Teaching Adolescents with Learning Disabilities to Generate and Use Task-Specific Strategies

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The effects of an intervention designed to enhance students' roles as control agents for strategic functioning were investigated. The goal was to increase the ability of students labeled learning disabled to generate new strategies or adapt existing task-specific strategies for meeting varying demands of the regular classroom. Measures were taken in three areas: (a) metacognitive knowledge related to generating or adapting strategies, (b) ability to generate problem-solving strategies for novel problems, and (c) the effects of the intervention on students' regular classroom grades and teachers' perceptions of the students' self-reliance and work quality. A multiple baseline across subjects design was used. The intervention resulted in dramatic increases in the subjects' verbal expression of metacognitive knowledge and ability to generate task-specific strategies. Students' regular class grades increased; for those students who did not spontaneously generalize use of the strategy to problems encountered in these classes, providing instruction to target specific classes resulted in improved grades. Teacher perceptions of students' self-reliance and work quality did not change, probably because baseline measures were already high in both areas. Implications for instruction and future research are discussed.

Interventions designed to enable adolescents labeled learning disabled (LD) to learn and perform independently in traditional secondary school settings have recently been the subject of much discussion and intervention research. One such intervention, learning strategies instruction, has been the focus of over 8 years of development and validation research (Deshler, Schumaker, & Ellis, 1986; Schumaker, Deshler, Alley, & Warner, 1983). The major focus of this research has involved the development of a specific technology for teaching learning strategies to adolescents with LD (Deshler, Schumaker, & Lenz, 1984) and the validation of several strands of task-specific strategies in the areas of reading, writing, listening, information storage, and test taking (Schumaker et al., 1983).

Because many low-achieving students seem to fail to use known skills appropriately in novel situations (Borkowski & Cavanaugh, 1979; Ryan, Weed, & Short, 1986; Schneider, 1985), the goal associated with the task-specific learning strategy instruction concerns teaching students with LD to use their existing skills in a strategically optimal fashion so that content information can be acquired, manipulated, stored, retrieved, and expressed (Deshler, Schumaker, Lenz, & Ellis, 1984). Thus, each task-specific strategy is designed to enable students with LD to complete specific tasks in school settings. Each strategy is arranged as a set of self-instructional steps that lead to solving a particular type of problem. For example, the Error Monitoring Strategy (Schumaker, Deshler, Nolan, Clark, Alley, & Warner, 1983) includes a specific set of writing procedures and error-monitoring questions that, when used, result in a nearly error-free written passage.

This focus on strategy interventions is related to the nature of cognitive deficits displayed by many adolescents with LD. Executive functioning (the ability to create and apply a strategy to a novel problem) appears to be a major cognitive deficit among adolescents with LD. Hallahan and Kneedler (1979) noted that many students with LD do not stop and consider the requirements of a task or the best way to address the task before responding. Disabilities related to executive functioning we[re] found in over one-half of the 318 ado[-] lescents with LD studied by Warne[r,] Schumaker, Alley, and Deshler (1980[).] Despite these cognitive deficiencie[s,] studies have demonstrated tha[t] taught a task-specific strategy, man[y] students can increase their success i[n] school (e.g., Schumaker, Deshler, Alley, Warner, & Denton, 1982). A number c[of] studies have shown that the students' us[e] of the strategies results in gains i[n] classroom test scores, improved cours[e] grades, and improved regular classroo[m] teachers' perceptions of student pe[r-] formance (e.g., Lee & Alley, 1981[;] Schmidt, 1983; Schumaker et al., 198[2;] Schumaker, Deshler, Nolan, Clark[,] Alley, & Warner, 1983).

One limitation of the task-specifi[c] strategies instruction is that, in mo[st] cases, it is the educator who assume[s] responsibility for designing the tas[k-] specific strategies that are taught to th[e] students. Typically, it is the teacher, n[ot] the student, who decides when a strateg[y] is needed, compares setting demand[s] with the student's strengths and weak[-] nesses, designs or selects an appropria[te] task-specific strategy, and then monito[rs] the student's use of the strategy f[or ef-] fectiveness and determines adapta[tions] needed (Ellis, 1985; Reid & Hresk[o,] 1981). Students are rarely given t[he] responsibility of independently acti[ng] strategically within the approach. Whi[le] this may be appropriate in the early i[n-] structional stages, in the long run, it m[ay] fall short of the goal of promoti[ng] learner independence (Ellis, 1986). [In] addition, it has been argued that instru[c-] tion in task-specific strategies alone do[es] not prepare students to be sufficient[ly] responsive to the broad array of situ[a-] tions encountered in both school a[nd] nonschool settings (Deshler, Sch[u-] maker, Lenz, & Lenz, 1984). To addre[ss] this problem, some authors have a[d-] vocated that students receive executi[ve] process training (e.g., Brown, 197[8,] 1980; Meichenbaum, 1981, 1982). T[he] alternative approach is designed to he[lp] students recognize a problem and sol[ve] it by creating a strategy, monitoring t[he] strategy's effectiveness, and making t[he] necessary adaptations. It would s[eem] reasonable to combine the task-spe[cific] strategies approach with executive p[rocess]

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cess training. That way, students would be exposed to a variety of task-specific strategies. They could then draw upon this experience to design new strategies on their own once they receive executive process training.

The effects of an intervention designed to enhance students' roles as control agents for overall strategic functioning were investigated in the present study. The goal was to increase the ability of students with LD to generate new strategies or adapt previously learned task-specific strategies for meeting varying demands of the regular classroom. The purpose of the study was twofold: first, to determine the effects of executive strategy training upon the metacognitive knowledge and use of executive processes of students with LD; and second, to determine whether training in an executive strategy results in improved regular classroom performance.

METHOD

Subjects

Thirteen students were drawn from a population of volunteering students enrolled in a Midwest public high school special education resource room program in Grades 10, 11, and 12. The mean age of the subjects was 17 years, 3 months (range = 15.2 to 19.5). Parent permission to participate in the study was secured for each participant. Classification of LD was based on a standard score regression formula with a 15-point discrepancy between ability and achievement (Cone & Wilson, 1981). Intelligence quotients as measured by the Wechsler Intelligence Scales for Children–Revised ranged from 82 to 109 ($\bar{X}$ = 92.6), and all exhibited deficiencies in one or more achievement areas. On the Woodcock-Johnson Psycho-Educational Battery Tests of Achievement, reading grade equivalency scores ranged from 2.8 to 8.0 ($\bar{X}$ = 5.75); math ranged from 5.3 to 9.4 ($\bar{X}$ = 6.61); and written language ranged from 2.8 to 12.5 ($\bar{X}$ = 5.72). Students exhibiting evidence of physical handicaps, emotional disturbance, or economic, environmental, or cultural disadvantage were not included. Marker characteristics of subjects are illustrated in Table 1.

All 13 students had previously participated in a Learning Strategies program, in which they had each mastered at least two and as many as nine task-specific strategies ($\bar{X}$ = 4.6, SD = 2.36). Reading strategies addressed word attack, interpreting visual aids, using self-questioning, and paraphrasing comprehension-enhancing techniques as well as a strategy for reading textbook chapters. Writing strategies were designed to enhance the student's ability to monitor composition and mechanical errors, and to write sophisticated sentences, paragraphs, and themes. In addition, some students received instruction in test preparation, first-letter mnemonics, listening, and notetaking, as well as test-taking strategies. Therefore, all participating students had been provided opportunities for developing a response set to strategic problem solving. Table 2 illustrates the task-specific strategies that individual subjects had either been exposed to (instruction was ongoing) or had mastered.

Procedures

Executive Strategy Procedures. The executive strategy was designed to enable the student to (a) focus on a problematic situation, (b) identify and analyze the critical features of the problem, (c) generate a series of problem-solving steps, and (d) monitor the effectiveness of the self-generated strategy and make necessary modifications. The strategy includes three substrategies: Zero-in-IDEA, TASC, and ECHO (Ellis, 1985). The Zero-in-IDEA substrategy is used to conduct assessments of the demands associated with given problematic situations and of the student's relevant strengths and weaknesses. The result of using Zero-in-IDEA is the identification of a specific weakness for which a strategy can be constructed. The substrategy TASC can be used to generate a strategy. In the first step in TASC, the student identifies any single step that is crucial to solving

TABLE 1
Marker Characteristics of Subjects

					Intellectual ability			Achievement grade equivalency		
Subject	Sex	Age	Race[a]	Grade level	Full scale IQ	Verbal IQ	Performance IQ	Reading	Mathematics	Written language
1	M	18-3	C	12	93	84	106	2.8	7.8	3.6
2	M	17-4	B	10	88	85	88	6.4	6.6	6.2
3	M	16-3	C	10	89	82	100	6.0	5.5	5.4
4	F	15-2	C	10	82	69	100	8.5	5.6	8.6
5	F	17-0	C	10	97	94	100	8.5	7.0	12.5
6	M	15-11	C	10	89	81	100	3.8	7.0	4.3
7	M	17-8	B	11	97	94	102	4.3	5.5	4.4
8	M	18-9	B	12	97	98	98	4.9	9.0	4.9
9	M	16-1	C	10	109	108	109	7.0	9.4	5.5
10	F	19-5	C	12	97	103	89	8.0	7.2	7.6
11	M	16-8	B	11	94	91	100	5.1	6.6	5.4
12	M	17-0	C	11	89	95	86	6.4	5.3	2.8
13										

[a]C = Caucasian; B = black.

TABLE 2
Subjects' Experiences with Various Task-Specific Strategies

Task-specific strategies	Subjects S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S1[illegible]
Word attack									M				M
Interpreting visual aids			E			E		E	M				
Self-questioning		E		E	M						E		E
Textbook reading	M						M	M		M	M	M	
Composition error monitoring	M	M	M	M	M	M	M	E	M	M	M	M	
Sentence generation	E	E	M	M	M	E	M	M	M	M	M	M	
Paragraph writing	E	M	E			M	M	M	E	M		M	
Theme writing							M	M		M		E	
Test taking	E	E	E	E		E	M	M	M	M			E
Test preparation										M			
First-letter mnemonics	M	M	M	E		M	M		M	M	M	M	E
Listening & notetaking	E		E			E	M	M	M	M	M	M	
Total strategies mastered	3	3	3	2	3	3	8	6	7	9	5	6	2
Total strategies	7	6	7	5	3	7	8	8	8	10	7	7	6
Percentage mastered	43	50	43	40	100	43	100	75	88	90	71	86	33

Note. E = exposure to strategy; M = mastered strategy.

the weakness previously identified. Then the student uses the Before-and-after Rule, in which a step that should immediately precede and another step that should immediately follow the original step are identified. The student applies the Before-and-after Rule to every subsequently identified step until ideas are exhausted. The result of TASC is a set of sequenced steps for solving the problem. The purpose of the third substrategy, ECHO, is to enable the student to test the new strategy by trying to use it, monitoring its effectiveness, and modifying it to meet situational demands. A student repeats the steps of ECHO until the strategy has been refined.

A superordinate strategy called SUCCESS (Ellis, 1985) was designed to combine the three substrategies into a single strategy. The steps for SUCCESS are illustrated in Figure 1. The first two steps are based on the Zero-in-IDEA substrategy. The third and fourth steps are based on TASC, while the remaining steps address the ECHO substrategy.

Instructional Materials. The instructor used a set of cue cards listing the various steps of the substrategies and superordinate strategy, SUCCESS, as well as a list of scenarios depicting problematic situations. These scenarios were used as stimuli to promote the student's practice of the strategies. Materials used by the student were paper, pencil, and multiple copies of a form that the student completed when applying the Zero-in-IDEA strategy.

Training Procedures. Each student received individual instruction from a teacher who was certified in learning disabilities and who had written the instructional materials for the study. Instructional sessions ranged from 20 to 40 minutes and were held daily in a resource room setting in an area isolated from others. Through the use of the instructional materials, students were firs taught each of the substrategies in isola tion. After all of the substrategies ha been mastered, students were provide instruction in the SUCCESS strategy After students had demonstrated profi ciency using the strategy on practic materials, they were asked to apply th strategy to problems they were countering in their regular classes. T students who did not appear to b achieving increases in their weekl grades were provided additional train

S = Sort out the most important demand or problem.

U = Unarm the problem by identifying the critical trouble spots.

C = Cash in on your old strategies, experiences, and observations of others.

C = Create a strategy for solving this problem that will work on all similar problems.

E = Echo your strategy (use substrategy ECHO)

- **E = Evaluate the strategy as you try it**
- **C = Change the strategy to make it work better for future use**
- **H = Have another try and re-evaluate it**
- **O = Overlearn your strategy**

S = See how well your strategy works in different situations.

S = Save your strategy.

Figure 1. Steps to the executive strategy.

ing to facilitate generalization. These students were instructed to target a specific class for application of the strategy. They were informed that they would have to report to their learning ...ter instructional group in 3 weeks. The report was to contain a description of how they had applied each step of the executive strategy to self-generate a new task-specific strategy for solving one of their real life academic problems in a specific class and a description of the effectiveness of the self-generated strategy.

The instructional procedures were adapted for use from those outlined by Deshler, Alley, Warner, and Schumaker (1981). They included testing the student's current level of functioning, describing and providing a rationale for each step of the executive strategy, modeling the strategy while thinking out loud, having the student verbally rehearse the strategy steps to 100% criterion, having the student practice the strategy on artificial problems, having the student apply the strategy to real life problems, and testing the student's use of the executive strategy after the student had reached mastery. Positive and ...ective feedback was provided in each practice session during the training.

Measures

Measures were collected in three areas: metacognitive knowledge, ability to generate problem-solving strategies for novel problems (near-generalization measures), and course grades and teacher perceptions of student self-reliance and work quality (far-generalization and social validity measures).

Metacognitive Knowledge Measure. To assess metacognitive awareness of factors affecting the construction and use of task-specific strategies, two probes were developed. The first metacognitive measure, called the Executive Awareness Probe, was designed to determine the subject's ability to verbally describe the 10 key executive behaviors associated with the process of self-generating, using, and monitoring task-specific strategies. Examples of these 10 key executive behaviors are (a) conducting an assessment of the demands of a problematic situation (i.e., assessing the strategic demands of a specific problematic class) and (b) conducting a self-assessment to determine strengths and weaknesses of personal skills that relate to the problem. The 10 key executive behaviors were identified and validated by Ellis (1985). The probe consisted of a structured interview in which the following question was asked of each student individually: "What are some things that are important to do when making up and using a learning strategy?" If a student did not appear to comprehend the question, then it was rephrased in the following manner: "So far, you have learned several learning strategies in the Learning Center. Teachers have always been the ones to make them up. If you decided to make up your own strategy, what are some important things to do in order to make it up and use it?"

Each subject's responses to the question were recorded on a tape recorder and were simultaneously scored by a trained independent observer certified in school psychology who used a checksheet to indicate which of the 10 key executive behaviors were mentioned by the subject. By dividing the score that the student attained by the total possible, we were able to compute a percentage score.

The second metacognitive measure was called the Demands Assessment Probe. It was designed to determine the student's ability to verbalize the specific executive behaviors needed for assessing the attributes of a problem. The eight executive behaviors assessed in the Demands Assessment Probe were based on a logical progression of identifying a key component or characteristic of the problem or skills needed to solve the problem and then identifying the related subordinate components or characteristics. For example, a subject might say that she was having trouble in science class because she doesn't know how to take lab notes (the key component to the problem). She would then further clarify the problem by stating that she felt that the reason for not being able to take lab notes was that she really didn't know *what* she is supposed to be writing in her notes because there was no lecture (subordinate components of the problem). The probe sought data regarding the subject's verbalizations concerning how one goes about reaching these conclusions regarding critical features of a problem. The Demands Assessment Probe was validated by Ellis (1985).

The Demands Assessment Probe was different from the Executive Probe in that cues were provided to aid in the identification of key steps. For example, in order to get the student to verbalize information about analyzing a problem, the student was asked, "Before you make up a strategy, it is important to know just what the strategy will be used for; to do that, you have to be able to analyze the problem. What are some things that are important to do in order to analyze the problem?"

Student responses to the question were tape-recorded, and the performance was scored on a checksheet that listed the eight Demands Assessment behaviors. Because a performance that included some of the eight Demands Assessment behaviors reflected greater sophistication (e.g., "I would try to figure out why I was doing poorly in Mr. Jones's class" versus "I would try to figure out what keeps stumping me on the multiple-choice questions from Mr. Jones's tests"), responses were weighted accordingly. A percentage score was obtained by summing the weighted values of the student's responses and dividing by the total points possible.

Near-Generalization Measures. To assess near-generalization, an instrument was developed to measure the student's ability to generate effective strategies for novel problems and to use past experiences and strategies in generating those strategies. The instrument consisted of a series of eight problematic scenarios, each with different story lines and critical features. Additional scenarios with differing story lines but similar critical features were developed to correspond to each of the original scenarios. These eight pairs of scenarios were used to elicit responses from a student, with each pair serving as a single probe of the student's skills. Scenarios were matched so that the student's strategies could be analyzed for evidence that the subject relied on past strategies for use when constructing new ones; the student was not required to actually test and modify the student-generated strategies associated with this probe. To control for an ordering effect, the members of pairs were randomized. For each administration of the instrument, one scenario from a pair was placed in front of the student and then read aloud. The student was instructed to create an effective strategy that would solve the problem presented in the scenario and to write the steps to his or her strategy on a piece of paper. Then, on the next school day, the second scenario from the pair was presented in the same fashion. When a student had generated and written strategies for both members from a pair of scenarios, a probe was completed.

The two student-generated strategies that resulted from each pair of scenarios were analyzed to determine if the identical critical feature represented in the two different scenarios was addressed as a problem to target and if each of the strategies employed similar problem-solving steps or processes. The executive strategy intervention (SUCCESS strategy) is designed to enable the student to use four key executive behaviors: student self-generating a strategy or modifying steps to an existing strategy, sequencing the strategy steps appropriately, encapsulating a strategy using some form of remembering system (e.g., acronyms, mnemonic devices), and designing the strategy not to be situation specific. The near-generalization task allowed the evaluation of presence or absence of evidence indicating use of the four key executive behaviors. In addition, each strategy was judged as either ineffective, appropriate, or ideal for solving the problem presented in the scenario. A student received points for each item, and a percentage score was derived by dividing a student's total score by the total points possible.

Far-Generalization Measures. Measures were taken of regular teachers' perceptions of subjects' classroom performance. In addition, a record of students' weekly regular classroom grades was maintained. The purpose of measuring teachers' perceptions of the quality of students' weekly work was to obtain an index of students' school-related success other than grades. Such a measure is important because subjects could choose to generate a strategy that might impact the quality of their work but might not immediately be reflected in their grades. A teacher questionnaire was used to gather information each week on satisfaction with the quality of a specific subject's school work, with the amount of self-reliance displayed by the student, and an estimation of the student's grade in that class for the immediately preceding week. The first two questions utilized a 5-point Likert-type format (1 = very dissatisfied, 5 = very satisfied). The question requiring estimation of the student's grade used a fill-in-the-blank format. The students' grades were later converted to point values for the purposes of analysis (A + = 14, F = 1). The teachers remained blind to the experimental conditions throughout the study.

Interobserver Reliability. Interobserver reliability was determined for the metacognitive knowledge measures and the near-generalization measures by having a second person independently observe each of the subjects, listen to tape recordings of responses or analyze permanent products prepared by the student, and record the behaviors to be measured on each probe. At least 20% of each student's performances on each measure were randomly selected for reliability purposes. The two observers' recordings were compared item by item. An agreement was scored if both observers recorded a behavior in exactly the same way. Percentage of agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. On the Executive Awareness probe, there were 84 agreements out of 85 opportunities (99% agreement). The Demands Assessment probe resulted in 53 agreements out of 58 opportunities (91% agreement). The near-generalization probe yielded 288 agreements out of 319 opportunities (90% agreement).

Research Design

Experimental Conditions. Measures were collected during three conditions: Baseline condition, the During Traini condition, and the Targeted Class cc dition. The Targeted Class conditi reflected the performance of those st dents who targeted specific cla' those who did not.

For the grades measure, an expe mental design was not used due failure to attain stable baseline for students within a limited period of tii (see Note 1). In lieu of this, grades da are reported as descriptive. Grades we tracked in 23 classes for a minimum 6 weeks prior to the executive proce training, and 5 weeks following t training. Classes that were tracked we selected based on two criteria: (a) It w a required course for a high scho diploma, and/or (b) the regular teach volunteered to participate. All of t students' classes were tracked throu the During Training condition. Then, those classes where generalization w *not* evidenced following the Duri Training condition, approximately ha were randomly selected to target usi the generalization interventic (Targeted Class condition). Of t classes where generalization w evidenced following the During ing condition, approximately on were also randomly selected to targ with the generalization interventio This procedure allowed comparison t tween those classes in which the gen alization intervention was not appli (Nontargeted Class condition) and the in which it was applied (Targeted Cla condition).

Experimental Design. A multip baseline across students design (Ba Wolf, & Risley, 1968) was used. T procedures followed for the multip baseline across students design were follows. Baseline data collection co tinued with 3 students until 1 stude had been tested at least twice and ha attained a stabilized baseline for measures (except grades). At this poi this student was trained in the use of t executive strategy. Baseline continu for the other 2 students. When the fi student had demonstrated improveme on all of the measures except grades a second student had attained a s baseline on all tests, the second stude received instruction in the strateg

Then, when the second student had demonstrated improvement on all the tests and a third student had attained stable baselines on all measures, the third student received instruction in the executive strategy. This procedure was replicated once; a third replication had 4 students.

RESULTS

Metacognitive Knowledge

Figure 2 shows results of the study with regard to metacognitive knowledge measures for 3 students, Bob, Mary, and Pete. The solid dots represent the percentage of key executive behaviors named in response to questions posed during the Executive Awareness Probe. The empty circles represent the percentage of behaviors correctly identified during the Demands Assessment Probe.

Figure 2 shows that for Bob, dramatic changes in metacognitive knowledge occurred immediately after training. This was evidenced by scores on both the Executive Awareness Probe and the Demands Assessment Probe. Prior to the training, Bob attained scores averaging around 37% on the Executive Awareness Probe and around 12% on the Demands Assessment Probe. Following training, his scores averaged 85% and 89%, respectively. The pattern was replicated by Mary and Pete. During the Baseline period, the subjects' scores on the Executive Awareness Probe averaged 25%. For the During Training condition, the subjects' scores averaged 95%. Increases in scores occurred only after training in each case. Thus, these data indicate that the students were more aware of metacognitive skills needed to generate and use task-specific strategies after training. Baseline scores on the Demands Assessment Probe averaged 11%. The During Training condition scores averaged 97%. Again, score increases occurred only after training. Thus, the students were more aware of processes involved in assessing the relative attributes of a specific problem after training. Their performance on the metacognitive measures is representative of the remaining students (see Figures 3, 4, and 5).

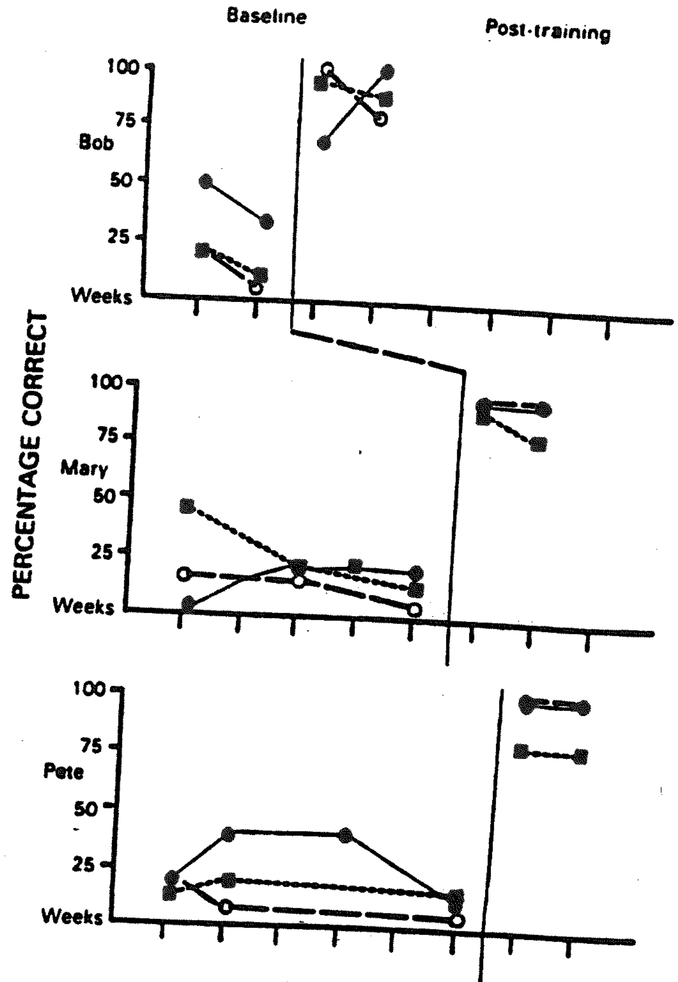

Figure 2. Metacognitive knowledge and near-generalization percentage scores for Bob, Mary, and Pete (see Figure 2a for legend).

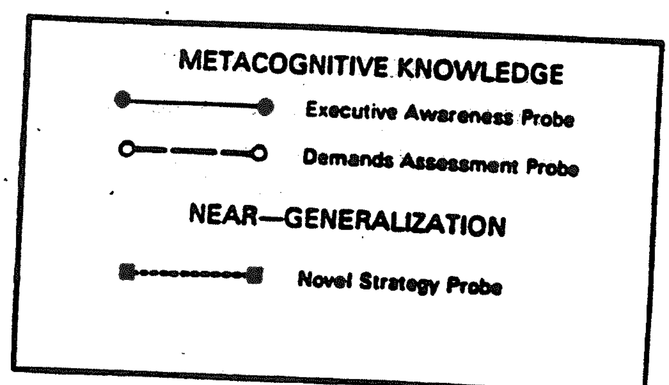

Figure 2a. Legend for Figures 2 through 5.

Near-Generalization

Figure 2 also shows the results for the near-generalization measure: the student's ability to generate new strategies. Squares in the figure represent the percentage of points earned by the students when generating a new strategy in response to the paired scenarios. The figure shows that for Bob, dramatic changes in ability to generate a strategy occurred immediately after training.

Before the training, Bob attained scores that averaged around 18%, and after the training, his scores averaged 90%. The pattern is replicated by Mary and Pete. Baseline scores averaged 22%. Following the training, students' scores averaged 84%. Marked increases occurred only after training in the strategy. The performances of Bob, Mary, and Pete (see Figure 2) are representative of 8 of the remaining 10 students in the study. Two students (Dean and Gordon, Figure 4) did not appear to show marked gains in ability to generate strategies following the intervention.

Far-Generalization

Quality of Work. Results of teacher perceptions of the quality of weekly work in targeted and nontargeted classes across different conditions suggest that in all classes during baseline, teacher-reported perceptions of the quality of students' work were very near the "satisfied" (4.0) point ($\bar{X}$ = 3.879; *SD* = .505). In other words, teachers' perceptions of the quality of students' work was relatively high prior to the intervention. The mean satisfaction score for the During Training condition was 3.75 (*SD* = .70), which was slightly lower than the baseline mean. For those students who were instructed to target specific classes for application of the executive strategy, the mean score during the Targeted Class condition was 3.88 (*SD* = .48). In short, no substantial differences were found in teacher perceptions of the quality of students' work across conditions.

Self-Reliance. Baseline results of the self-reliance measure suggest that for all classes (targeted and nontargeted), teachers' perception of the students' self-reliance was near the "satisfied" (4.0) point ($\bar{X}$ = 3.839; *SD* = .565). In other words, teachers' perceptions of students' self-reliance were also relatively high prior to the intervention. In the During Training condition, the mean satisfaction score for all classes was 3.758 (*SD* = .709), which was slightly lower than the baseline condition mean. Thus, the training in the executive strategy followed by general instructions to apply it in regular classes did not result in

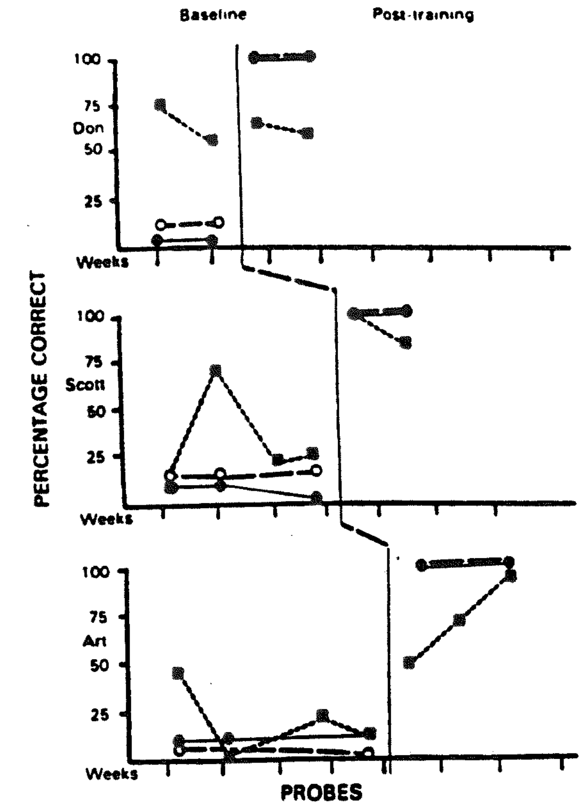

Figure 3. Metacognitive knowledge and near-generalization percentage scores for Don, Scott, a Art (see Figure 2a for legend).

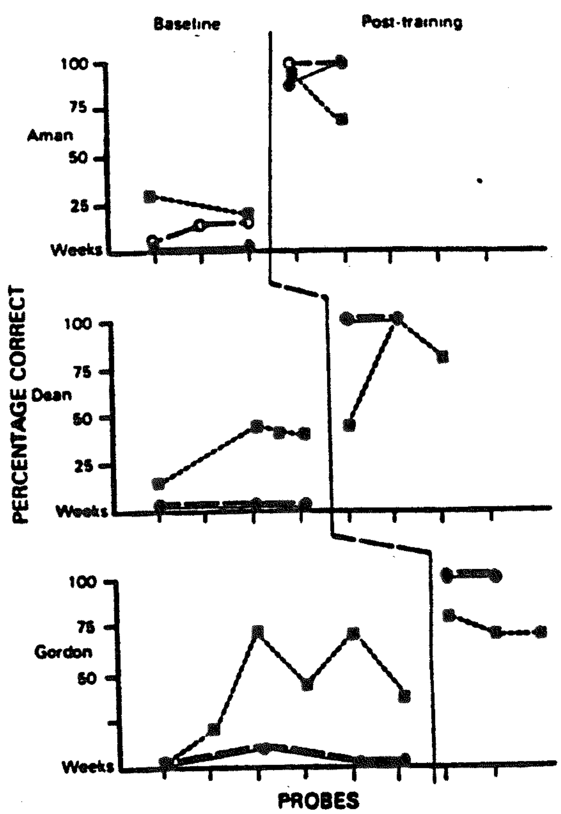

Figure 4. Metacognitive knowledge and near-generalization percentage scores for Aman, Dean, Gordon (see Figure 2a for legend).

positive changes in teachers' perceptions of students' self-reliance. However, comparison of the mean self-reliance scores in the Targeted Class condition ($\bar{X}$ = 3.93; *SD* = .49) with self-reliance scores from those same classes in the During Training condition ($\bar{X}$ = 3.41; *SD* = .73) revealed statistically significant gains ($p < .05$) using the Wilcoxon Signed Ranks nonparametric test for equal sized samples (Conover, 1980). Thus, training in the executive strategy followed by instructions to target a specific class for application, and establishing the expectation of generalization by requiring students to report about their efforts, appear to result in changes in teachers' perceptions of students' self-reliance.

Grades. Students did not receive instructions to target use of the executive strategy in 11 of the 23 classes where grades were tracked since their regular class performance improved following the intervention. The classes where grades improved were represented by 7 of the 13 students participating in the study (see Table 3). Weekly grades averaged 6.61 (*SD* = 2.17) during baseline. Then, in the During Training condition, grades averaged 8.63 (*SD* = 2.87), resulting in a mean gain of 2.07 (*SD* = 1.4).

Of the remaining 12 classes where performance did not improve following the During Training condition, students were asked to target seven specific classes for use of the executive strategy (see Table 4). Baseline grades averaged 7.24 (*SD* = 3.46), and During Training grades averaged 5.37 (*SD* = 2.89), an overall *decline* in grades of 1.92 (*SD* = .96). Then during the Targeted Class condition, grades averaged 8.46 (*SD* = 3.23), which represented an improvement in grades, as compared to a baseline of 1.22 (*SD* = 2.76); more notably, a recovery from the During Training condition was represented by a average gain of 3.09 (*SD* = 2.05).

Of the five classes where grades did *not* improve following the During Training condition, and instructions to target a specific class for applying the executive strategy were *not* given for these specific classes, students' grades averaged 7.8 (*SD* = 1.69) during baseline and then

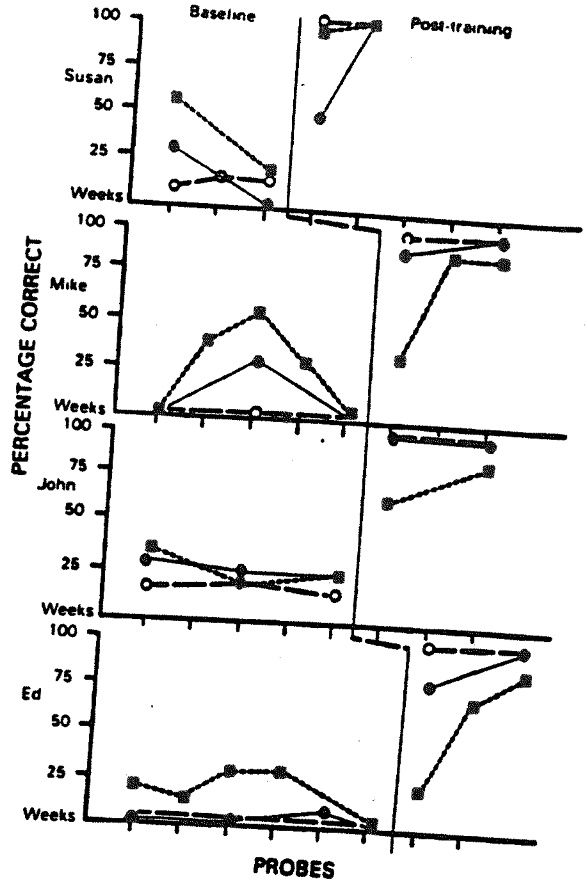

Figure 5. Metacognitive knowledge and near-generalization percentage scores for Susan, Mike, John, and Ed (see Figure 2a for legend).

TABLE 3
Grades in Mainstream Classes Where Initial Generalization of the Execution Strategy Spontaneously Occurred

Subject's classes	Baseline	During training	During training gains versus baseline
Bob's English	6.2	9.5	3.3
Mary's Fundamentals of Math	9.25	11.17	1.92
Mary's Lab Science	5.4	5.6	.20
Pete's English	3.8	8.0	4.2
Susan's English	7.8	8.0	.2
Art's English	9.4	13.0	3.6
Art's Biology	1.63	3.0	1.37
Aman's English	8.2	11.67	3.47
Bob's American Government	8.6	10.00	1.4
Mike's American History	4.88	7.0	2.12
Ed's American Government	7.56	8.0	.94
N	11	11	11
$\bar{X}$	6.61	8.63	2.07
SD	2.47	2.87	1.40

Grade scale
0 = F− 3 = D− 6 = C− 9 = B− 12 = A−
1 = F 4 = D 7 = C 10 = B 13 = A
2 = F+ 5 = D+ 8 = C+ 11 = B+ 14 = A+

TABLE 4
Grades in Mainstream Classes Where Initial Generalization Did Not Spontaneously Occur Followed by Teacher Instruction to Target These Classes for Application of the Executive Strategy

Subject's class	Baseline	During training	During training gains versus baseline	Targeted class condition	Targeted class gains versus baseline	Targeted class gains versus during training
Don's Child's World	8.75	6.6	−2.5	12.0	3.25	5.4
Pete's Child's World	12.0	8.5	−3.5	9.0	−3.0	.5
Aman's American History	9.67	8.0	−1.67	10.5	.83	2.5
Gordon's English	4.4	4.0	−.4	9.5	5.1	5.5
Gordon's Algebra I	2.86	1.0	−1.86	2.0	−.86	1.0
Susan's Communism	9.0	7.0	−2.0	9.25	.25	2.25
John's English	4.0	2.5	−1.5	7.0	3.0	4.5
N	7	7	7	7	7	7
$\bar{X}$	7.24	5.37	−1.92	8.46	1.22	3.09
SD	3.46	2.89	.98	3.23	2.76	2.05

Grade scale
0 = F− 3 = D− 6 = C− 9 = B− 12 = A−
1 = F 4 = D 7 = C 10 = B 13 = A
2 = F+ 5 = D+ 8 = C+ 11 = B+ 14 = A+

averaged 5.76 (*SD* = 1.69) in the During Training condition, an overall regression in grades of 2.04 (*SD* = .71) (see Table 5).

Of the three classes where gains *did* result in improved grades following the During Training condition, and these classes were specifically targeted for using the executive strategy *anyway*, average grades during baseline were 8.2 (*SD* = .40), and grades for the During Training condition averaged 9.89 (*SD* = 1.84), an average gain of 1.69 (*SD* = 1.65). Then, after students were requested to specifically target these classes for application of the executive strategy, grades averaged 10.57 (*SD* = 2.29) in the Targeted Class condition. This represented an average of 1.22 (*SD* = 2.76) increase in grades over those during baseline, but only .68 (*SD* = 1.05) average increase in grades from the During Training condition (see Table 6).

TABLE 5
Grades in Mainstream Classes Where Initial Generalization Did Not Spontaneously Occur and the Teacher Did Not Instruct Students to Target These Classes for Application of the Executive Strategy

Subject's classes	Baseline	During training	During training gains versus baseline
Scott's English	9.14	7.0	−2.14
Dean's English	6.86	4.8	−2.06
Dean's Consumer Math	10.0	8.0	−2.0
Mike's English	7.0	4.0	−3.0
John's Lab Science	6.0	5.0	−1.0
N	5	5	5
$\bar{X}$	7.8	5.76	−2.04
SD	1.69	1.69	.71

Grade scale
0 = F− 3 = D− 6 = C− 9 = B− 12 = A−
1 = F 4 = D 7 = C 10 = B 13 = A
2 = F+ 5 = D+ 8 = C+ 11 = B+ 14 = A+

DISCUSSION

Many adolescents with LD appear to be unable to generate effective task-specific strategies, although many can learn to use strategies generated by others. This study was designed to determine the effects of an intervention developed to teach students to generate and use their own strategies. A number of conclusions can be drawn from the results of this study. First, it appears that the metacognitive knowledge as verbally expressed by the adolescents with LD who participated in this study was minimal prior to the intervention. These results suggest that although adolescents with LD can learn to use task-specific strategies effectively (as these students had prior to this study), they do not necessarily learn to verbalize the metacognitive skills involved in the process of generating new strategies. A second conclusion supported by these results is that significant gains in verbalizations o metacognitive knowledge are associate with training in use of the executiv strategy. Third, skill of students wit LD in generating new strategies can in crease dramatically when training is prc vided. However, the increased ability t verbalize the metacognitive processe and generate new task-specific strategie under controlled conditions does nc necessarily result in their generalized u in regular classrooms. While all t students demonstrated marked progre in these skills, only a little more tha

TABLE 6
Grades in Mainstream Classes Where Initial Generalization Spontaneously Occurred Followed by Instruction to Target These Classes for Further Application of the Executive Strategy

Subject's class	Baseline	During training	During training gains versus baseline	Targeted class condition	Targeted class gains versus baseline	Targeted class gains versus during training
Bob's American Government	8.6	10.0	1.4	9.5	.9	−.05
Aman's English	8.2	11.67	3.47	13.2	5.0	1.53
Susan's English	7.8	8.0	.2	9.0	1.2	1.0
N	3	3	3	3	3	3
$\bar{X}$	8.2	9.89	1.69	10.57	2.37	.68
SD	.40	1.84	1.65	2.29	2.29	1.05

Grade scale
0 = F− 3 = D− 6 = C− 9 = B− 12 = A−
1 = F 4 = D 7 = C 10 = B 13 = A
2 = F+ 5 = D+ 8 = C+ 11 = B+ 14 = A+

half of the classes tracked evidenced generalization of these skills without an additional generalization intervention. Fourth, data from the far-generalization measures tentatively suggest that students' grades in mainstreamed classes can improve following the intervention. Of those classes where gains were found following training in executive processes, performance increased slightly ss than the equivalent of a letter grade, as compared to baseline scores. Of those students who demonstrated improved grades following the training but were asked to target specific classes anyway, only minimal gains resulted. Further, the data suggest teachers' satisfaction with products, but this is not necessarily reflected in an increase in students' grades. One possible explanation is that teachers' perceptions of students' work may be biased due to their knowledge of the student's label. It appears that students who are *already generalizing* the executive process training may not necessarily benefit from the extra generalization condition. In contrast, for those students who have received the executive process training but are not demonstrating generalization behaviors in regular classes, requesting them to target specific classes for application of he executive strategy and then report ack to their instructional group regarding the results of their efforts appears esult in improved regular class performance of slightly more than a letter rade. Thus, training in the executive strategy appears to contribute to moving adolescents with LD a step closer to independence because it enables them to be less dependent on their teachers for the design of task-specific strategies.

There are a number of additional conclusions that can be drawn that are related to the specific components of the executive strategy and to theoretical concerns discussed in the literature. First, use of the strategy requires the student to conduct a demands assessment and a self-assessment. Much of the responsibility for this task traditionally has been assumed by the educator (Brown, 1978; Brown & Smiley, 1978; Loper, 1980). The present study demonstrated that some adolescents with LD can learn to conduct a demands assessment and a self-assessment to some degree; their ability to conduct in-depth assessments is probably limited by their knowledge of underlying subordinate components of easily recognizable situational demands and of personal skills. Second, the results suggest that adolescents with LD can be taught to reflect upon their repertoire of experiences with strategies to aid in the generation of new ones. This supports Meichenbaum's (1982) notion that learners may be able to draw upon strategies in their repertoire that are similar to the academic strategy that is deficit. Third, some authors have stressed the importance for students to be able to make a plan and monitor its effectiveness (e.g., Brown, 1978), but students with production deficiencies (including students with LD) experience difficulty generating effective strategies (Flavell, 1980). The present study demonstrated that some students with LD can learn to generate effective strategies for some types of problem-solving situations. Fourth, studies have demonstrated that students with LD experience difficulty monitoring and assessing the factors in a problem that are relevant to problem solving (e.g., Havertape & Kass, 1978), while a related task that should be undertaken in successful problem-solving activities is the monitoring and modification of any self-generated strategy (Meichenbaum & Goodman, 1971; Nelson & Birkimer, 1978). The results of the present study suggest that some adolescents with LD can learn a substrategy for monitoring self-generated strategies. This finding is consistent with the findings of Lodicao, Ghatala, Levin, Pressley, and Bell (1983), who found that teaching students to self-monitor the utility of a strategy increased their ability to select the most appropriate strategy and to explain why the one selected is best.

Generalization of the results is limited to the extent that the sample of adolescents with LD in this study are comparable to the population with LD in general. It is noteworthy that all subjects in this study had a unique history of experiences associated with learning task-specific strategies (i.e., these students had experienced opportunities for the development of response sets to strategic thinking). In other words, the students' unique histories may have facilitated their acquisition of the executive strategy. Another limitation of this study relates to the fact that stable baselines were not obtained on the grades measure for some students due to practical reasons. Because of this limitation, grades measures were reported only as descriptive measures. In addition, due to space limitations, grades from each condition were reported as mean scores; thus the variance of actual weekly grades within a condition is not reflected in the data.

Additionally, since the study had to be terminated at the end of the school year, it is not known how long the effects might be maintained. A comparison of baseline data to posttraining data suggests that sharp grade increases occurred for many of the students following the targeted condition, but that some students displayed rapid decreases in grades following initial success. For those classes where gains did not occur, analysis of baseline data suggests that the intervention was not powerful enough to overcome a history of failure. Generally, students who had been performing in the D and F range in some classes continued to do so regardless of the intervention. The intervention appeared to have more positive effects in classes where baseline performance was in the C− or better range.

A number of factors should be considered when implementing instruction of the executive strategy. First, it is important for teachers to make the distinction between task-specific strategies and situation-specific strategies. Task-specific strategies are designed to address a specific set of critical features to a problem, regardless of the situation in which the critical features are found. For an example, studying for a test on how to close-out a cash register for a department store could have the same critical features as studying for a history test. A task-specific strategy can be designed to attack the general problem of studying for a test that would encompass both situations plus other, similar situations with relatively equal effectiveness. In contrast, a situation-specific strategy may include steps that are relevant only to one specific situation. Teachers should train students to generate task-specific rather than situation-specific strategies so that they can avoid addressing insignificant features of a problem and thus get off track, as well as avoiding the time and energy spent generating a strategy for every problematic situation they encounter.

Second, since many problems in the secondary school setting have similar features (i.e., with regard to memorizing information, the demands of science, history, and shop classes are very similar), it seems important to demonstrate to some students the utility of creating mini-strategies that address a core set of common critical features. As new situations arise that contain the same critical features, the mini-strategy can serve as a foundation for generation of a new strategy. In many cases, all that is required is the addition of a few steps to cover the critical feature(s) that the mini-strategy does not address.

Third, while some subgroups with LD may benefit from executive process instruction in lieu of, or prior to, instruction in task-specific strategies, this remains an empirical question. Since the executive strategy has been tested only with students with prior experience with task-specific strategies, teachers are encouraged to teach the executive strategy as part of a larger strategies curriculum rather than teaching it independently. Thus, the executive strategy can be effectively taught *after* students have mastered a few task-specific strategies. An advantage to this approach is that the executive strategy may be relatively easy to learn since response sets of strategic thinking may develop as students learn task-specific strategies. In addition, students will have been provided opportunities to experience the need for an executive strategy and to learn why some task-specific strategies do or do not work. Further, the present study suggests that those students who are maintaining satisfactory performance (e.g., grade of C− or better) will most likely reap the greatest benefits from executive process training. For students performing below this level, greater focus on learning and generalizing task-specific strategies might be more appropriate.

Finally, a teacher's history of experience in teaching strategies may affe the instruction. It is likely that the executive strategy requires a relatively hig level of sophistication on the te part to be able to teach it and provid feedback. Some teacher skills that appear to be related to successful instruction of the executive strategy that shoul be investigated are (a) familarity wit the cognitive processes involved wit strategic behavior, (b) knowledge of th limitations and rationale for teachin task-specific and executive strategies, (c ability to distinguish between task specific and situation-specific strategies (d) sensitivity to affective problems tha may hamper the effectiveness of th learning process, and (e) skill at teachin a strategy.

Research is needed in several areas t clarify the strength of the intervention First, it will be important to clarify th characteristics of those who can benefi from the intervention and those who wi not. For example, research is needed t clarify the role of prior experience i learning task-specific strategies. Additionally, it will be important to deter mine the relationship of a stud affective characteristics (i.e., locus control, motivation) to his or her success in learning the executive strategy especially since results of studies de signed to investigate attributional con sequences of self-instructional trainin have been inconclusive (Johnson, 198 Ryan et al., 1986; Short, 1981). Second research should be conducted to deter mine whether instruction in the strateg can be simplified. Students in this stud were taught to apply three substrategie independently and then to integrate th three substrategies into a superordinat strategy. It may be possible to simplif this instructional sequence, eliminat some of the instructional time require and still obtain the same results. Third future research should focus on the effectiveness of training the executiv strategy in groups of students and de termining the optimal size of thos groups. It may be that students wi learn more quickly if they can benef from one another's experiences as w as their own. Fourth, future resea should further address the strength o the intervention with regard to genera ization of the use of the strategy for targeted classes. Research is needed to determine what procedures are necessary to maintain students' use of the executive strategy and their improved grades. Finally, research is needed to assess students' generalization of the use of the executive strategy outside of the academic setting. It will be important to determine whether students can and will use the executive strategy to approach tasks in home, job, and community settings.

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NOTE

1. Stable baselines were attained for grades with most, but not all, students due to practical limitations associated with time constraints placed upon investigators by the school district and the school calendar.

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