

# **The Effects of Instruction in a Paired Associates Learning Strategy as an Intervention for College Students with Learning Disabilities**

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## **Abstract**

A multiple probe across subjects design was used to evaluate the effectiveness of instruction in a Paired Associates Strategy provided to nine college students with learning disabilities on their ability to identify and recall important information from textbooks. Students received instruction in the strategy in the context of an on-campus disability support service center. Results of the study indicated that instruction in the Paired Associated Strategy improved students' ability to identify important information from textbooks, create study cards, and to recall that information in testing situations. Instructional data are presented as well as implications for future research and campus practices.

Increasing numbers of students with learning disabilities (LD) are attending colleges and universities upon completion of high school (Brinckerhoff, Shaw, & McGuire, 2002; Ellis, Sabornie, & Marshall, 1989; Murray, Goldstein, Nourse, & Edgar, 2000). However, college students with LD are graduating from institutions of higher education at lower rates than their peers without disabilities (Murray et al., 2000; Vogel & Adelman, 1992). According to a report from the National Longitudinal Transition Study-2 on postsecondary outcomes of youth with disabilities, although 89% of postsecondary students with disabilities reported that they were working toward a diploma or certificate, only 29% had graduated or completed their programs by the time they left their postsecondary institution (Newman, Wagner, Cameto, & Knokey, 2009). Like all college students, those with LD encounter complex academic demands. In order for students with LD to be successful in the college setting, however, access to effective service delivery models, support, and academic interventions is often necessary.

Due to the autonomy colleges claim in implementing programs and services unique to each campus,

postsecondary students with LD often encounter vast differences in service options from college to college. While institutions are mandated to provide equal access to students with disabilities who are otherwise academically qualified, colleges are not required to follow a continuum of special education services, as are elementary and secondary schools (Brinckerhoff, Shaw, & McGuire, 2002). Therefore, colleges are allowed to select or create their own support service model for students with LD and other disabilities (Deshler, Ellis, & Lenz, 1996). Often, systems of support for college students with LD focus more on subject-specific tutoring (Hock, Deshler, & Schumaker, 1999), curriculum modification such as foreign language course substitutions, and the provision of course-based accommodations (Brinckerhoff et al., 2002). Although these are integral parts of any support and service system for college students with LD, service delivery models that only include these elements may inadvertently enhance students' dependence on the accommodations and services provided by others. Providing students with access to empirically-validated models of learning

strategy instruction, in addition to the mandated supports described above, holds the promise of teaching students more independent approaches to achieving academic success. Hughes and Smith (1990) reviewed studies involving college students with LD, only to find that there was a great absence of studies that focused on specific interventions or instructional approaches for this population. Given this lack of intervention research, and knowing that students with disabilities report various reasons for leaving postsecondary school and not attaining their degrees (Newman et al., 2009), a lack of validated interventions is one possible explanation for the high numbers of college students with LD who fail to attain their college degrees. A model that combines traditional support services with specific interventions designed to help students independently meet the demands of complex academic settings may lead to improved outcomes for college students with LD.

Without the use of specific interventions that are designed for their unique learning needs, students with LD may continue to lag behind their peers without disabilities in graduation rates and other indicators of college success (e.g., job placement following graduation, satisfaction with college experience). Development of specific interventions should include consideration of the existing college-level learning environments. Currently, many segments of the higher education community use instructional practices derived from traditional adult learning theory. Prominent areas of adult learning theory, such as self-directed learning (Rogers, 1969), transformational learning (Mezirow, 1981), and experiential learning (Brookfield, 1995), are constructivist in nature. Constructivist processes are those that “emphasize that it is the learner who makes learning occur, and materials, teachers, and other external influences are important only if they provide experiences that enable the learner to construct new meanings” (Mercer, 1997, p. 295). Although traditional constructivist instructional methods may be successful for the majority of students, they do not appear to be sufficient for many college students with LD. While many students with LD meet admission requirements and are determined to earn a degree, they often lack the necessary strategies needed to successfully construct their own learning and cope with the academic setting demands of the college environment (Ellis, Deshler et al., 1989).

One learning tool that has been empirically validated at the K-12 level and may hold great promise in postsecondary settings is strategy instruction. While

strategy instruction can take a variety of forms, the Strategic Instruction Model (SIM) developed by researchers at the University of Kansas (KU) Center for Research on Learning is a model that has undergone stringent validation processes and is arguably the most prevalent commercial strategy curriculum used in K-12 settings in the United States (Clark, Deshler, Schumaker, Alley, & Warner, 1984; Ellis, Deshler, & Schumaker, 1989; Hughes & Schumaker, 1991; Lenz & Hughes, 1990). The SIM is a curriculum of numerous strategies, each designed to improve students’ independent performance in a variety of academic skill areas. Each strategy is made up of steps that cue the student to take certain physical or mental actions as they approach a task.

Systematic field tests have validated strategy instruction as having high potential for allowing students with LD to cope more effectively with the academic demands of the secondary school environment (Deshler et al., 1996; Deshler & Schumaker, 1986). Schumaker and Deshler (1984) also point out that, ultimately, the responsibility of performance shifts from the teacher to the student. Given mastery of several learning strategies, the student becomes capable of analyzing the setting demands and choosing or designing an appropriate strategy to meet those demands.

It is feasible that at least some of the KU Learning Strategies Curriculum could serve as an effective intervention model for college-age students with LD who have difficulty meeting academic demands. Strategy instruction could serve as a potential alternative to, or enhancement of, tutoring and curriculum modification and benefit college students with LD (Ellis, Deshler et al., 1989). In a study to determine the direct service needs of college students with LD, McGuire, Hall, and Litt (1991) found that “without specific instruction in study skills that are critical in dealing with the demands of college studies, LD students may be at risk because they lack the tools of learning that many college faculty assume they have mastered” (p. 104). Further, students with LD in postsecondary settings may be at risk due to the traditional focus put on specific subject tutoring and academic accommodations and the possibility that these approaches do not improve students’ independent learning tools. Indeed, many of the articles about this topic published in the last two decades continue to reflect the earlier findings of Hughes and Smith (1990), (e.g., Alster, 1997; Hock, Deshler, & Schumaker, 1999; Holzer, Madaus, Bray, & Kehle, 2009; McNaughton,

Hughes, & Clark, 1997; Raskind & Higgins, 1995; Reed et al., 2009; Ruhl & Suritsky, 1995; Runyan, 1991; Schiff & Calif, 2004).

Many of these studies involved interventions or approaches that were dependent on assistive devices or instructor behavior but a few investigated the effects of strategy instruction. Zawaiza and Gerber (1993) examined the effects of explicit instruction on the word-problem math performance of community college students with LD. Results indicated that students were “responsive to strategy instruction and can change their problem-solving behavior accordingly” (p. 78). Butler (1995) conducted research to investigate the effects of the Strategic Content Learning model on the ability of adults with LD to use self-regulated and strategic learning techniques. Results indicated that students improved task performance while becoming more active in developing and modifying strategies to help them complete academic tasks. In addition, participants generalized strategies to new settings and situations and they attacked new tasks in a strategic manner. Spiegel and Barufaldi (1994) investigated the effects of instruction in a strategy to construct graphic post-organizers on the immediate recall of science knowledge. Results indicated that students who used the post-organizer strategy to develop a graphic representation of text structure recalled more information than students who simply highlighted, underlined, or reread text to gain information from anatomy and physiology textbooks. As the need for effective support services for students with LD in colleges and universities continues to grow, so will the need for research that demonstrates effective means for this sizable population to meet the complex demands placed on them by the college and university settings.

The behavior of faculty members is also a key focal area in developing models of intervention for college students with LD. Instructional practices such as the pause-procedure (Ruhl & Suritsky, 1995) and providing extended time (Alster, 1997; Runyan, 1991), however, create an environment in which students’ success may be dependent on the behavior of the professor. Some research has described interventions that create student dependence on devices such as computer spell-checking programs (McNaughton et al., 1997) and speech synthesis devices (Raskind & Higgins, 1995). Other interventions, such as strategy instruction, are more empowering to students. This is true because students then become responsible for exhibiting the

behavior necessary for improving performance and for generalizing the use of strategies to novel settings and situations without relying on external assistive devices or the behavior of instructors or professors.

Evidence from a small number of studies indicates that college students with LD can improve academic performance when provided specific instruction in the use of learning strategies. The purpose of this study was to add to this emerging body of research and determine the effectiveness and social validity of the Paired Associates Strategy (Bulgren & Schumaker, 1996) for college students with LD. The Paired Associates Strategy (PAS) was selected because it emphasizes the ability of high school students to read textbooks, identify important information, and strategically recall that information. These related learning behaviors are a critical skill for successful college students as well.

## Methods

### Participants and Setting

*Students.* Nine college students (referred to as S1 through S9) identified as having LD participated in this study. All participants were enrolled at least part-time at a midsize comprehensive regional public university and were receiving support services through the school’s disability support service program. Confirmation of the participants’ classification as learning disabled occurred prior to implementation of the study with the assistance of on-campus disability support service personnel. Participants were recruited with the assistance of the on-campus disability support service office. While 12 students initially expressed interest in participating and attended an informational meeting, nine participants agreed to participate after being notified on the time commitment required to participate in the study.

*Student pretesting.* All students identified as potential participants for the study were administered a pretest to determine their current ability to correctly identify and recall important information from printed materials. Students who scored below 90% on the Finding Information Pretest and/or below 80% on the Mastering Information Pretest were included in the study. Pretesting materials were provided as part of the PAS Instructor materials (Bulgren & Schumaker, 1996).

*Instructional Setting.* All sessions were conducted at the disability support service center on the college campus or individual meeting rooms in the campus

library. The library setting was used only to facilitate subject requests for meeting times after the regular operating hours of the disability support service center.

### Experimental Design

Three implementations of a single-subject multiple probe research design (Horner & Baer, 1978; Tawney, Gast, & Skouge, 1984) across students were used to determine the effectiveness of instruction in the PAS on the ability of college students with LD to identify and recall important information. A multiple probe design allows researchers to determine a functional relationship between independent and dependent variables when using small numbers of subjects in a study.

### Procedures

*General procedures.* After the collection of initial baseline data, each of the nine students who participated in the study received instruction in the PAS (Bulgren & Schumaker, 1996) from the lead author. It should be noted that in order to use the PAS or other strategies from the Kansas Strategy Curriculum, teachers or researchers must first receive training in the strategy from a trainer who has been certified by the University of Kansas Center for Research on Learning. PAS is designed to improve students' ability to identify and recall important pairs or trios of information (e.g., the *Civil War* ended in 1865; *Tim Rose* wrote *Vengeance* in 1955). Instruction in PAS took place primarily in small group arrangements of 2 to 4 students. Several one-to-one instructional sessions occurred for students who did not master the information and needed additional practice and feedback or whose schedule necessitated meeting times that could not be coordinated with other subjects. During the course of the study, instructional materials were used that are provided in the Paired Associates Instructor's Manual (Bulgren & Schumaker, 1996).

Controlled Test Probes and Content Test Probes were administered to assess student learning. The Controlled Test Probe consisted of a stimulus sheet with 20 sentences and a corresponding test sheet. Each of the 20 sentences contained either a pair of information or a trio of information (16 sentences had pairs of information and 4 sentences had trios of information). Content Test Probes consisted of stimulus reading passages that were approximately one to two pages long and double-spaced. A corresponding test sheet accompanied the stimulus passage.

During both the Controlled Test Probe and Content

Test Probe, a stimulus sheet was randomly selected and distributed. Students made study cards for the information using blank index cards provided by the researcher in preparation for a test over information contained within the stimulus sheet. Students were given 50 minutes to independently study the information and create study cards without assistance or feedback. At the end of 50 minutes, the stimulus sheets and study cards were collected. At the next scheduled meeting, students were allowed 20 minutes to review the study cards then given 20 minutes to complete the probe. The probes consisted of a 20-item fill-in-the-blank format test. Student responses were scored as correct or incorrect. Answers needed to closely approximate the required answer although exact spelling was not a requirement. The percentage of correct responses was recorded for each student.

*Instructional procedures.* All instructional procedures came directly from the stages of instruction in the Paired Associates Instructor's Manual (Bulgren & Schumaker, 1996). PAS is designed "to facilitate students' recall of information . . . it was developed for use primarily in relation to test situations for which the students are expected to recall factual information" (Bulgren, Hock, Schumaker, & Deshler, 1995, p. 24). All instructional sessions began with an advance organizer and ended with a review and post-organizer. PAS uses an eight-stage instructional process that employs scripted lessons for the delivery of instruction. Each stage required at least one meeting with students, and up to four meetings with students. Some stages were completed in one meeting, while others took multiple meetings over several weeks. Each student completed all stages over a two month time period.

After seeing their pretest results, the baseline condition consisted of students making a verbal commitment to learn PAS and being administered a set of Content Test Probes and Controlled Test Probes. The term "probe" refers to a quiz, or assessment of mastery of a specific skill or content knowledge. Students remained in the baseline condition until data were stable and showed no identifiable trend.

The goal of the second stage of instruction was to provide students with the specific knowledge needed to carry out the strategy. The primary behaviors necessary in using PAS are the ability to use a memory device to remember important information in testing situations and the ability to construct study cards in a systematic fashion to assist the student in studying the information.

To assist students in remembering information, a four-step mnemonic device called CRAM was used. The specific steps of the CRAM device are as follows:

- C = Create a picture
- R = Relate something
- A = Add boxes
- M = Make a code

Once students learned the CRAM device, they were taught how to systematically construct study cards through the mnemonic device called PAIRS:

- P = Pick a clue
- A = Arrange the items
- I = Identify the questions
- R = Recast the information using "CRAM"
- S = Self-test

During the third stage of instruction, the researcher demonstrated and modeled PAS through a "think aloud" process for all students. The researcher modeled both the use of the CRAM device and the PAIRS device by demonstrating several examples. In the fourth stage of instruction, students went through a process of verbal practice in which they verbally described the procedures of PAS. This allowed the researcher to ensure that each student had an understanding of the strategy and could verbally convey the concepts and processes of the strategy. A student Verbal Practice Checklist (Bulgren & Schumaker, 1996) was used for ensuring that each student met the verbal practice requirement.

During the fifth stage of instruction, students practiced using mnemonic devices on Controlled Practice Materials (Bulgren & Schumaker, 1996, pp. 170-189). Students proceeded through a series of five Controlled Practice Study Sheets and Controlled Practice Quizzes. Each set of practice materials consisted of five stimulus sentences and a corresponding answer sheet. Scores on these measures were recorded on the Paired Associates Score Sheet (Bulgren & Schumaker, 1996, p. 157). This process occurred as students proceeded through each of the five levels of Controlled Practice Materials. The researcher provided positive and corrective feedback to each student following each Controlled Practice Quiz.

After students met all mastery requirements in the Controlled Practice stage of instruction, the *Advanced Practice and Feedback* stage was introduced. During

this stage, students worked on Content Practice Materials (Bulgren & Schumaker, 1996), which consisted of reading passages from students' individual textbooks. The researcher worked with each student to identify two reading passages in a textbook provided by the student that could be used for advanced practice. Students had to find pairs of information embedded in the reading passages and create corresponding study cards. A mastery level of 90% accuracy on the Content Practice Materials was required to complete the *Advanced Practice and Feedback* stage of instruction.

The Controlled Test Probe and Content Test Probe were administered as post-tests in the seventh stage of instruction. The post-tests were taken from the same pool of Content and Controlled Probes that were used during the baseline condition of the study; however, students were given Content and Controlled Probes that had not previously been given to them during baseline conditions. The results of the post-test probe sessions were communicated to the students. Students had to meet a mastery level of 80% on Controlled Test Probes and 75% on Content Test Probes. Students who failed to reach these levels, were provided additional feedback and instruction before being administered an additional set of Content and Controlled Probes.

*Contingent feedback and maintenance procedures.* After each student reached mastery levels on the Content and Controlled Tests and following training in PAS, maintenance sessions were conducted by periodically administering Content and Controlled Test Probes. This was done to ensure the skills were maintained over time.

### Reliability

Reliability was assessed on both the independent variable (procedural reliability) and the dependent variable (student response reliability). Acceptable levels of agreement on dependent variable reliability and accuracy on procedural reliability were 90% or higher. During the baseline probe condition and the contingent feedback and maintenance probe conditions, the researcher was 100% accurate on having materials ready, distributing cards to students, allowing the appropriate time for studying the cards, collecting the cards, waiting 10 minutes, distributing the probe, allowing appropriate time to complete the probe, and collecting probe from the students. During the instructional, or intervention condition, reliability data were collected on all stages of instruction including the describe stage, the modeling stage, the verbal practice

stage, controlled practice and feedback stage, advanced practice and feedback stage, and the generalization stage of instruction. The error rate was extremely low and the overall procedural reliability of 99% indicates the intervention was implemented reliably.

## Results

### Effectiveness Data

Figures 1, 2, and 3 display effectiveness data for each of the nine participants. Data are expressed in terms of percent correct on Content and Controlled Probe sessions during the baseline condition and the contingent feedback and maintenance condition.

*Controlled probe session data.* Prior to the intervention, students' mean scores on Controlled Probes ranged from 24% to 85% correct, with an overall mean score of 60% correct. Following instruction in PAS, student mean scores on Controlled Probes ranged from 83% to 97% correct with an overall mean score of 91% correct. During the baseline condition, individual test scores ranged from 15% to 95% correct. After instruction in PAS, individual test scores ranged from 70% to 100% correct. The performance of each individual student is discussed in this section.

A visual analysis of Figures 1, 2, and 3 reveal a consistent accelerating trend across each student following instruction in PAS. The mean percent correct score on Controlled Probes for each student increased following the instruction in PAS. Each student reached the mastery criterion level of 80% correct and eight students (i.e., all except S6) were able to reach criterion immediately following instruction in PAS and required no further instruction or feedback. S6 required one additional instructional session before reaching the mastery criterion level. Also, results indicate that students maintained mastery levels of performance on Controlled Probes for the remainder of the study.

*Content probe session data.* Prior to the intervention, student mean scores on Content Probes ranged from 25% to 75% correct, with an overall mean score of 55% correct. Following instruction in PAS, student mean scores on Content Probes ranged from 70% to 95% correct with an overall mean score of 85% correct. During the baseline condition, individual test scores ranged from 15% to 85% correct. After instruction in PAS, individual test scores ranged from 60% to 100% correct.

A visual analysis of Content Probe data in Figures 1, 2, and 3 reveal a consistent accelerating trend

across each student following instruction in PAS. The mean percent correct score on Content Probes for each student increased following instruction in PAS. Each student reached the mastery criterion level of 75% correct with six students (i.e., S1, S4, S5, S7, S8, and S9) reaching criterion immediately following instruction in PAS and requiring no further instruction or feedback. Three students (i.e., S2, S3, and S6) required one additional instructional session each before reaching the mastery criterion level. Also, results indicate that students maintained mastery levels of performance on Content Probes for the remainder of the study.

## Discussion

This study investigated the effects of teaching the Paired Associates Strategy (Bulgren & Schumaker, 1996) to college students with LD and its influence on their ability to identify and recall important information in testing situations. Results of this study were uniformly positive and indicate that each of the nine participants in the study improved their ability to identify and recall pairs and trios of information following instruction in PAS. Data collected during the contingent feedback and maintenance Controlled and Content probe sessions indicated a 14% overlap with data collected during baseline Controlled and Content probe sessions. The relatively low percentage of overlap supports the effectiveness of the procedure.

Six of the nine students (i.e., S1, S4, S5, S7, S8, and S9) met mastery criterion levels on both Controlled and Content Probe materials during the first probe sessions following instruction in the strategy. The other three students (i.e., S2, S3, and S6) each required one additional instructional session before reaching mastery criterion levels on subsequent Content and Controlled Probe materials. This would indicate that the instructional methods prescribed in the Paired Associates Instructor's Manual (Bulgren & Schumaker, 1996) are effective in improving students' abilities to identify and recall information in testing situations.

The positive results regarding the effectiveness of teaching PAS to college students with LD are noteworthy considering how strategy instruction methodology contrasts with traditional adult learning theory instructional practices often utilized on college campuses. PAS entails systematic and explicit instruction across all stages of instruction to promote student involvement through mastery-oriented learning. In addition, PAS

Figure 1. Content and Controlled Probe Scores for Students 1, 2, and 3

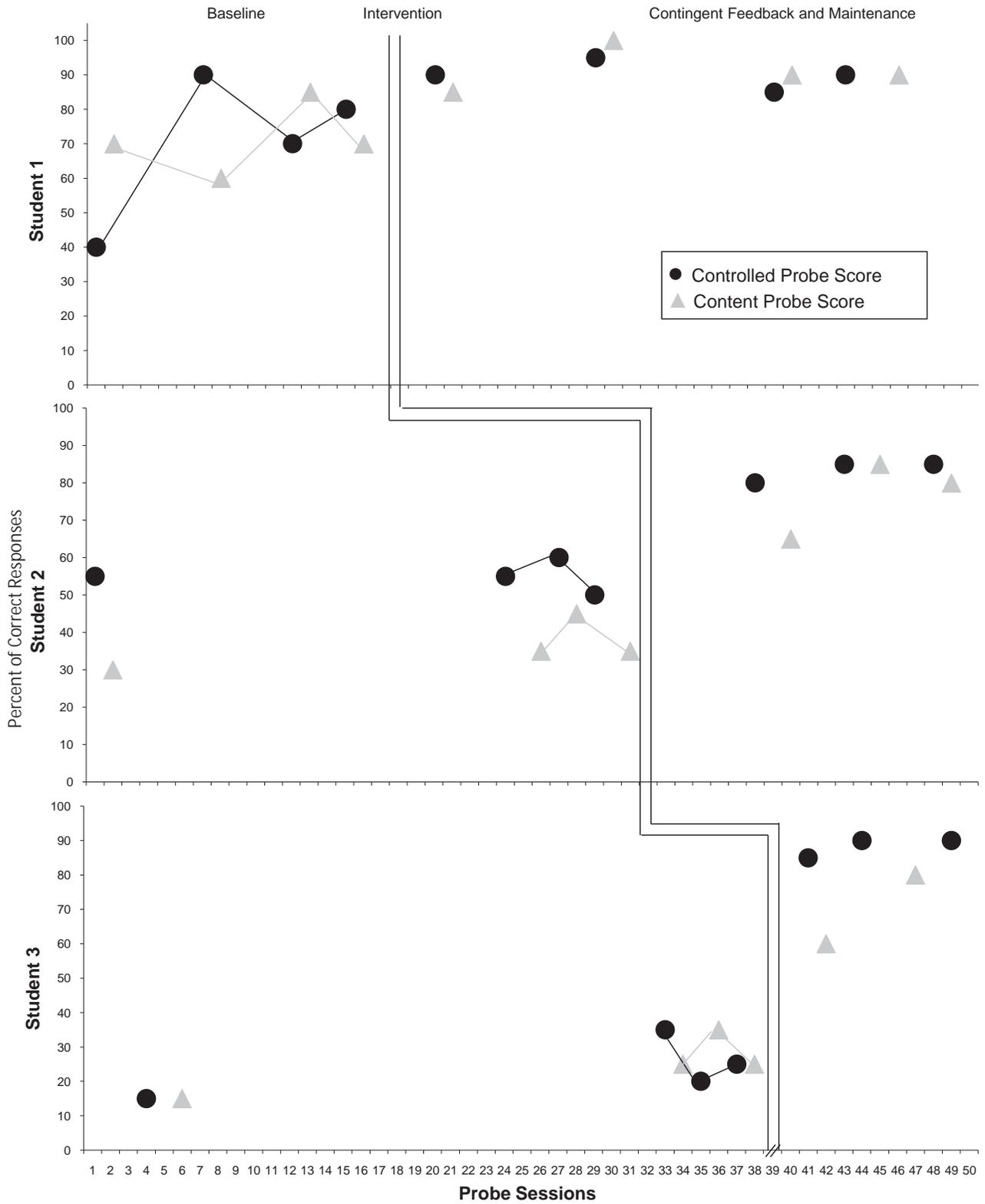


Figure 2. Content and Controlled Probe Scores for Students 4, 5, and 6

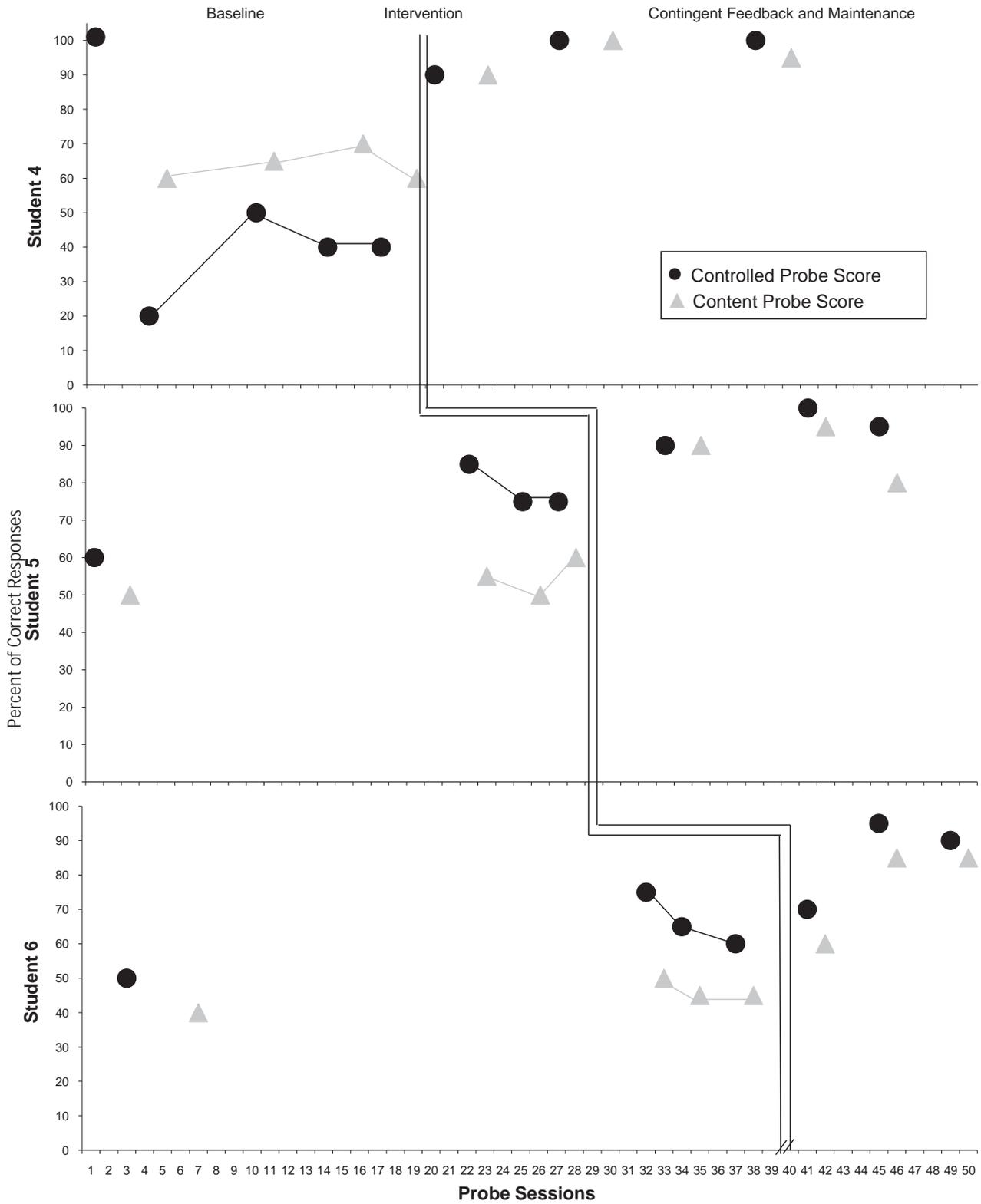
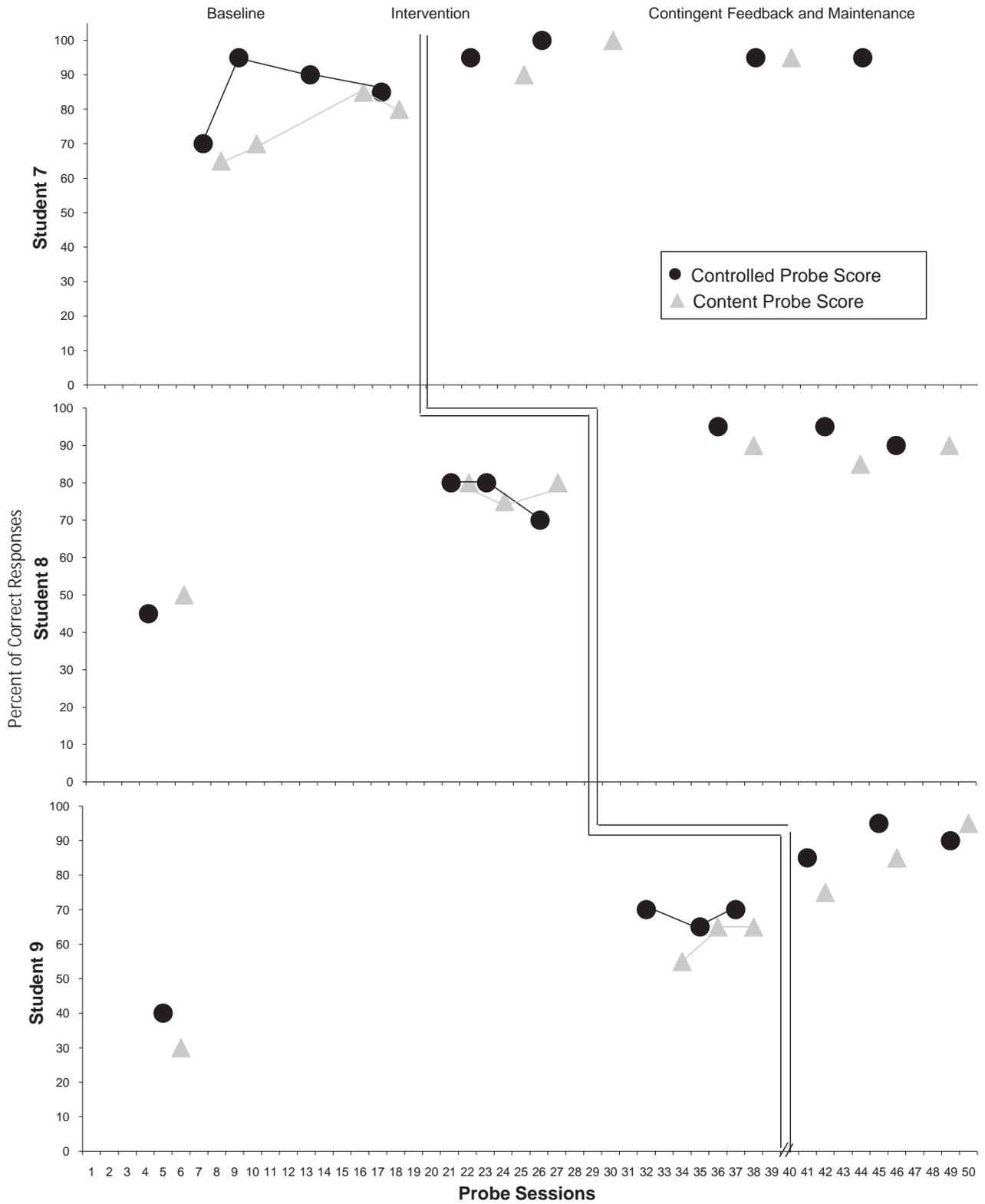


Figure 3. Content and Controlled Probe Scores for Students 7, 8, and 9



incorporates systematic procedures for teaching students how to generalize use of the strategy in independent settings. These results indicate that explicit and systematic instruction of strategies developed for use with high school students can be an effective method of instruction for postsecondary students with LD as well.

These findings suggest that it is possible to implement a strategy like PAS with minimal modifications of procedures specified in the Instructor's Manual (Bulgren & Schumaker, 1996). Most of the minor modifications implemented can be traced to the research design. In a non-research setting, students would be administered one pretest instead of repeated baseline measures that required additional sessions. Also, due to the multiple probe research design, it was necessary for students in the upper tiers of the research design replications to reach mastery levels on Controlled Practice materials before instruction could begin with students on the lower tiers. This, combined with the relatively short college semester and the limited student time available, made it necessary to combine as much instructional material as possible into the time available for instruction. The ability and necessity to combine lessons within PAS could be viewed as a positive component of strategy instruction with college students with LD because college settings are not restricted to traditional 50-minute instructional time periods found in high schools. Therefore, it may be possible to proceed through the stages of strategy instruction at a faster rate in the college setting.

### **Limitations of the Study**

Several limitations of this study have been identified. One limitation is the incomplete student records available for the participants of the study. One student (i.e., S5) did not have achievement score records in his student file; the only documentation of LD was a letter from a school psychologist indicating his diagnosed disability areas. Other students had records that were limited in both content and expression of student strengths and weaknesses, thus reducing the ability to provide complete subject descriptions. However, all participants did satisfy university documentation requirements for receiving disability support services and exhibited academic characteristics consistent with students with LD.

A second limitation was the possibility that students had previously been exposed to some material from the Controlled and Content Test Probes. While

every precaution was taken to ensure that the material was taken from textbooks not currently used by the students, the information was factual in nature (e.g., U.S. and World History material, Science material). Little could be done to preclude the possibility that students had been exposed to some of the material at some point in their academic career.

A third limitation of the study is the use of highly motivated student participants. All of the subjects volunteered for participation in the study and were not compelled to participate for any reason other than personal improvement. Therefore, the subjects may not be fully representative of the population of college students with LD and the results can only be viewed in terms of students who sustained their intrinsic motivation to learn the PAS strategy. The only potential motivating factor identified by the researchers that may lead participants to continue participating is that the instructional process itself provided positive and corrective feedback during the instructional stages of the strategy.

A final limitation is the changes made to probe session scheduling during the contingent feedback and maintenance phase of the study. Due to the approaching end of the semester, students on the second and third tiers of the research design replications had to change from maintenance probes occurring at two-week intervals to maintenance probes occurring at one-week intervals. A one-week interval between maintenance sessions may not have been ideal in determining if students were able to maintain use of the strategy over time. Also, it would have been desirable to allow maintenance probe sessions to continue for several more weeks for students on the lower tiers of the research design replications.

### **Implications for Colleges and Universities**

This study provided evidence that instruction in the PAS (Bulgren & Schumaker, 1996) is an effective procedure for improving the ability of college students with LD to identify and recall important textbook-based information in testing situations. This finding has implications for college students with LD and postsecondary personnel who provide services to students with LD.

*Implications for college students with LD.* While an increasing number of students with LD are enrolling in college (Brinckerhoff et al., 2002; Ellis, Sabornie et al., 1989; Gregg, 2007; Sparks & Lovett, 2009), they are not experiencing the same level of academic success

as their peers without disabilities (Murray et al., 2000; Vogel & Adelman, 1992). The empirical validation of effective interventions for college students with LD is one step in the process of providing college students with LD the ability to independently meet the academic demands of the college environment. Specifically, PAS can provide students a tool to promote their ability to identify and recall important information from college textbooks; a skill that the participants in this study identified as one that is important for all college students. Ultimately, the provision of strategies for meeting the academic demands of college could lead to improved rates of success for college students with LD.

Many of the support services and accommodations that college students with LD receive create an environment in which the student is dependent on others for the provision of support (e.g., tutoring, note-taking services, course outlines, etc.). Strategies are an independent tool that can decrease students' reliance on external assistance. Strategies assist students in accepting the responsibility of knowing how, when, and in what situations to use the learning techniques they have been taught, including the ability to generalize strategic learning skills in new situations. While there is an initial investment of time and effort in both teaching and learning a strategy, the positive effects can be long lasting. When used in conjunction with other services and accommodations, strategy instruction could prove to be a factor in helping college students with LD to achieve higher persistence and graduation rates.

Implications for postsecondary disability service providers. The findings of this study indicate that strategies such as PAS can be taught to college students with LD in disability support services settings including small group instruction and one-on-one instructional formats. This offers personnel who provide services to college students with LD another resource for providing these students with empirically validated supports during their academic careers. In addition, the findings of this study may spark interest in postsecondary faculty and disability support personnel to conduct more research on strategies and other instructional interventions in an effort to identify effective models of support for students with LD. Also, the findings may assist in creating avenues for collaboration between disability support offices and other academic skills staff on college campuses or colleges of education, who may have expertise and personnel who could assist disability support offices with strategy instruction.

### **Future Research**

The present study leads to at least two areas in which further research is warranted. First, future research needs to address the generalized use of PAS by college students with LD. A follow-up study of the participants could yield important data about their ability to maintain and apply the strategy to novel settings and situations over time. This will be critical when designing systems to implement this type of strategy use in college disability support service environments because of the importance placed on independent learning in college settings.

Finally, future research should be conducted to identify other strategies and instructional approaches that can assist students with LD to independently meet the academic demands of the college environment. While the strategies developed at the University of Kansas have shown great promise, there are other strategies developed individually by practitioners in the disability support service field that must be empirically validated and disseminated to other professionals in the field.

These findings are important because they extend the use of the PAS by providing evidence that the procedure can be used effectively with college students with LD and add to the scarce database of empirical research studies on effective interventions and instructional approaches for college students with LD.

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