lectures; instead it was used by students as they read passages (Horton, Lovitt, & Christensen, 1991). While the results show that this technique was effective at increasing comprehension, its effectiveness during lectures has yet to be assessed. The only other research-based notetaking technique was guided notes (Lazarus, 1991). In this investigation, six high school students with LD were trained to use the guided notes format while listening to tape-recorded lectures. According to the author, once students were trained to use guided notes, they exhibited greater gains on tests than when using their conventional notetaking technique. Lazarus also noted greater gains when students used guided notes in conjunction with a short review period.

As evidenced by the literature, only two techniques (guided notes by Lazarus (1991) and the AWARE strategy by Suritsky and Hughes (1996)) have been reported as research-based notetaking techniques for students with LD to use during lectures. While other notetaking techniques have been suggested, the dearth of published, research-based, student-oriented techniques or strategies is surprising in light of the evidence emphasizing the importance of notetaking skills for junior and high school students with LD (Putnam et al., 1993). Because of the need to examine notetaking techniques that promote active engagement during notetaking for students with LD during lectures, this study sought to assess the effects of strategic notetaking on the performance of high school students with LD. More specifically, we sought to determine the effects of strategic notetaking on immediate free recall measures, long-term free recall measures, comprehension measures, and overall length of notes for students with LD.

In this particular study, we decided to count the number of words rather than information (or idea) units (IU). Our reasoning behind this was that past research (Kiewra & Fletcher, 1984) has shown that there was a significant correlation between the total number of words recorded in notes and test performance. In addition, we decided to count vocabulary words to ensure the validity of our word count.

METHOD

Subjects and Design

The sample (Table 1), as described by recommendations set forth by the 1993 Council for Learning Disabilities (CLD) Research Committee (1993), consisted of 26 high school students, 22 of whom were categorized as learning disabled (LD)

TABLE 1
Characteristics of the Control and Experimental Groups

	Control Group (*N = 13*)	*Experimental Group* (*N = 13*)
Gender:		
Male	11	10
Female	2	3
Ethnicity:		
African-American	1	1
Anglo	11	12
Hispanic	1	0
Grade:		
10th	4	4
11th	4	4
12th	5	5
Disability:		
LD	11	11
EMR	2	2
WISC III:		
LD Mean Full Scale	80.6	81.9
(SD)	(6.2)	(2.9)
EMR Mean Full Scale	67.5	69.0
(SD)	(0.7)	(1.4)
Wide Range Achievement Test:		
LD Mean Reading Score	74.0	73.2
(SD)	(6.0)	(7.8)
EMR Mean Reading Score	60.0	57.5
(SD)	(5.7)	(4.9)
LD Mean Math Score	77.8	79.1
(SD)	(9.0)	(18.6)
EMR Mean Math Score	56.5	65.5
(SD)	(6.4)	(7.8)
LD Mean Writ. Lang. Score	75.0	76.6
(SD)	(7.4)	(13.0)
EMR Mean Writ. Lang. Score	62.5	57.5
(SD)	(6.4)	(1.0)
Writing Sample:		
LD Mean CBM Idea Units	6.5	7.1
(SD)	(2.7)	(3.7)
EMR Mean CBM Idea Units	5.0	4.5
(SD)	(4.2)	(1.0)

*Scores from 3-minute writing sample—number of idea units.

Note. EMR is defined as significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affect a child's educational performance.

LD is defined as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations (IDEA Regulations, 34 C.F.R. 300.7).

and 4 of whom were categorized as educable mentally handicapped (EMR). All of the students were enrolled in a special education English or science class. Using an experimental group-control group design (Kerlinger, 1986), students in 10th through 12th grade were randomly assigned by grade and disability to either a control or experimental group, with each group comprised of 13 students. The original sample size consisted of 29 students, but through attrition was reduced to 26, due to nonattendance during training and testing sessions.

The sample included only those students who were identified as LD or EMR by the local school district and Illinois State Board of Education guidelines. Students identified as LD had documentation of a significant deficit between achievement and IQ scores, as specified in 23 Illinois Administrative Code Part 226 (2000). Similarly, students identified as EMR displayed subaverage IQ and adaptive behavior scores. We did not question the categorical label assigned to the students, but instead relied upon the district for properly identifying students as either LD or EMR.

In order to ensure that both the experimental and control groups (no treatment group) were equivalent, an initial t-test was conducted. The results from this initial analyses found no significant difference between the two groups on IQ scores, nor were there any significant differences between the two groups on (pretreatment) writing sample scores.

Setting

The students attended a large high school (approximately 2,000 students) in a rural district bordering a large metropolitan area in the Midwest. Each special education classroom was staffed with a special education teacher and a paraprofessional, both of whom were present throughout the study. The teachers did not directly participate in any component of the training. The investigators conducted all training throughout the study.

Materials

Two videotaped lectures were used in this study, one for training and the other for the testing session. As a control for student's prior knowledge, lecture topics were drawn from *Scientific American* magazine. (The articles were about desert frogs and Sican metal workers.) We assumed that students did not have knowledge of these topics. The videotaped lectures ranged from 26 to 30 minutes in length and began by the instructor introducing the topic and informing students to begin taking notes on his cue. The lectures were presented at an average rate of 110 words per minute on one 25-inch color television monitor. The videotaped lectures simulated typical high school lectures in that they were all presented by the same lecturer and, with the exception of a few vocabulary words on the board (10 per lecture), they were auditory in nature.

Independent Variable

The independent variable was strategic notetaking. (An abbreviated version of the strategic notetaking form is presented in Figure 1.) In this study there are two levels of the independent variable. The first level includes students who received the strategic notetaking and the second includes those students in the no-treatment group. Strategic notetaking involved training students to use this "cued" form. Because using metacognitive skills, such as organizing information and combining new with prior knowledge, are believed to aid comprehension during learning (Palincsar & Brown, 1984), the written prompts for the notetaking form were developed

Strategic Notetaking Form

Fill in this portion before the lecture begins.

Page 1

What is today's topic?

Describe what you know about the topic.

As the instructor lectures, use these pages to take notes of the lecture.

Today's topic ?

Name three to seven main points with details of today's topic as they are being discussed.

Summary - Quickly describe how the ideas are related.

New Vocabulary or Terms:

Page 2

Name three to seven new main points with details as they are being discussed.

New Vocabulary or Terms:

Summary - Quickly describe how the ideas are related.

Page X

Name three to seven new main points with details as they are being discussed.

New Vocabulary or Terms:

Summary - Quickly describe how the ideas are related.

Last Page

At End of Lecture

Write five main points of the lecture and describe each point.

1.

5.

FIGURE 1 An Abbreviated Strategic Notetaking Form.

using this theory. In this way, students could use these “meta-thinking” skills to become more actively involved during lectures. A number of notetaking studies support this theory (i.e., during notetaking students should actively generate relationships among parts of the information and between information and one’s prior knowledge), particularly for nondisabled college students (Bretzing & Kulhavy, 1981; Kiewra, 1985; Peper & Mayer, 1986).

As students used the form to take notes, they were instructed to read each prompt and relate it to a lecture point (see Figure 1); thereby aiding the students with note generation and depth of processing (Bretzing & Kulhavy, 1981; Kiewra, 1985; Peper & Mayer, 1986). Specifically, the first portion of strategic notetaking requested students to quickly identify the lecture topic and relate the topic to their own prior knowledge. In doing so, students are able to make a connection between new and previously learned information, making the new information more "meaningful"; thereby storing it in long-term memory (Peper & Mayer, 1986). The next step requested that students cluster together three to seven main points with details from the lecture as they are being discussed. By clustering ideas together, it was our belief that students would more efficiently encode this information to long-term memory and prevent information decay (Hughes, 1996). Similarly, we believed that summarizing (or categorizing) in the next step would aid students at encoding and storage of information in long-term memory (Kiewra, DuBois, Christian, McShane, Meyerhoffer, & Roskelley, 1991). The steps of naming three to seven new main points and summarizing immediately after naming these points was repeated until the lecture ended. The last step, writing five main points and describing each, was intended to serve as a quick review of the lecture. This last step was included because other studies have supported the use of "review" to enhance encoding of memory to long-term storage. (See Kiewra (1985) for his review of notetaking research.)

Recorded Units Per Recall Measure and Notes

As mentioned earlier, student productivity was assessed by the number of words recorded. As used by other researchers (Hartley & Marshall, 1974), we felt that this method would result in a more accurate measure of productivity. As a safeguard to ensure that students were writing words that related to the lecture, we also counted the number of vocabulary (or reference) words used by each student on the immediate and long-term free recall measures and student notes. Their vocabulary words were compared to the vocabulary words used in the actual lecture notes and students were awarded one point for each vocabulary word match. As with the word count, each vocabulary word was awarded one point even if the student wrote the same word more than once.

Dependent Variables

The four dependent variables used to assess the effectiveness of strategic notetaking include: an immediate free recall (IFR) measure, a long-term free recall (LFR) measure, a comprehension test (CT), and the number of words found in students' notes.

An immediate free recall measure was used promptly after students viewed the videotape to assess their knowledge about the lecture topic. Upon completing the videotape, students were instructed to place their notes out of sight and use blank paper to *write down* as many facts, vocabulary, and lecture ideas as they could within a five-minute time period.

An independent rater scored all IFR measures and counted the number of words. Using the IFR measures, a second rater randomly selected one-third of the completed IFR measures and scored each in the same manner as the first rater. Interrater reliability was calculated to be 0.97 for the IFR measures using the total number of words and 0.94 using the total number of vocabulary words.

Long-term free recall measures (LFR) were administered to assess long-term knowledge about each lecture topic. Two days after viewing a videotape, students completed an LFR measure. Like the IFR measure, students were instructed to write down as many facts, vocabulary, and lecture ideas as they could within a five-minute time period.

Interrater reliability was also assessed for the LFR measure. Using one-third of the randomly selected LFR measures, interrater reliability was calculated among the two raters and found to be 0.97 using total number of words and 0.95 using the total number of vocabulary words.

The comprehension test for the lecture consisted of 18 multiple-choice questions derived from the lecturer's notes. In order to avoid ceiling effects, the level of difficulty for the comprehension test was set high. Immediately following each IFR measure, students were administered the comprehension test. Using an answer key, each test was scored by an independent rater and random spot checks revealed 100% scoring accuracy.

Finally, the notes taken by students during the lecture were assessed by an independent rater. Similar to the reliability procedures used with the IFR and LFR measures, one-third of student's notes were randomly chosen and assessed. Interrater reliability was calculated to be 0.98 using total number of words and 0.95 using total number of vocabulary words.

Overall Procedures

The study was conducted over four sessions. During the first two sessions, experimental students were trained using the first videotaped lecture. On the third session, experimental and control students together viewed the second videotaped lecture, recorded notes, and completed the IFR and comprehension measures. The control group was provided with lined (blank) paper and instructed to use conventional notetaking procedures to record notes from the videotape. On the other hand, the experimental group was provided with the strategic notetaking form and instructed to record notes as they were trained during the previous two sessions. On the fourth session (two days later), experimental and control students together completed the LFR measure.

Strategic Notetaking Training

During a 50-minute training session, the primary investigator followed a scripted lesson and trained students how to use the strategic notetaking form. Throughout the training, the investigator provided a brief description of strategic notetaking, modeled the technique, and guided students through practice portions of the videotaped lecture while providing appropriate feedback. At the start of the session, the investigator explained to students how the strategic notetaking form was developed and its purpose. Next, the investigator reviewed all the strategic notetaking sheets, pointing out the crucial prompts on each page. Following this description, the investigator turned on the videotape and began modeling the use of strategic notetaking by writing notes on the form and by using a "think aloud" technique to verbally convey his thoughts to students. At the end of the first lecture portion, the investigator stopped the tape and explained to students what he had written on the notetaking form. During this time the instructor pointed out to students how he recorded words and phrases and how he did not record the lecture verbatim. He also pointed out to students that he was not concerned about spelling or grammatical errors, as long as the notes were written legibly. After soliciting questions, students were instructed that they should now fill in the form as the next section of the videotaped lecture was played. Once students completed this next section, the videotape was stopped, questions were solicited, and student responses from their written notes were discussed. This procedure was repeated until the conclusion of the videotaped lecture.

During a second, 50-minute, training session, experimental students again used the *same videotape* and a *new* strategic notetaking form, except the videotape was not stopped until the end of the lecture. As the videotape was played, the investigator encouraged students to continue recording notes even though some students were recording notes at a faster pace than others. The purpose of this training session was to acclimate students with the speed of the lecture and improve their fluency at using strategic notetaking. At the end of the lecture, the investigator reviewed student notes for accuracy and completeness and verbally reinforced correctly recorded notes.

RESULTS

Data Analysis

Because more than one dependent variable was used in conjunction with the independent variable, a Multivariate Analysis of Variance (MANOVA) was the preferred data analysis technique (Stevens, 1992). Average student scores were compared using this analysis. The recall scores were expressed as number of written words per measure and the comprehension scores were expressed as percentage points (i.e., if students correctly answered 12 out of 18 questions, they would earn a score of 67%).

Total Number of Words

Using IFR measures, LFR measures, comprehension scores, and number of words from notes, the analysis yielded statistical significance with Wilks' Lambda = 0.20, $F(4, 21) = 21.59$, $p = 0.00$. Because overall significance was obtained, univariate analyses of variance (ANOVA) were conducted to determine the significance of each variable used in the overall MANOVA.

Table 2 displays the average scores for both the experimental and control groups of the ANOVAs. The average score on the IFR for the experimental group was 37 words (SD = 24.7), 23 more words than the control group (14 words, SD = 11.2), and statistically significant at the 0.05 level. The second variable, LFR, was found to be significant with an average experimental group word length of 22 (SD = 16.8), compared to an average control group word length of 4 (SD = 5). On the third variable, the comprehension test, a significant difference was found between the experimental group (37.4%, SD = 10.9%) and the control group (27.1, SD = 13.4%). Finally, on the last measure, number of words from notes, as we expected, the experimental group significantly outperformed the control group (176 words (SD = 61.8) versus 21 words (SD = 30.5)).

TABLE 2
Results of Univariate ANOVA Using Total Word Count

Measure and Group	*Mean*	*SD*	*F*	*df*	*Power*	*ETA2*
Immediate Free Recall:						
Experimental	37.5*	24.7	9.5	1,24	0.84	0.28
Control	14.3	11.2				
Long-Term Recall:						
Experimental	22.2*	16.8	14.3	1,24	0.95	0.37
Control	3.9	4.9				
Comprehension Test:						
Experimental	37.4%*	10.9	4.6	1,24	0.54	0.17
Control	27.1%	13.4				
No. of Words in Notes:						
Experimental	175.4*	61.8	64.8	1,24	0.99	0.73
Control	21.5	30.5				

*Significant at .05 level.

Total Number of Vocabulary Words

Using IFR measures, LFR measures, and number of words from notes, the analysis yielded statistical significance with Wilks' Lambda = 0.34, $F(3, 22) = 14.29$, $p = 0.00$. Because an overall significance was obtained, univariate analysis of variance (ANOVA) was conducted to determine the significance of each variable used in the overall MANOVA.

Table 3 displays the average scores for both the experimental and control groups of the ANOVAs. The average score on the IFR for the experimental group was 10 vocabulary words (SD = 6.2), compared to 5 (SD = 3.4) vocabulary words (average) for the control group, and was statistically significant at the 0.05 level. On the next variable, LFR was found to be significant with an average experimental group vocabulary word count of 7 (SD = 6.5), compared to an average control group vocabulary word count of 1 (SD = 1). On the last measure, number of vocabulary words from notes, as expected, the experimental group significantly outperformed

TABLE 3
Results of Univariate ANOVA Using Vocabulary Word Count

Measure and Group	*Mean*	*SD*	*F*	*df*	*Power*	*ETA2*
Immediate Free Recall:						
Experimental	10.5*	6.2	8.1	1,24	0.78	0.25
Control	4.9	3.4				
Long-Term Recall:						
Experimental	6.9*	6.5	9.5	1,24	0.84	0.28
Control	1.1	1.0				
No. of Words in Notes:						
Experimental	59.9*	24.8	41.8	1,24	0.99	0.64
Control	10.5	11.9				

*Significant at .05 level.

the control group (60 vocabulary words (SD = 24.8) versus 11 vocabulary words (SD = 11.9)).

Power and Effect Sizes for Both Univariate Analyses

Of interest, we included the power and ETA squared (effect size) coefficients for each variable. Power is an important variable to consider because it represents the probability of correctly rejecting a false hypothesis (Kerlinger, 1986). Similarly, ETA squared is also of importance because, taken together with power and sample size, it represents the strength of the independent variable or the proportion of variation explained by the treatment in an experiment (Keppel, 1991).

In Table 2, for three of the variables, IFR, LFR, and notes, a power analysis yielded large power. For IFR, LFR, and notes the power ranged from 0.84 to 0.99. However, on the comprehension measure, medium power was found (0.54). Similarly high power coefficients (range = 0.78 to 0.99) were found using the three variables, IFR, LFR, and notes in the second univariate analysis (Table 2). In addition to high power levels, a statistical analysis revealed large effect sizes using partial ETA squared. Tables 2 and 3 display the partial ETA squared coefficients which range from 0.17 to 0.73. According to Cohen (1977), using partial ETA squared, coefficients of 0.14 or larger represent a large effect size.

DISCUSSION

The strategic notetaking technique used in this investigation was demonstrated to be more effective than conventional notetaking by initially prompting students to record more notes, produce more words on both recall (IFR and LFR) measures, and improve their comprehension of lecture information. We hypothesized that the positive effects on the long-term recall and comprehension test probably occurred because students were forced to chunk information during the lecture (e.g., name three to seven new main points with details) and because they were asked to summarize lecture points during one of two steps of the notetaking procedures (e.g., quickly describe how the ideas are related or write five main points of the lecture). We feel that manipulation of lecture points, through these two metacognitive processes of chunking and summarizing, aided encoding of information during notetaking, resulting in more lecture points being stored in long-term memory or lecture points being stored more efficiently in long-term memory.

In terms of the strength of strategic notetaking at producing substantial changes on ITR, LFR, length of notes, and comprehension, large effect sizes were found for all measures, along with medium to high power. From the results, observed differences indicated that strategic notetakers performed from twice (word count) to five times (vocabulary) better than conventional notetakers on the IFR measure and strategic notetakers performed on average five times better than conventional notetakers on the LFR measure. From student notes, the total number of notes taken (i.e., using total words and vocabulary words) also ranged from six to eight times that of conventional notetakers.

One disappointing finding was observed in terms of comprehension test scores. The mean difference on test scores between the two groups was small—10%—and the scores were low—37%—for the experimental group. We can only hypothesize that the difficulty level of the test may have suppressed student performance. One researcher in the area of test development, Sax (1989), has warned that when item difficulty is extremely "hard," the items may *not* effectively discriminate between students' scores. Still another possibility may have been that students had difficulty or were unable to read the test questions, resulting in poor test performance.

One limitation was that we did not counterbalance the training and test videos. Counterbalancing the training and treatment variables might have reduced any treatment effects from practice. A second limitation concerns the possibility of the Hawthorne effect on those students who received the strategic notetaking training. It might be possible that any training received would have increased notetaking and recall performance. Future studies should examine these limitations and attempt to address them by providing equal attention to the control group.

On the other hand, the results from the present investigation corroborate results from previous research that used college students with and without disabilities. Our findings concur that activities, such as strategic notetaking, which engage students during notetaking result in improved notes (Boyle, 1996; King, 1992; Ruhl & Suritsky, 1995), improved recall (Boyle, 1996; Ruhl, Hughes, & Gajar, 1990; Ruhl & Suritsky, 1995), and improved comprehension on tests (King, 1992; Ruhl et al., 1990).

In addition, our results parallel the results of Lazarus' (1991) study in that high school students with LD who used a student-oriented notetaking technique improved comprehension, albeit small, of lecture information. On the other hand, our study differs from that study in two distinct ways. First, rather than using audiotaped lectures as Lazarus did, we used a videotape lecture during practice and testing sessions, which more closely resembles an actual lecture. Second, the guided notes used by Lazarus required content-specific cues on the notetaking form whereas strategic notetaking's generic form makes it easily applicable to different content areas and requires little teacher preparation.

During our training of students with LD, we received feedback from them about the technique that may be helpful to educators. For instance, students reported that the informal poststudy interview technique was at first difficult to use and that they would probably improve their performance further if given extended practice using this "new" notetaking technique. As a result of these comments, we suggest that students should be taught to use this technique with a number of lecture topics before actually incorporating it into their own classes. Although this technique at first may seem cumbersome, it is possible that once students master this technique they could then be taught to fade out the use of the forms and incorporate only the written prompts during notetaking (Weishaar & Boyle, 1999). One way to do this would be to have the instructor write the strategic notetaking prompts on the board and then refer students to these prompts as the students take notes. Another suggestion would be to have students write the prompts on a notecard that could then be used as a reference while taking notes. Other modifications are possible (Boyle, in press) that could assist students wanting to use this technique in general education classes. Moreover, because this technique was effective with lecture material, it holds great potential as an effective technique for students to increase comprehension during other types of learning tasks, such as reading textbook material. As with any new technique, however, suggestions concerning generalization should be empirically tested to determine the effectiveness and feasibility of notetaking during actual learning tasks.

Future research may want to examine several aspects of strategic notetaking, or similar notetaking techniques, to identify the specific components that are responsible for enhancing understanding and recall of lecture information. As King (1992) has indicated, there may be certain generative components that are useful with different types of learning tasks (i.e., long-term tasks such as an essay exam versus short-term memory tasks such as constructing a research paper). Also, future research may want to examine the effectiveness and feasibility of a review period following notetaking. Moreover, questions still remain concerning the generalizability of strategic notetaking with "real" lectures taken from content areas and presented by classroom teachers. Finally, because students have difficulty noting important information from lectures, future research should examine this aspect of notetaking with the aim of developing different techniques that could assist students.

In conclusion, because notetaking skills are essential for high school students, strategic notetaking provides them with a method for increasing their short-term and long-term recall, while at the same time using metacognitive notetaking skills. We feel that this technique, as possibly modified by results from future research, has implications not only for students with learning disabilities, but also for any student who has experienced difficulty taking notes. Even though conventional notetaking skills may be sufficient for some students to pass some of their courses, we feel that a small initial investment of time learning this notetaking technique could help many students acquire skills that could greatly aid them in content-area classes.

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