Note-Taking and Secondary Students with Learning Disabilities: Challenges and Solutions

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As more secondary students with learning disabilities (LD) enroll in advanced content-area classes and are expected to pass state exams, they are faced with the challenge of mastering difficult concepts and abstract vocabulary while learning content. Once in these classes, students must learn from lectures that move at a quick pace, record accurate and complete notes, and then demonstrate their mastery of the content on tests. This article provides an overview of the challenges faced by students with LD in content-area classes and discusses the problems that students have learning from lectures and recording notes. Further, the article discusses theory and research related to note-taking and presents note-taking interventions that teachers can use to help students improve their note-taking skills, and ultimately, improve their achievement in these classes.

As the number of secondary students with learning disabilities (LD) who receive their education in general education content-area classes continues to grow, so too do the challenges that these students face. Between 1990 and 2008, there was a 166 percent increase in the percentage of students with LD who were educated in general education settings (McLeskey, Landers, Hoppey, & Williamson, 2011). For example, in some states as many as 96 percent of districts offer general education science classes for students with disabilities (Vannest et al., 2009). In many of their content-area classes, students with LD must master difficult content and integrate high-level thinking skills within problem-solving activities (e.g., experiments and research reports) (Deshler et al., 2001). Moreover, students with LD must learn new skills and content while at the same time dealing with their own deficiencies in listening comprehension, written language, and reading (Mason & Graham, 2008; Schumaker & Deshler, 2009; Ward-Lonergan, Lilies, & Anderson, 1998, 1999). To complicate matters, secondary teachers are less likely to provide substantive support in the form of accommodations and modifications to address students’ learning problems (Mastropieri & Scruggs, 2001), and by the time students with LD reach middle and high school, teachers expect them to be independent and autonomous learners who will meet the same standards as students without LD (Olson, 2004; Schumm et al., 1995).

Despite the increasing number of students with LD in advanced courses (National Council on Disability, 2008; Olson, 2004), most students with disabilities still have a difficult time mastering the skills and content in these classes (Lynch et al., 2007). Several studies illustrate the problems that students with LD have in content area classes. For example, when Deshler et al. (2004) examined grades of secondary students with disabilities in core courses, they found that 51 percent of these students had grade point averages of Ds or Fs. Similarly, in a sample of high school students with LD, Cawley, Kahn, and Tedesco (1989) reported that approximately 50 percent of students with LD earned D or F grades in the content areas of science and social studies. Likewise, national tests reflect students’ difficulties in content classes. On the National Assessment of Educational Progress, (NAEP) of 2005 in science, only 27 percent of middle school students with disabilities scored at or above the “Basic” level and 73 percent of students of these students scored “Below Basic.”

As more states require students to pass state tests for end-of-the-course and graduation requirements (Trotter, 2006), it becomes imperative that students with disabilities learn note-taking and study skills to keep up with the pace of instruction in their classes (Scruggs, Mastropieri, Berkeley, & Graetz, 2010; Schumm & Vaughn, 1995). For some students, keeping up in secondary classes can be difficult because 40–50 percent of the time is spent in lectures (Putnam, Deshler, & Schumaker, 1993). For example, Moin, Magiera, and Zigmond (2009) reported from their classroom observations of inclusive/cotaught science classes that the most common activity was whole-class instruction using a lecture format. This format occurred 42 percent of the time. During these lectures, students listened and took notes, copied information from the board, and used an organizer or handout to follow the lecture. In another study, Robinson (2002) reported that teachers employed in two primary learning methodologies during instruction in inclusive high school science classes—lecture with note-taking and cooperative learning with hands on activities. Teachers reported that it was important for all students, regardless of disabilities, to be engaged in the lectures through note-taking. Finally, in postsecondary settings, 98 percent of college students reported using...
note-taking skills in their classes to learn course content (Brobst, 1996). Because lectures represent the dominant form of conveying content information to students, note-taking skills represent a critical method of acquiring content knowledge.

When science and social studies teachers develop their lectures, the course textbook often serves as the primary source of information (Bean, Zigmond, & Hartman, 1994; Sanchez & Valcarcel, 1999; Scruggs, Mastropieri, & Okolo, 2008). Unfortunately, textbooks may be ill-suited as a main source of information because they are comprised of numerous concepts, verbally-based facts, abstract vocabulary, and detailed illustrations or diagrams (Cawley & Parmar, 2001; Harniss et al., 2001; Scruggs et al., 2007). Moreover, when presented in a lecture format, multiple concepts, facts, and vocabulary may be difficult for students with LD to learn, particularly when content is presented at a fast pace or if the lecture content is too dense (Scruggs et al., 2008). In fact, according to Marino (2010), science is considered one of the most difficult subjects for students with LD because of its complex vocabulary and theoretical concepts. Students with weak or inefficient note-taking skills are at a distinct disadvantage during content-area lectures because when they fail to keep up with the pace of the lecture, they end up recording incomplete or inaccurate notes (Hughes & Suritsky, 1994; Suritsky & Hughes, 1991). Thus, poor note-taking skills place students at risk twice during the learning process: once, as they learn the content during lectures and twice, when they go to study inaccurate or incomplete notes (Suritsky & Hughes, 1996).

Despite the importance of note-taking skills for learning content during lectures, students with LD are rarely taught formal note-taking skills (Beirne-Smith, 1989; Fulk, 2003). For many students, it is believed that they learn note-taking skills on their own before reaching middle and high school (Beirne-Smith, 1989). While students with and without LD may learn some note-taking skills, research has shown that these skills are ineffective. For example, studies have shown that students without LD record only about 25 percent of total lecture information (Boyle, 2010a; Risch & Kiewra, 1990). The main problem with recording such little lecture information is that once the lecture is over, if not captured through electronic means (i.e., audio recording), lecture information will be lost forever, leaving students to rely upon their memory to recall the information (Suritsky & Hughes, 1996). Likewise, if information is recorded poorly in their notes, students will more than likely perform poorly on tests (Stringfellow & Miller, 2005). Because teachers often use their own notes to develop tests (Putnam et al., 1993), and test scores account for 50 percent of a student’s grade (Putnam, 1992), accurate and complete notes are critical for students to be successful in content area classes.

### CHALLENGES OF LECTURES AND NOTE-TAKING FOR STUDENTS WITH AND WITHOUT LD

During lectures, teachers present two types of lecture points to students: cued (CLPs) and noncued lecture points (non-CLPs). CLPs are defined as those lecture points that have been deemed important by the teacher and are usually preceded by a teacher cue (e.g., “This is important to remember...”). Non-CLPs are the remaining lecture points found in notes. When added together, cued plus non-CLPs equal total lecture points (TLPs) found in students’ notes. Past research has shown that students with LD record fewer overall notes, record fewer CLPs, and perform poorly on tests and recall measures, even after recording lecture notes, compared to students without LD (Boyle, 2010a; Hughes & Suritsky, 1994). For example, Hughes and Suritsky (1994) compared the note-taking skills of college students with LD to students without LD and found that college students with LD recorded fewer overall lecture points (i.e., recording only 36 percent of overall lecture information, compared to 56 percent for students without LD), recorded fewer important lecture points (i.e., recording only 46 percent of CLPs, compared to students without LD who recorded 77 percent), and used fewer abbreviations in notes (i.e., using only 19, compared to students without LD who used 34). Likewise, Boyle (2010a) compared the note-taking skills of middle school students with LD and without LD and found that students with LD only recorded about 13 percent of TLP (i.e., when compared to the teacher’s lecture notes), compared to students without LD who recorded 25 percent of TLP. He also found that students with LD recorded fewer CLP, 18 percent, compared to students without LD who recorded 42 percent of CLP.

In addition to recording fewer lecture points, students with LD record fewer vocabulary and fewer words overall when compared to their counterparts without LD. To illustrate the degree to which students with LD differ from their peers, Boyle and Baharev (in preparation), using data from the Boyle (2010a) study, separated students into three groups based upon students’ grades in science class and state test scores or identified LD: high achieving (HA) students, average achieving (AA) students, and students with learning disabilities (LD). The average performance of the three groups were then compared. Boyle and Baharev (in preparation) found significant differences in the number of TLP recorded. Students with HA recorded an average of 23.64 TLP, compared to students with AA who recorded an average 13.6 TLP, and students with LD who recorded an average 9.78 TLP. Perhaps the most striking finding from this analysis was that there were significant differences between the type of notes recorded between these three groups. Students with HA recorded more important notes, recording 6.8 CLP compared to students with AA who recorded 3.75 CLP and students with LD who recorded only 2.33 CLP. Finally, because vocabulary plays an important role in comprehending lecture content (Gomez & Madda, 2005; Pearson, Hiebert, & Kamil, 2007) and is moderately correlated ($r = .55$) with test scores, students’ notes were analyzed for their inclusion of critical science vocabulary (e.g., plasma, asteroid, protoplanets, Delta-V, ion). Similar to other findings, students with HA recorded significantly more vocabulary (i.e., 18 vocabulary words) in their notes, compared to students with AA who recorded 10 vocabulary words in their notes, and students with LD who only recorded 6 vocabulary words in notes.

When representative samples of lecture notes from students in each group were compared to the teacher’s
original lecture notes for science content, Boyle and Baharev (in preparation) found that students with HA selected and recorded important lecture points on a fairly consistent basis. These students were able to pick out the general gist, as well as supporting details in each section of the lecture. Students with AA could select and record some important lecture points, but often missed critical vocabulary (e.g., protoplanets, Delta-V) or subsequent explanations about them. Students with LD often missed the important lecture points in multiple sections of the lecture (e.g., plasma engine uses 1/10 of the fuel) and instead recorded fewer important lecture points (e.g., plasma engine will evenly replace a chemical rocket engine), recorded incorrect lecture points (e.g., the plasma engine uses only one engine), or recorded nothing. Finally, examinations of their notes revealed that students with LD often failed to record important vocabulary terms and subsequent definitions of these words.

A Potential Framework: Working Memory Problems and Note-Taking

From previous research, it appears that working memory problems may interfere with students’ efficient processing of lecture content and recording of notes. Baddeley’s multi-component model (Baddeley, 2003, 2006; Baddeley, Hitch, & Allen, 2009) can serve as a useful framework to describe the note-taking process in students (Altemeier, Jones, Abbott, & Berninger, 2006; Peverly, 2006). According to this model, there are four main components to working memory: central executive, phonological loop, visuo-spatial sketchpad, and an episodic buffer (Baddeley et al., 2009). The central executive is responsible for a wide variety of tasks that include: regulating information in working memory, retrieving strategies, directing attention for both encoding and retrieval of information in long-term memory (LTM) via the episodic buffer, and task shifting (Baddeley et al., 2009; Gathercole, Alloway, Willis, & Adams, 2006). The phonological loop is responsible for holding and rehearsing verbal and speech-based information for temporary storage. Information fed through this loop allows the individual to temporarily store this information or use information indefinitely (Baddeley, 2006). The visuo-spatial sketchpad performs a similar holding and rehearsal function for visual information. In this subsystem, any visual or spatial information is processed and encoded for storage. The episodic buffer is believed to be a temporary store where representations from short and long-term memory are manipulated, restructured, and stored as episodic chunks of information (Baddeley, 2003; Baddeley et al., 2009).

When looking at the theoretical aspects of lectures and note-taking, the working memory (WM) model can serve to help educators understand the difficulties that students with LD face when note-taking. For example, if teachers present content at an average rate of 110 words per minute (wpm) during lectures (Boyle, 2010a; Titsworth, 2004), and middle school students write at an estimated rate of 17 wpm (i.e., assuming four letters per word) on a writing sample in which there is no cognitive effort (i.e., wrote first name for three minutes at an average of 68 letters per minute (lpm)1 Boyle, 2010a), then the typical presentation rate may be six times faster than students can write. Once in learning situations where cognitive skills are necessary, students will undoubtedly have difficulty writing fast enough to keep up with the teacher. According to Peverly (2006), during a lecture students must use WM to perform three main tasks: temporarily hold/rehearse incoming verbal lecture information via the phonological loop; quickly construct representations of the information through the episodic buffer; and then, through the visuo-spatial sketchpad, transcribe the representations onto paper before information in the verbal store is lost and before new incoming information is processed. During this process, the central executive appears to play a major role at switching attention back and forth from listening to the speaker to recording notes, inhibiting irrelevant lecture points (i.e., deciding which lecture points are relevant to record and which are irrelevant), and interacting with the episodic store to move ideas from long term to WM as they relate to incoming lecture points (Altemeier et al., 2006).

For students with disabilities, the note-taking process can break down at any of these stages. For example, Suritsky (1992) found that students with LD had a difficult time discerning important from unimportant information during lectures. Even when instructors assisted students by stressing important lecture points through use of lecture cues, students with disabilities typically recorded fewer CLPs (Boyle, 2010a; Hughes & Suritsky, 1994). In terms of verbal information, holding lecture information in verbal working memory while processing other information is a difficult task for students with disabilities (Swanson & Saez, 2003) and any interference with verbal task affects both orthographic (i.e., writing) and semantic (i.e., writing the correct meaning) encoding of the verbal information (Kellogg, Olive, & Piolat, 1993). Likewise, Berninger, Raskind, Richards, Abbott, and Stock (2008) found that students with mild disabilities had deficits in WM related to phonological word-form storage and processing. Therefore, using a note-taking technique or procedure that encourages students to quickly record information in notes should free space in verbal working memory to allow students to process information in that store on a deeper level (i.e., rehearsal or relating it to information in LTM) or should free space for processing of new, incoming information. In other words, notes provide an external extension of memory that allows students to visually hold information on paper, rather than having to suspend the information in WM (Scanlon, Cass, Amtzis, & Sideridis, 2009).

Potential Problems of Providing Students with Lecture Notes

To help compensate for poor note-taking skills, students with LD often are provided several different options for capturing lecture content. These methods include: the use of a scribe to record notes for students with disabilities, providing students with the teacher’s lecture notes, or tape recording of notes for later playback (Cawthon, Nichols, & Collier, 2009; Lindstrom, 2007). While these methods may be helpful to students, there are three main reasons why students with LD should learn to effectively record their own notes from lectures. First, note-taking allows for active engagement
Assessing Note-taking Skills

<table>
<thead>
<tr>
<th>Note-taking Components</th>
<th>Student’s Notes</th>
<th>Model Notes</th>
<th>% of Student’s Notes</th>
<th>Examples of Missing Components</th>
</tr>
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<tbody>
<tr>
<td>Total Lecture Points</td>
<td></td>
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<tr>
<td>Important Lecture Points</td>
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<tr>
<td>Organized Lecture Points</td>
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<tr>
<td>Diagrams or Illustrations with labels</td>
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<tr>
<td>Vocabulary Words with Definitions</td>
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Additional Components of Notes:

0 = not found in notes      1 = found in some notes  2 = found in most/all notes

_____ Dates of notes
_____ Organized ordinate/subordinate
_____ Legible notes
_____ Vocabulary spelled correctly
_____ Uses abbreviations
_____ Marks that indicate confusing info.

FIGURE 1 Assessment of student’s notes.

during lectures. Research has indicated that students with learning difficulties are often “passive” learners and taking notes actively engages the student in the learning process, thus improving comprehension (Ruhl & Suritsky, 1995; Suritsky & Hughes, 1996; Van Meter, Yokoi, & Pressley, 1994). Second, note-taking encourages clarification of confusing information and aids encoding during long-term storage (Ruhl, Hughes, & Gajar, 1990; Van Meter, Yokoi, & Pressley, 1994). Third, the act of writing down information aids memory and recall (Boch & Piolat, 2005; van Dijk & Kintsch, 1983). Beyond these benefits, students’ dependence on teacher’s notes or an assigned note-taker can become an obstacle toward the acquisition of effective note-taking skills for lecture learning and might hinder students from becoming autonomous learners (Kiewra, 1989; Kobayashi, 2005). For these reasons, even if students are assisted in recording notes, they should still record their own version of notes. In order to determine skill deficits (e.g., failure to abbreviate words or record vocabulary), teachers should first assess students’ current note-taking skills.

**How to Assess Note-Taking Skills**

Like other academic areas, it is important to find the specific skill deficits associated with students’ note-taking. As previously mentioned, several components of notes such as CLPs and vocabulary are correlated with test performance (Boyle, 2010a; Titworth, 2001; Titworth & Kiewra, 2004). Therefore, these components should be found in the notes of all students, including students with LD. To provide a diagnostic assessment of a student’s notes, the use of the chart in Figure 1
might be helpful. For students with chronic note-taking problems, teachers will need to compare the student’s notes with either the content-area teacher’s notes or model notes (from another student) to determine which specific skills or strategies students are lacking. Specifically, the teacher can count the TLPs found in both the student’s notes and the model notes.

To assess lecture notes, take the TLPs recorded by the student, divide by the TLPs found in the model notes, and multiply by 100 to determine the percentage of TLPs. For important lecture notes, review the model notes and pick out those lecture points that are critical to understanding the content of the lecture. Compare these important lecture points with those recorded in the student’s notes to determine the percentage. To find organized lecture points, look for notes that might indicate a clustering of related ideas (e.g., there are six parts to the cell) and then count each cluster. Use similar procedures as previously described to determine the percentage of organized lecture points. Because diagrams and illustrations are similar to organized lecture points, follow the same procedures to determine the percentage found in the student’s notes. Beginning with vocabulary, identify the key vocabulary words and their definitions that are recorded in the model notes and then find the percentage in the student’s notes. Finally, the bottom of the chart lists several other components found in notes. Rate each of these components as they relate to the student’s notes.

SOLUTIONS TO HELP STUDENTS BECOME BETTER NOTE-TAKERS

Student Note-Taking Interventions: Guided Notes

Once note-taking deficits are determined, teachers can next decide whether to teach a specific skill (e.g., how to abbreviate a word) or a note-taking intervention (e.g., strategic note-taking, SN). In terms of note-taking interventions for K-12 students with disabilities, teachers have a choice of two research-based techniques which have been used with students with LD to improve their notes and comprehension of lecture content: guided notes and SN. Guided notes are teacher-prepared outlines of the lecture that are meant to guide students through the lecture. Guided notes provide students with an outline of the content from the lecture and contain designated spaces for students to record more detailed information about specific lecture points (Hamilton, Seibert, Gardner, & Talbert-Johnson, 2000; Lazarus, 1991, e.g., see Figure 2). Several studies have examined the use of guided notes during lectures for elementary to high school students with disabilities (Hamilton et al., 2000; Lazarus, 1991, 1993; Patterson, 2005; Sweeney et al., 1999). These studies have found that students who used guided notes increased accuracy of notes and improved test scores when compared to phases in which students used conventional note-taking.

In guided notes studies that were examined, students were trained over one to three sessions using history or science lecture content. There were two different versions of guided notes used by researchers: cloze-type guided notes and outline-type guided notes. The cloze-type guided notes used a cloze procedure in which the notes were missing essential words (i.e., students were provided with a blank space) that students would fill in as the teacher lectured. Sweeney et al. (1999) developed two subtypes of cloze-type guided notes: short-form guided notes and long-form guided notes. In the short-form guided notes, one to three essential words were missing per statement and in the long-form guided notes, four to eight words were missing per statement. The other version of guided notes developed by Lazarus (1991, 1993) is an outline-type guided notes that uses roman numerals and uppercase letters, along with words or questions that corresponded to the lecture. Sometimes referred to as skeleton outlines (Lazarus, 1996), these outline-type guided notes list main lecture points of the teacher’s verbal presentation and provide designated spaces for students to elaborate on the lecture points.

In the studies by Lazarus (1991, 1993), students with LD were taught over three consecutive periods to use guided notes (e.g., either science or history teacher). During the first session, students were taught to recognize main ideas and key terms. As the teacher reviewed main ideas and key terms on a transparency, students learned to differentiate between them. During the second training session, students completed guided notes as they listened to two 10-minute audio-taped lectures. During the third training session, the teacher lectured using completed notes presented on transparencies, as students filled in and completed their own-guided notes. When finished, students’ guided notes were evaluated and students were provided with reinforcement and corrective feedback.

With respect to the effectiveness of guided notes, Hamilton et al. (2000) examined the effects of guided notes among adolescent students with LD and found average quiz scores increased from 42 percent during baseline phases to 73 percent during guided notes phases. They also found accuracy of students’ notes increased from 36 percent during baseline phases to 85 percent during guided notes phases. Likewise, among elementary students with emotional behavior disorders (EBD) and LD, Patterson (2005) found average quiz scores increased from baseline phases of 34 percent to guided notes phases of 91 percent and students also increased accuracy of notes from about 32 percent to 90 percent. In a third study (Sweeney et al., 1999), both the short and long form of guided notes (mentioned previously) were used by students. Both forms used a cloze procedure in which the guided notes were missing essential words (i.e., student were provided with a blank space) that students would fill in as the teacher lectured. These researchers reported that students increased average quiz scores from 5.17 to 9.28 on the short form and 5.17 to 8.59 on the long form. In terms of accuracy, students more accurately recorded notes when using the short form (i.e., group average was 60 percent) compared to the long form (i.e., group average was 45 percent). Finally, using the outline-type of guided notes studies, Lazarus (1991, 1993) found increases in test scores when students with LD used this type of guided notes, compared to baseline sessions, and, more importantly, found the largest increases when students used guided notes plus a 10-minute review session. This resulted in an average 24 percent boost in test scores compared to when students used guided notes without review sessions.
Weather in the United States

1. Weather is the state of the __________________ at a specific time and place.

2. Weather describes the four conditions of:
   A. ____________________________    B._________________________
   C.____________________________    D. ________________________

3. When the temperature in the air is high, molecules ___________________________
   ____________________________________________

4. Air moving is a specific direction is called________________________________

5. An anemometer measures ____________________________________________

6. Humidity is the amount of _____________    _____________ in the air

7. Relative humidity differs from humidity in what way?_______________________

8. Clouds form in three main ways:
   A.___________________________________________________________
   B. __________________________________________________________
   C.__________________________________________________________

9. Clouds are classified by their ______________________ and __________________

10. Hail forms in clouds when water freezes and is____________________________

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**FIGURE 2** Sample guided notes for weather.

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**Student Note-Taking Interventions: Strategic Note-Taking**

The second type of research-based note-taking technique is SN. Originally developed and used with college students (Boyle, 1996), SN (see Figure 3) was refined for use with high school students with mild disabilities (Boyle & Weishaar, 2001), and later the CUES strategy (see Figure 4) was integrated into training for middle school students with LD (Boyle, 2010b).

The Boyle (2010b) SN study best illustrates how to teach students with LD to use SN. Strategic note-taking was developed to assist students as they listened to lectures by incorporating steps that would help them focus their attention on teacher cues and vocabulary in the lecture, as well as steps to help them organize lecture content such as clustering similar lecture ideas and summarizing (i.e., categorizing) clustered lecture points. In the strategy, each step prompts the student to perform an action using lecture information and the SN paper. In the Boyle study, training took place over two days during which the researcher used a videotaped lecture to train students to use the CUES strategy using SN paper. During the first training session, the researcher followed a scripted lesson and taught students how to use the SN paper via the SN strategy. Throughout the training, the investigator provided a brief description of SN, modeled the technique, and guided students through practice portions of the videotaped lecture while providing appropriate feedback. During the training, the researcher would periodically stop the videotaped lecture to review students’ notes and provide feedback to them. At the start of the first training session and after students initially completed the top portion of the SN paper in which they
Strategic Note-taking Form

What is today's topic?

Describe what you know about the topic.
(Fill in this information before the lecture begins)

When the lecture begins, use these pages to take notes.

Today's topic?

Name 3 to 6 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:

Name 3 to 6 new main points with details as they are being discussed.

New Vocabulary or Terms:

Summary - Quickly describe how the ideas are related.

Name 3 to 6 new main points with details as they are being discussed.

New Vocabulary or Terms:

Summary - Quickly describe how the ideas are related.

Name 3 to 6 new main points with details as they are being discussed.

New Vocabulary or Terms:

Summary - Quickly describe how the ideas are related.

At End of Lecture

Write five important lecture points and describe the details of each lecture point:

1.
2.
3.
4.
5.

FIGURE 3 Abbreviated version of strategic note-taking paper.


described what they knew about the topic, they began using the CUES strategy steps with each corresponding section of the SN paper. For example, during training as the videotaped lecture was being played, students would Cluster (i.e., write) three to six related lecture points under the heading: Name 3 to 6 main points...of the SN paper. While doing this, they would incorporate the Use step to listen for teacher cues and then record CLPs as part of the three to six lecture points. Likewise, whenever they heard new vocabulary or terms, they would use the Enter step to record vocabulary or terms in that portion of the SN paper. Periodically, students would use the Summarize step to categorize or label how the three to six lecture points were related. These steps were repeated throughout the lecture until the lecture ended. Finally, on the last page of the SN paper, students wrote down five important points from the lecture.

In the second training session, Boyle reported that students used the same video-taped lecture, but with new SN paper, during which they recorded notes independently and without stopping or pausing the videotaped lecture. He reported that the purpose of this second training session was to acclimate students to the pace of an actual lecture.

In another study, Boyle and Weishaar (2001) found that high school students with mild disabilities who were trained...
During the Lecture, Listen for CUES

C – Cluster – Cluster together 3 to 6 main points of the lecture

U – Use – Use teacher cues to record ideas

1. Number Cues –
   ex. There are six parts to the cell

2. Importance Cues –
   ex. This is really important to remember...

E – Enter – Enter important vocabulary

S – Summarize – Summarize quickly and whenever possible

FIGURE 4 Strategic note-taking strategy. 

to use SN (i.e., experimental group) increased the number of words recorded in notes (i.e., 175 words) compared to students who used conventional note-taking (i.e., 21.5 words). Likewise, students in the experimental group outperformed control group students on measures of comprehension (i.e., 37.4–27.1 percent favoring the experimental group), immediate recall (i.e., 37.5 words to 14.3 words favoring the experimental group), and long-term recall (i.e., 22.2 words to 3.9 words). Results from the Boyle (2010b) study found that middle school students who were taught SN outperformed control students on the comprehension test (i.e., 9.9–8.5, favoring the experimental group), immediate free recall measure (i.e., 40 words to 17.6 words, favoring the experimental group), long-term free recall (i.e., 28.4 words to 8.8 words, favoring the experimental group), and number of words recorded in notes (i.e., 109 words to 41 words, favoring the experimental group).

In summary, as shown by past research, both guided notes and SN are effective interventions to improve the note-taking skills of students with LD. Guided notes provide students with a framework for learning lecture information by providing aspects of the content in an outline format. In contrast, SN provides students with prompts to assist them to use cognitive skills as they record notes. These prompts encourage students to cluster lecture points, listen for CLPs, record critical vocabulary, and periodically summarize lecture points. In addition to teaching students how to use these note-taking interventions, teachers can also assist students to record better notes by adjusting the way they lecture to students.

Teachers Helping Students to Record Better Notes

While students can learn note-taking strategies, during lectures teachers can also play a key role. To help students discern important from less important content, teachers can stress important lecture content to students using one or more of the following strategies during lectures: distinguish important lecture points from less important ones, providing purposeful pauses, writing critical lecture information on the board, helping students categorize information, and repeating important lecture information. First, teachers commonly use lecture cues to highlight what they feel is important lecture information and to attract students’ attention to this information (Moore, 1968). The two main types of verbal lecture cues used by teachers are emphasis cues and organizational cues (Boyle, 2010b, Suritsky & Hughes, 1991; 1996). An emphasis cue is a verbal cue (e.g., “the key point is...” or “it is important to remember that...”) that immediately precedes an important lecture point, thereby drawing attention to it. An organizational cue is a verbal cue (e.g., “there are six parts to a cell” or “the four main types of clouds are...”) that immediately precedes a series of related lecture points to provide a framework or structure to the content. Along with verbal cues, teachers may use nonverbal cues such as gestures to emphasize a lecture point (e.g., a teacher holds up three fingers when explaining three types of tree frogs). Teachers should use meaningful lecture cues to prompt ALL students to record the important lecture information in their notes and remind students to star or highlight that information to indicate its importance. When used in classes, highlighting important lecture points through lecture cues has been shown to boost the number of notes recorded by students and subsequent lecture comprehension (Boyle, 2010b; Titsworth & Kiewra, 2004). Second, teachers can use purposeful pauses to cue students that they want them to record the lecture point being stated (Suritsky & Hughes, 1996). A long pause by the teacher should alert students that they need to record what the teacher just said. Third, teachers should write vocabulary and important lecture points on the board. In one study, Locke (1977) examined lectures from twelve different classes and found that on average 88 percent of the lecture content that was written on the board showed up in students’ notes. Fourth, teachers should categorize an upcoming list of items or provide a title for content about to be presented (Boch & Piolat, 2005). Fifth, teachers should repeat or restate relevant information for students in an effort to emphasize its importance and to ensure that students record it in their notes (Maddox & Hoole, 1975). When teachers use one or more of these methods and students are aware of their use, students typically will record more overall lecture points and more important lecture points in their notes (Titsworth, 2004).

Integrating Note-Taking Interventions in Content Area Classes

Once students become proficient at using note-taking interventions during training, they should be taught to generalize the techniques to classes. Initially, it might be best to use the note-taking technique in only one class until students can become fluent at using it in that setting. For teachers who are training students to use note-taking skills and techniques in these classes, it is imperative to observe how the content-area teacher lectures and presents information to students in class (Boyle, 2001). When observing the lecture, it is important...
to examine the pace of the lecture, specific cues used by the teacher, and whether lecture content is presented in an organized manner (Howe, 1970; Scerbo, Warm, Dember, & Grasha, 1992). In terms of the pace of the lecture, studies using a new note-taking technique will need time to get acclimated, particularly in those classes where lectures moves at a quick pace. The pacing of the lecture has been shown to affect the amount of notes recorded (i.e., with fast-paced lectures resulting in students recording poor notes, [Ladas, 1980]), as well as performance on tests (Kiewra, 1987). Post-secondary students with LD have reported that writing fast enough to keep up with the lecture was the most difficult aspect of note-taking (Suritsky, 1992). Another area of concern during generalization involves helping students to recognize teacher cues. It is critical for students to learn how teachers use different cues to distinguish important from unimportant lecture content (Titworth & Kiewra, 2004). There are times when the teacher may use verbal cues (e.g., using emphasis or organizational cues, restating information) and other times, when the teacher uses nonverbal cues (e.g., pauses or gestures) to indicate important lecture points. These cues should be recognized and the accompanying lecture content recorded by students. Following students’ use of a note-taking intervention in a content-area class, the teacher should review the students’ notes to make sure they used the technique properly, as well as make sure that students have recorded all of the important lecture content in their notes. Again, it would be helpful for students to compare their own notes with the teacher’s notes to determine if students have recorded the relevant lecture content.

With respect to reviewing notes after the lecture, secondary students should be taught to review their notes as soon as possible after class. Reviewing notes serves two purposes. First, it gives students a chance to fill in gaps and clarify confusing content (Ruhl & Suritsky, 1995). Second, a review serves to help students encode information on a deeper level (Kobayashi, 2005; Lazarus, 1993). Moreover, there is evidence to support that pairing students together to review lecture notes leads to gains in learning (O’Donnell & Dansereau, 1993). Whether students review notes in pairs or individually, reviewing notes results in students having a more complete set of notes than if they did not review (Suritsky & Hughes, 1991). Reviewing notes also provides students with an opportunity to elaborate or personalize their notes, making their notes more meaningful (VanMeter et al, 1994). When students review their notes, it is important that they review notes in a generative way, such as elaborating on lecture points, in order to fully benefit from the review session (Kiewra, 1987).

**Using Technology to Enhance Note-Taking**

Technology offers much promise to students with LD to assist them with capturing content during lectures. Whether students are using assistive technology in the form of handheld devices such as digital pens or tablet personal computers (pcs) or teachers are using guided notes via electronic lectures (e.g., PowerPoint ©), technology is no doubt changing the way in which students learn and record notes in their content-area classes (Fons, 2010). For instance, the smartpen allows students to digitize notes while recording the audio of the lecture. It comes with a special sensor that reads text as it is being written and converts the text to pdf and txt files. In addition, when used with specially designed paper, the smartpen can also record the audio portion of the lecture and then sync up the audio of specific lecture points in the notes so that students can listen to those sections of their notes at a later point in time (Hannon, 2008). Therefore, if students have incomplete lecture points in their notes, they can point the pen to the specific lecture point that is incomplete and then replay the audio from that portion of the lecture. Despite this advance in note-taking, to date no research has examined whether smartpens can improve the achievement of students with LD who use these devices. Another technology that has changed the way that students record notes is the tablet pc. Using tablet pcs such as the iPad, students can download a note-taking application and record notes directly on it using a stylus for a pen. Once saved in an electronic format, notes can be revised, organized, and shared with others (Palaigeorgiu, Despotakis, Demetriadis, & Tsoukalas, 2006). While tablet pcs offer the advantage of turning handwritten notes in to text, allowing students to easily search through their notes for specific words or terms, some of the more personalized aspects of handwritten notes (e.g., writing gestures or drawings) may be lost because applications may not be able to read and interpret these personalized aspects of notes (Kim, Turner, & Quinones, 2009). Finally, electronic lectures (e.g., PowerPoint©) have allowed teachers to present content in new and exciting ways, making lectures more interesting for students, while also providing teachers with an easy method to share guided notes (i.e., paper copies of their PowerPoint slides) with students (Gier & Kreiner, 2009). Despite the promise of using slides as guided notes, caution must be exercised because research appears to be mixed in terms of the effects of electronic notes on student achievement (Austin, Lee, & Carr, 2004; Neef, McCord, & Ferreri, 2006). Finally, while technology offers promise for secondary students with LD and note-taking, much of the technological advances have yet to be fully assessed in the classroom. Early research has also indicated that students may not easily adapt to using technology in the classroom. For example, in one small-scale study, researchers found that when students used electronic note-taking devices to help solve mathematical problems, students with low achievement had difficulty with the electronic interface (e.g., digital pens and graphical tablets) than with more traditional pen and paper interface (Oviatt, 2006). In turn, this difficulty resulted in lower scores when compared to a comparison group who used paper-based interface.

**A Final Word of Caution**

While much research exists in the area of secondary students without LD and note-taking, to date there are only a few studies that have examined how students with LD learn during lectures while they record notes. Hence, while authors of educational articles have advocated for using note-taking interventions such as Cornell/split page notes (Bernie-Smith,
Austin, J., Lee, M., & Carr, J. (2004). The effects of guided notes on under-


In and passing more advanced courses, the impetus should
what is important to record, and allowing students time to

important notes and vocabulary on the board) so students know

lecture cues (e.g., emphasis and lecture cues, writing impor-

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information to students by slowing down the pace of the lec-

Second, teachers can modify the way they present

can then embed these techniques within their curricula to

teachers become familiar with note-taking interventions, they

look like and using the model notes, students can then make

Content area teachers become familiar with note-taking interventions, they
can then embed these techniques within their curricula to

students with LD have difficulties processing information and recording notes dur-
ings lectures, there are options for them. First, teachers can
show students how to use note-taking interventions such as
guided notes or SN. In some cases, teachers can develop their

own notes using these interventions (i.e., model notes) so

that students can compare their notes to the model (Lazarus,

1988). Model notes show students what “good” notes should

look like and using the model notes, students can then make
corrections to their own notes. Moreover, as content area

teachers become familiar with note-taking interventions, they
can then embed these techniques within their curricula to

make for a seamless integration of the technique with the

content. Second, teachers can modify the way they present

information to students by slowing down the pace of the lec-
ture (e.g., use pauses or pause procedure), proving explicit

lecture cues (e.g., emphasis and lecture cues, writing import-
ant notes and vocabulary on the board) so students know

what is important to record, and allowing students time to

review their notes at the end of class (Suritsky & Hughes,

1996). With the increased emphasis on students enrolling in

and passing more advanced courses, the impetus should be

on teachers to make sure that students with LD have the

proper tools to learn and thrive in these classes.

NOTE

1. Studies confirm that middle school students write at

an average rate of 68–69 lpm (Ziviani & Watson-Will,

1998.) and that older students record notes at approxi-

mately 20 wpm (Ladas, 1980).

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