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ABSTRACT

This study examined the effectiveness of PLAE (Preplan List, Activate, and Evaluate) in training students to have executive control over their learning strategies. Subjects, 56 at-risk students enrolled in four separate sections of an upper-level study strategies course at a major southern university, received intensive, direct instruction in either PLAE or more traditional time management techniques during a 5-week period. During a second 5-week period, subjects constructed study plans or time management schedules as part of preparation for content area exams. Results indicated that subjects trained in PLAE performed statistically better over the four content area exams than subjects trained in other techniques. Results also indicated that subjects trained in PLAE became statistically more aware metacognitively as indicated by both global and on-line predictions. (Four tables of data are included.) (RS)

The Effects of PLAE upon Students' Executive Control, Self-Regulation, and Test Performance

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The Effects of PLAE upon Students' Executive Control, Self-Regulation, and Test Performance

Past research has provided considerable information about the differences between efficient and inefficient readers and the characteristics of effective learning strategies. However, these studies have not fully addressed the more critical issue of training students to have executive control over these strategies in order to become independent learners (Weinstein, 1988). To become autonomous learners, students must be able to plan, implement, monitor, evaluate, and if needed, modify a plan of action with a variety of tasks and texts (Kluwe, 1987). Knowing that even college students often lack the ability to monitor and control their learning (Anderson & Armbruster, 1984; Maki & Berry, 1984; Pressley, Snyder, Levin, Murray, & Ghatala, 1987), we operationalized these executive control processes into a heuristic entitled PLAE [Preplan, List, Activate, and Evaluate] (Simpson & Nist, 1984).

Based on tetrahedral models of learning (Bransford, 1979; Jenkins, 1979), PLAE focuses on five student-directed operations necessary for strategy control and regulation. Students must (a) establish goals, allocate resources (i.e., select strategies, allot time), and make a plan of action that incorporates the appropriate strategies and distributes practice over time; (b) have a repertoire of strategies for the numerous tasks and texts they will encounter because there is no one superior or generic method of study; (c) select the most appropriate strategies based on the characteristics of text, task, and personal learning preferences: (d) activate and monitor a plan of action and make appropriate changes, when necessary; and (e) evaluate their plan's success or failure in order to plan for future situations.

PLAE is a recursive model that involves students in four stages of test preparation. In Stage 1, Preplanning, students find out information about the test and set performance goals by answering a series of questions. In Stage 2, Listing, students list the most appropriate strategies and construct a task-specific study plan that outlines their specific goal for each study session, the amount of time they predict it will take to reach their goal, and where/when they will study. In Stage 3, Activating, students implement and monitor the plan's effectiveness and make adjustments if their plans are not working. Stage 4, Evaluation, occurs after students have received their test scores. Students evaluate their performance by diagnosing errors and looking for patterns of strengths and weaknesses. This information is then used as they plan for subsequent exams.

Two previous studies have been conducted to validate PLAE's effectiveness. In the first study, the planning variable, as operationalized by PLAE, was found to be more predictive of and accounted for a greater amount of the variance in test performance than did encoding, rehearsal, or word knowledge (Nist, Simpson, Olejnik, & Mealey, 1989). A second study focused solely on the possible role PLAE might have in improving both test performance and metacognitive abilities. In this study we found that over a 5-week period, students' test scores, as well as both on-line and global metacognitive abilities, improved (Nist & Simpson, 1989). However, past research has yet to compare students who were trained to use PLAE with those who were trained to use more traditional methods of management such as scheduling and prioritizing. Thus, the present study sought to answer the following questions: (a) Would students trained to use PLAE perform significantly better on four content area exams than an alternative group trained to use traditional time management skills? (b) Would students trained to use PLAE significantly improve their abilities to globally predict test scores over an alternative group trained to use traditional time management skillls? (c) Would students trained to use PLAE significantly improve their abilities to engage in on-line predictions over an alternative group trained to use traditional time-management skills?

Method

Subjects

The subjects were 56 at-risk students (45% male; 90% Caucasian) enrolled in four separate sections of an upper-level study strategies course at a major southern university. Students were mandatorily enrolled in this course as a prerequisite to taking regular core courses. These students could decode words and comprehend brief passages as measured by their scores on a state mandated basic skill exam. However, they had difficulty understanding and remembering extended pieces of text as measured by departmental exam over a college-level psychology chapter excerpt. High school grade point averages and SATV scores were equivalent for both groups (PLAE, hsgpa= 2.54, SATV = 400; TM, hsgpa= 2.56, SATV= 407, $p < .01$ in both cases). In addition, they had a mean university predicted grade point average of 1.78 on a 4-point scale. Two sections were randomly assigned to the PLAE condition (PLAE, n = 26), and the other two sections served as the Time Management condition (TM, n = 29).

Procedures

In Phase I of the study, subjects in both groups received intensive, direct instruction on a variety of study strategies. (Each of the two researchers taught one PLAE and one TM group to control for teacher effects.) During this 5-week period, all subjects learned how to activate prior knowledge and survey, annotate text, and use a variety of recitation strategies. The overall training differed only in that the experimental groups received instruction on PLAE, and the alternative treatment groups received instruction on more traditional time management techniques. During Phase II of the study, the 5-week data collection period which followed Phase I, all subjects constructed study plans or time management schedules as part of their preparation for each of four full-length content area chapter exams.

PLAE group. The initial training took place over a 6-day period. On Day 1, the rationale for PLAE was discussed and procedures and examples of PLAE were provided. PLAE subjects were then assigned to construct a plan for the first exam and bring it to class the following day. On Day 2 the attributes of an effective plan were discussed and students met in pairs with a checklist which described plan strengths and weaknesses. On Days 3 and 4, plan monitoring and fix-up strategies were discussed. Subjects took the exam on the fifth day. On Day 6 all exams were returned so that subjects could diagnostically evaluate their performance. With the exception of discussing the PLAE model in great detail, this same cycle was followed for each of the remaining three exams.

Time Management group. The alternative treatment group also went through an initial 6-day training cycle that focused on time management principles. For each exam they constructed a weekly schedule and a daily "To Do" list. On Day 1, the rationale and steps for constructing schedules and lists were discussed. We distributed examples and assigned students to create schedules and lists for the following day. On Day 2 the attributes of effective schedules/lists were discussed and students met in pairs with a checklist to evaluate. As with PLAE subjects, the TM group spent days 3 and 4 in monitoring and fix-up strategies. On Day 5 they also took the exam. On Day 6, TM subjects were provided with the correct answer for each exam item and were permitted to ask questions on confusing items.

Data Collection

Four exams based on four full-length content area chapters from college level texts (communications, political science, biology, and psychology) were constructed, each containing 40-45 objective items and a balance of memory and higher-level questions. The reliabilities on the tests ranged from .68 to .87 and there were no statistically significant differences between mean item difficulties (.59, .64, .66, and .65 respectively, F = .871). Mean item difficulties were determined by computing the proportion of students getting each item correct and then averaging these proportions across each test.

For each test, all subjects engaged in two key tasks as ways to measure both global and on-line metacognition. First, as they took the exam, they predicted whether they thought they got each objective item correct or incorrect. Students were instructed to put a "1" if they were sure that it was correct and a "2" if they had reasonable doubt about the correctness of their answer. From these responses, the mean proportion of correct predictions (i.e., they predicted that they got the item correct and it was correct, or they predicted that they got the item incorrect and it was incorrect) was computed for each of the four exams for both groups. In addition, after completing each of the four tests, subjects also engaged in global predictions by predicting the overall grade they though they would receive.

Results

The results of this study indicated several significant findings. First, a repeated measures analysis revealed a main effect for group ($F_{1,\ 52} = 5.79$, $p < .0197$) and no interaction between test and group ($F_{3,156} = 1.11$, $p < .3481$). As shown by the mean scores (and standard deviations) in Table 1, PLAE subjects scored higher than TM subjects on all exams.

Insert Table 1 about here

Second, a Chi-square analysis indicated that statistically significant changes in favor of the PLAE condition occurred between T1 and T3 ($\chi^2 = 7.57$, $p < .01$), T1 and T4 ($\chi^2 = 16.149$, $p < .001$), T2 and T3 ($\chi^2 = 12.20$, $p < .001$), and T3 and T4 ($\chi^2 = 25.57$, $p < .001$) in subjects' ability to globally predict test scores. No statistical changes occurred between the groups on T1 versus T2 or T2 versus T3 ($\chi^2 = 1.63$ and 2.12 respectively).

Table 2 indicates the frequency of under, exact, and over global predictions for each test for the two groups. The Cochran's Q Test, used to determine if there were overall changes in subjects' abilities to globally predict their grades, was statistically significant, $\chi^2 = 7.81$, $p < .05$. Stewart's extension of McNemar's test (Stewart, 1955), used to determine the nature of these changes, indicated that subjects in the PLAE group changed from making overpredictions to making exact predictions by the time they took T4. Such change did not occur in the TM group. As shown in Table 3, the only significant change that occurred in TM was between T1 and T3 when there was an increase in overpredictions.

Insert Tables 2 and 3 about here

Means (and standard deviations) for mean on-line predictions are included in Table 4. There was a statistically significant interaction between group and on-line prediction, $F_{3, 153} = 7.46$, $p < .0002$. Simple effects for differences between groups at each level of on-line prediction indicated no statistical differences between the groups for T1 and T2 ($p < .634$ and .149, respectively). However, statistically significant differences, favoring the PLAE subjects, were found for T3 and T4 ($F = 9.50$, $p < .003$ and $F = 26.80$, $p < .0001$, respectively). These results indicated that abilities to predict on-line accurately were dependent on the test subjects took.

Insert Table 4 about here

Discussion and Conclusions

The results of this study indicated that subjects trained in PLAE performed statistically better over the four content area exams. It could be argued that the significance found in this study was a result of test order rather than an improvement in strategy control and regulation. However, the fact that there were no statistically significant differences in the mean item difficulty levels of the tests weakens this argument. In addition, scores for both groups on T1, the most difficult of the four tests (.59), were higher than were the scores for T2 and T3. Furthermore, T3 (.66), the easiest of the four tests, had the lowest scores for both groups.

The statistically significant difference between PLAE and TM over the four exams gains practical significance when examining the letter grade differential across the four tests. Specifically, for two of the exams (T1 and T4), the PLAE group received Bs, and the TM group received Cs. On T3 PLAE subjects received C grades, and the TM subjects received Ds. On T2 there was a half-grade difference between the two groups. At first glance one letter grade or one half-grade difference between the groups might seem inconsequential. However, when it is noted that these high risk students were predicted to perform at a 1.78 or D+ level in university course work, a half or whole grade beyond a D+ would make a difference between probation and staying in school. Given the fact that most college freshmen have not developed executive control over their independent learning, more opportunites for vertical transformations with PLAE would probably make these intial effects even more pronounced.

The results of this study also indicated that subjects trained in PLAE became statistically more aware metacognitively as indicated by both global and on-line predictions. It should be noted that these differences between the groups became more pronounced over time. As noted in Table 4, the PLAE Group increased their on-line predictive ability from 76% on the first exam to 85% on the fourth exam. However, the TM group declined in their ability from 77% on the first exam to 75% on the last exam.

In addition, the interaction between group and prediction indicated that the two groups predicted on-line with equal degrees of accuracy for the first two tests. But by the last two exams, those in the PLAE condition statistically improved metacognitively, while those in TM declined or remained stagnate. Hence, had this study ended after the first data collection point, the statistically significant differences favoring PLAE would not have been noted since both groups were initially equivalent in their abilities to predict their on-line performance.

Not only did PLAE subjects improve in their abilities to predict on-line, but they also statistically improved in their global predictions. It is interesting to note, however, that no dramatic change was evident for the PLAE group until T4, again indicating the importance of giving students sufficient time to learn to control and regulate new strategies.

PLAE may have facilitated metacognitive performances because subjects had to specifically define each of the four tasks, select appropriate strategies, construct a task-specific plan of action, monitor and evaluate that plan of action, thus encouraging strategy control and regulation. In contrast, TM subjects, with a knowledge of the same Phase I strategies, appeared not to be able to control, regulate, and monitor those strategies in an appropriate fashion to the four different tasks and texts. The TM subjects did not perform as well on the tests, nor did they grow in their abilities to metacognitively assess their global and on-line performances.

These findings have implications for research as well as for professionals helping students to become more autonomous learners. Long-term training seems particularly important when conducting research on at-risk students who need powerful interventions coupled with lengthy training across a variety of tasks and texts.

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Table 1

Mean Test Scores (and Standard Deviations) for PLAE and SM

	Tests			
	1	2	3	4
PLAE	80.88 (7.51)	75.88 (9.16)	71.00 (7.07)	85.77 (4.93)
SM	75.25 (9.16)	72.00 (14.82)	68.89 (8.36)	79.14 (8.99)

Table 2

Frequency of Under, Over, and Exact Global Predictions for PLAE and SM

	PLAE			SM		
	Under	Over	Exact	Under	Over	Exact
Test 1	3	12	11	2	15	12
Test 2	4	11	11	4	13	12
Test 3	3	19	4	9	12	8
Test 4	2	1	23	8	12	9

Table 3

Value of Contrasts for Global Predictions for PLAE and SM

	PLAE			SM		
	Under	Over	Exact	Under	Over	Exact
T1 w T2	.039	.423	.038	-.069	-.034	.103
T1 w T3	.000	.269	-.269	-.214	.107*	.107
T1 w T4	.077	-.500*	.423*	-.207	.138	.069
T2 w T3	.038	.269*	-.308*	.071	.143	-.072
T2 w T4	.077	-.500*	.423*	-.138	.172	-.034
T3 w T4	.039	-.769*	.730*	-.036	-.036	.071

Note: T = Test

* = Statistical significance, $p < .05$

Table 4

Mean Proportions of Correct On-Line Predictions (and Standard Deviations) for PLAE and SM

	Tests			
	1	2	3	4
PLAE	76.19 (8.00)	74.85 (8.43)	74.00 (5.24)	85.42 (4.64)
SM	77.10 (6.94)	70.86 (11.31)	69.29 (6.11)	74.26 (10.01)