Empowering At-Risk Students to Stay in School Using a Cognitive-Based Instructional System

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Introduction

As we move into a super-symbolic (Toffler & Toffler, 1995), internationalized and information-based economy, a well-educated workforce is becoming the key factor for maintaining our competitiveness as a nation. While workplace requirements are calling for employees with higher order skills, an alarming proportion of young Canadians are dropping out of secondary school before graduation. It is estimated that 18% of young Canadians are not completing secondary school (Human Resources and Labour Canada, 1993). The Steering Group on Prosperity (1992) notes that the alarmingly high dropout rate makes Canadians wonder whether they are being adequately prepared "for a world in which we must rely more on our brains than on brawn to innovate and compete" (p. 35). Employment

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and Immigration Canada indicates that 64.5% of all new jobs, which will be created between 1990 and the year 2000, will require a minimum of 12 years of education or training (Human Resources and Labour Canada, 1993).

High school dropout rates appear to have important implications for the Canadian society. The Conference Board of Canada (1992) estimates that the Canadian society will lose more than $4 billion over the lifetimes of the 137,000 students who dropped out of school in 1989. The Conference Board also estimates that each young male and female dropping out of school will respectively lose $129,000 and $107,000 over their working lives.

Closely associated with the high school dropout situation is the problem of illiteracy. Empirical evidence suggests that the basic literacy skills of high school dropouts are significantly lower than those of high school completers (Rock, Hilton, Pollack, Ekstrom, & Goerty, 1985). Estimates are that each year illiteracy costs the Canadian society and Canadian business $10 and $4 billion respectively. Results of a survey released by the Canadian Labour Market and Productivity Centre (1990) revealed that illiteracy was linked with low productivity (46%), poor product quality (42%), and increased training cost (42%).

This research project focused on the empowerment of students who were at risk of dropping out of school because they could not cope with the information-processing demand imposed upon them by school learning. They were empowered to succeed in school learning through cognitive skills augmentation and transfer training.

Conceptual Framework

Research indicates that students drop out of school for a variety of reasons (Hargroves, 1986). In this project, the primary interest was in students who were at risk of dropping out of school due to problems in coping with the information-processing demands prevalent in typical school learning situations. A recent report released by the Prosperity Secretariat (1992) notes that too often, programs developed to intervene and service “at-risk” youth focus on the symptoms rather than the basic causes of dropping out. The Prosperity Secretariat (1992) further notes: “research on dropouts shows that, while in school, they are the most severely mismatched student group in terms of the instructional and learning dynamics of the classroom” (p. 31). As a result, these “students feel anxious and direct their energies to dealing with stress and frustration rather than learning" (p. 31). In its recommendation to address high school dropout, The Prosperity Secretariat (1992) argued that the curriculum and the instructional approaches/strategies used (how students learn and teachers teach) should be revised and revitalized.

Individual differences among students regarding their preference for various modes of gaining, storing, processing, and using information constitute sources of considerable variation in learning (Witkin, Moore, Goodenough, & Cox, 1977). Some students are unable to accomplish tasks simply because they lack the necessary information-processing skills (Regan, Back, Stansell, Ausburn, Ausburn, Butter, Huckabay, & Burkett, 1979). Johnson (1992) indicated that schools are not helping students develop these important skills because schools are still too entrenched in the behavioral psychology foundations. Ertmer and Newby (1993) argued that the tendency to "de-emphasize a concern with overt, observable behavior and stress instead more complex cognitive processes such as thinking, problem-solving, language, concept formation and information processing" (p. 57) has resulted in a fundamental shift away from behaviorism to a growing interest in cognivitism. The authors noted that "cognitive theories stress the acquisition of knowledge and internal mental structures; they focus on the conceptualization of students' learning processes and address the issues of how information is received, organized, stored and retrieved by the mind" (p.58).

Cognitive-based research over the last 15 years has demonstrated that one of the most important factors contributing to achievement differences is the profile of cognitive skills that a student brings to academic tasks. (Letteri, 1992). Letteri further argued that in order to succeed, a student "must possess a repertoire of thinking skills that meet the cognitive demands of learning and performance tasks. Without appropriate cognitive skills, students can never be self-directed and independent in academic tasks" (p. 59). Cognitive-based research has validated the use of the Cognitive Profile Assessment Instrument (CPAI) to measure students' cognitive skills and to identify those who are at risk of failure in school learning (Letteri, 1992). The CPAI, assembled by Letteri, consists of seven bipolar measures of basic cognitive skills. These include:

Analytical/Global: This dimension marks a tendency of a student to either experience items as part of a background (global) or to overcome the influence of an embedded context and view items as separate from the background (analytic).

Focus/Non-Focus: This dimension describes an individual's extent and intensity of attention-deployment to a given task.

Reflective/Impulsive: This dimension marks the degree of consistency in the speed and accuracy with which an individual selects hypotheses and processes information relative to comparative analytical tasks.

Narrow/Broad: This dimension marks a student's consistent preference for the degree of inclusiveness in establishing the acceptable and appropriate range of specific category parameters.

Complex/Simple: This dimension describes individual differences in the variety of highly organized, distinct and highly specific categories by which information is structured in memory, as well as the ability to use this information to examine new information from a variety of relevant perspectives.

Sharpener/Leveller: This dimension describes reliable individual variations in the assimilation of information in memory.

Tolerant/Intolerant: This cognitive dimension represents the skills required to engage and examine apparently ambiguous information for the purpose of modifying existing structures of information and of accommodating new information within these related structures.

These seven cognitive skill dimensions have been found to determine and predict with high accuracy ($p < .05$ or better) students' levels of success in academic learning and performance tasks. Each dimension can be assessed separately and the results used to generate the student's cognitive profile. The CPAI sorts the student population into three large categories (Types I, II, and III), which are called Cognitive Profile Types (Letteri, 1985) as described below:

Type I Profile: These students show evidence of strength in a majority (four or more) of the seven cognitive skills. They are typically in the top 15-18% of the population in academic achievement (Letteri, 1992).

Type II Profile: These students do not demonstrate particular strengths or weaknesses in the controls included in the cognitive profile. They tend to be highly inconsistent and are usually of average (mediocre) academic achievement. Type II students comprise 60-70% of the population (Letteri, 1992).

Type III Profile: These students demonstrate a major deficit (4 or more) in terms of the cognitive skills as indicated by their cognitive profiles. These students typically present severe learning problems and are several grade levels below their placement grade in all areas of standardized testing. These students usually have long histories of failure and, as research indicates, no amount of assistance has been able to rectify the situation. Type III students represent 15-18% of the school population (Letteri, 1992).

The learning problems of the Type III student, as well as those of the Type II student, do not tend to be related to the difficulty or complexity of the subject matter. Rather, these problems relate to their lack of specific cognitive skills required by their assigned academic learning and performance tasks (Chinien, 1990; Letteri, 1988). The Cognitive-Based Instructional System (CBIS) can be used to help Type II and Type III students enhance their cognitive skills through augmentation and transfer training. Research conducted by Letteri (1985) indicates that placing Type II and III students in a Cognitive Augmentation program for a minimum of 20 hours is likely to have significant and long-lasting impact on grade level achievement. Although the cognitive empowerment of these students through the CBIS is manifested in improved academic performance, enhanced sense of competence, improved self images, and more positive attitudes toward school (Letteri, 1980, 1985), little is known regarding its potential contribution in preventing at-risk students from dropping out of school. Consequently, the following framing question provided the general orientation for the study: Can the CBIS assist at-risk students to stay in school by helping them enhance their cognitive skills, self-esteem, academic performance, and attitudes toward school?

Methods

Subjects

The target population for this study was junior-high school students who have been identified as potential dropouts. Four junior-high school sites were included in this demonstration project. In consultation with the school principals, a purposive sample of eight teachers (two from each site) and all their students in one intact class (for each teacher) were selected using the following criteria: (a) grade level, (b) significant number of at-risk students, (c) teacher willingness to participate, and (d) native language (English or French). Purposive sampling was used to ensure the participation of a sufficient number of at-risk students in the project and to meet the requirements of the funding agency. Three resource teachers (from three of the sites) were included in the project at the request of their school principals.

These project activities spanned the entire school year. All participating teachers received seven full days of training in the CBIS. Teachers were briefed on project goals, objectives, procedures, and anticipated outcomes. They were introduced to CBIS and trained to administer the CPAI and to analyze the results. They were also trained to use some basic augmentation and transfer strategies to modify students' cognitive profiles using the cognitive apprenticeship model (Collins, Brown, & Newman, 1987). The CBIS teachers also received on-site individualized training and coaching while they were working on the augmentation strategies with their students.

Instrumentation

The CPAI was used to assess the cognitive profiles of all 175 students. The CPAI is administered to students on an individual basis. The average administration time was approximately one hour per student. The CPAI consists of seven different sections, each designed to measure one of the seven cognitive skills, namely: analytical/global, focus/non-focus, reflective/impulsive, narrow/broad, complex/simple, sharpener/leveller, and tolerant/intolerant. Although these seven cognitive skills have been found to determine and predict with high accuracy a student's level of success in academic learning and performance tasks, the validity and reliability of the CPAI have not been assessed, because conventional methods used for establishing these indicators are not amenable to the nature of the instrument. The trustworthiness of the CPAI was established by asking teachers to use their knowledge of the students' academic achievement to classify them as Type I, II, or III. The students' cognitive profile type identified using the instrument was subsequently compared to the teachers' classification. The match was almost perfect in all cases.

A specifically assembled battery of standardized tests also was administered to all 175 students as a pretest. The following tests were included in this battery: (a) the Canadian Test of Basic Skills—forms 7 and 8, from Nelson Canada, (b) the Culture Free Self-Esteem test from Special Child Publications, (c) the School Attitude Measure from American Testronics, and (d) the Dropout Prediction Scale from The Ohio State University. These tests (CPAI and battery of standardized tests) were all administered at the beginning of the school year as pretests.

Students were classified as Type I, II, or III according to their performance on the CPAI. All Type III and extreme Type II students (N=45) were selected for the CBIS cognitive augmentation and transfer training. The 45 students selected for the CBIS training were assigned to the classroom teachers who were involved in the project. The average teacher-student ratio for the CBIS training was 4:1.

The same test battery also was administered to all students in the treatment group (n=45) as posttests. This study was funded as a demonstration project and, as such, there was no requirement for a formal control group. However, since the pretest scores were available on a large number of students, a nonequivalent control group was formed to provide the potential for making some comparative analyses. In order to reduce the posttest's administration time and costs, 27 students in the intact groups were selected to form a control group. These students were selected on the basis of their teachers' recommendation, cognitive profile (Type I, II, or III) and academic achievement. The posttests also were administered to this control group.

Treatment

Augmentation training. The treatment was administered to students on a one-on-one basis. Each student received an average of 20 hours of CBIS training during the school year. The teachers used CBIS basic augmentation strategies to modify the cognitive profile of their Types II and III students. The objective was to enable Types II and III students to perform as Type I on cognitive tasks. Students were given training and practice in the skills of monitoring, directing, and controlling their information processing system sequentially for each of the seven cognitive skills (analytical/global, focus/non-focus, reflective/impulsive, narrow/broad, complex/simple, sharpener/leveller, and tolerant/intolerant) using a workbook designed by Dr. Letteri. During the augmentation session, teachers used a think-aloud technique to monitor students' ability to manage and manipulate information, analyze content, identify problems, and determine what was required for successful problem-solving or task completion. The teachers also modeled each of the cognitive skills and coached the students to use these skills effectively.

Students first were given augmentation training for analysis since the first operation in dealing with new information is to segment the information into component parts for the purposes of identification and categorization. The augmentation training for analysis consisted essentially of segmenting geometric figures into parts in as many different ways as possible. For example, they were shown a circle that had been divided into four equal quadrants and then were asked to break the figure down into component parts. Subsequently they were asked to draw, name, and label these parts for separate identification.

Transfer training. Considerable evidence suggests that the transfer of skills across tasks is enhanced by the ability to monitor and control the conscious cognitive processes (Redding, 1990). Redding (1990) states that Dudley-Marling & Owston (1988) believe that "skill transfer is viable if the following conditions are met: (a) the trainee possesses the basic declarative knowledge common to both tasks, (b) the tasks are similar or analogical, (c) the trainee recognizes the similarities, and (d) the strategies and skills to be transferred are neither too specific nor too general" (p. 27).

The OECD Secretariat for the Centre for Educational Research and Innovation (1991) cites Perkins and Salomon (1988) and Perkins (1989) as having identified two distinct mechanisms for transfer: (a) low-road transfer, which depends on perceptual similarities, occurs as an automatic triggering of well-rehearsed schemata; and (b) high-road transfer, which involves abstract thinking and metacognitive management, is a deliberate mindful abstraction of a principle and its application in a different context. According to Perkins and Salomon (1988), demonstrating linkages, applications, and examples can facilitate low-road transfer; high-road transfer can be enhanced by pointing out principles, encouraging students to make generalizations, and by mediating the processes of abstraction and connection-making (cited by the OECD Secretariat for the Centre for Educational Research and Innovation, 1991).

Once the students have acquired a degree of comfort with specific cognitive skills, these guiding principles were used to assist them in transferring the newly acquired cognitive skills to various subject matter content. This was achieved by showing the students the relationship between the augmentation exercises and the cognitive skill requirement for academic tasks. Students also were coached to apply the augmented cognitive skill to complete academic tasks. Authentic materials such as homework and other assignments were used to increase the meaningfulness and effectiveness of the transfer process. In order to assist students to transfer the analytical skills acquired through the Circle Exercise (previously described) to mathematics, students were asked to translate the geometric figure into a series of basic calculation problems (addition, subtraction, multiplication, and division).

Results

Dropout Prediction

Students' potential for dropping out of school was assessed using the Dropout Prediction Scale. Figure 1 shows the pretest and posttest results of the dropout prediction for students included in the treatment (n=45) and control (n=27) groups. Results indicated that

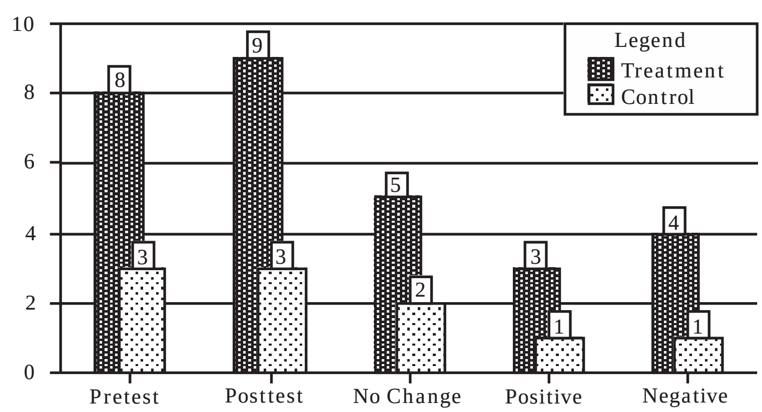

Figure 1. Dropout prediction for CBIS students.

eight students in the treatment group and three in the control groups met the cutoff level criterion to be identified as potential dropouts. The number of potential dropouts between the treatment and control groups did not change substantially on the posttest (nine and three respectively). Further analysis of pretest and posttest results indicated that the at-risk status of five of the eight students included in the treatment group was unaltered. While three students experienced a positive change, four others moved from a non-dropout prone to an at-risk status. Similarly, two of the students in the control group remained at risk from the pretest to the posttest; one moved from an at-risk status to that of a non-potential dropout. One student experienced a negative change.

Cognitive Profile

The cognitive profile for the treatment (N=45) and control groups (N=27) was assessed using Letteri's CPAI. Students were classified as Type I, II, or III according to their performance on the CPAI. Table 1 shows the frequency and percentage distribution of the treatment and control groups by Type I, II, or III on the pretest and posttest.

Table 1 also provides a comparison of the pretest and posttest results for cognitive profile type by treatment and control groups. It is noteworthy that while there was no Type I student in the treatment group on the pretest, 10 of these students scored as Type I on the posttest. This shift was accompanied by a reduction in Type II and Type III students (five in each case). Examination of the pretest and posttest distribution of the students in the control group reveals that there was an unexpected augmentation of nine Type I students in that group. There was also a decrease of nine in Type II students for the control group.

Table 1

Frequency and Percentage Distribution of Treatment and Control Group by Overall Type I, II, III on Pretest and Posttest

	Type I Pretest/Posttest				Type II Pretest/Posttest				Type III Pretest/Posttest			
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Treatment	0	0	10	22	33	73	28	62	12	27	7	16
Control	7	26	16	59	19	70	10	37	1	4	1	4

Table 2 provides a detailed breakdown of the distribution of the treatment and control groups by type, across the seven cognitive skills on the pretest and posttest. The overall pattern of the data showed an important gain in Type I students for both treatment and control groups from pretest to posttest. It is noteworthy that while a large percentage of students were classified as Type III on tolerant on the pretest, an important increase in the number of Type III students was observed on the posttest for both treatment (24%) and control groups (30%).

Although there was a significant gain in the number of Type I students among the treatment group on sharpener (29%), analytical (21%) and reflective (20%), there was little movement to Type II on focus (4%) and complex (4%). There were no positive gains on narrow and a loss of two Type I students on tolerant. The increase in Types I and II students within the treatment group was paralleled with an overall decrease in Type III students on all cognitive skills, with the exception of tolerant.

Results for the control group also indicated some augmentation in the number of Type I students from the pretest to the posttest on five of the cognitive skills. This relative increase in Type I students for the control group was surprising. (Note: During post-study teacher interviews, it was discovered that the cognitive skill augmentation was also being used with some control group students, although in an unsystematic manner). While the augmentation in Type I students was important for analytical (30%) and narrow (22%), it was somewhat more substantial for sharpener (37%). There was a moderate gain for focus (15%); little gain for reflective (7%), and no gain for tolerant. A drop in the number of Type III students also was observed from pretest to posttest. The cognitive profile data were analyzed to determine the nature of the overall cognitive profile changes as well as specific changes for each cognitive profile type, for the treatment and control groups. Slightly more than one-half of the students in the treatment group did not experience any change in cognitive profile, whereas 38% had some form of positive change (Table 3). Only three cases of negative change were recorded among these students. It is interesting to note that although the control group was not subjected to any form of treatment, 44% of the students recorded a positive change in a cognitive profile. A detailed breakdown of the nature of cognitive profile change by cognitive dimensions for the treatment and control group is provided in Table 4.

Table 2
Cognitive Profile Type by Seven Cognitive Dimensions for Treatment and Control Groups on Pretest and Posttest

Types	Groups	Analytical		Focus		Reflective		Narrow		Complex		Sharpener		Tolerance	
	Treatment	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
	Pretest	16	35	22	49	13	29	9	20	8	18	8	18	2	4
Type I	Posttest	25	56	24	53	22	49	9	20	10	22	21	47	0	0
	Control	f	%	f	%	f	%	f	%	f	%	f	%	f	%
	Pretest	15	55	21	78	14	52	2	8	9	33	10	37	1	4
	Posttest	23	85	25	93	16	59	8	30	5	19	20	74	1	4
	Treatment	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
	Pretest	25	56	12	27	10	22	20	44	17	38	22	49	12	27
Type II	Posttest	20	44	15	34	7	16	24	53	19	42	18	40	30	7
	Control	f	%	f	%	f	%	f	%	f	%	f	%	f	%
	Pretest	11	41	6	22	6	22	16	59	16	59	12	44	10	37
	Posttest	4	15	0	0	7	26	15	55	16	59	6	22	2	7
	Treatment	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
	Pretest	4	9	11	24	22	49	16	36	20	44	15	33	31	69
	Posttest	0	0	6	13	16	35	12	27	16	35	6	13	42	93
Type III	Control	f	%	f	%	f	%	f	%	f	%	f	%	f	%
	Pretest	1	4	0	0	7	26	9	33	2	8	5	19	16	59
	Posttest	0	0	2	7	4	15	4	15	6	22	1	4	24	89

Table 3
Nature of Overall Cognitive Profile Change by Treatment and Control Groups

	No Change		Positive Change		Negative Change	
	f	%	f	%	f	%
Treatment	25	55	17	38	3	7
Control	12	44	12	44	3	12

Table 4
Nature of Cognitive Profile Change by Cognitive Dimensions for Treatment and Control Group.

	No Change		Positive Change		Negative Change	
Complex	*f*	%	*f*	%	*f*	%
Treatment	24	53	14	31	7	16
Control	11	41	4	15	12	44
Analytical	*f*	%	*f*	%	*f*	%
Treatment	28	62	15	34	2	4
Control	17	63	9	33	1	4
Reflective	*f*	%	*f*	%	*f*	%
Treatment	24	53	15	34	6	13
Control	16	59	8	11	3	11
Sharpener	*f*	%	*f*	%	*f*	%
Treatment	11	24	26	58	8	18
Control	12	45	13	48	2	7
Focus	*f*	%	*f*	%	*f*	%
Treatment	25	56	11	20	9	24
Control	20	74	5	19	2	7
Narrow	*f*	%	*f*	%	*f*	%
Treatment	25	55	12	27	8	18
Control	12	44	12	44	3	12
Tolerant	*f*	%	*f*	%	*f*	%
Treatment	30	67	2	4	13	29
Control	14	52	3	11	10	37

In general, a large percentage of the treatment and control groups did not experience any change in cognitive profile, a moderate number demonstrated a positive change, and fewer showed a negative change. The greatest gain for both treatment and control groups was on sharpener. The treatment group showed substantial gains on four of the cognitive skills (complex, analytical, reflective, and narrow), while very little gain was observed on tolerance. The positive and negative changes among the control group were unexpected. Finally, analysis of the nature of change by overall cognitive profile type for the treatment group revealed that 46% experienced no change. Data indicated that 38% of the treatment group experienced a positive change in overall cognitive profile type, 20% moved from Type II to I; 2% moved from Type III to I; and 16% moved from Type III to II. Seven percent experienced a negative change, moving from Type II to III (Table 5). Results also indicated that 44% of the

Table 5
Nature of Change by Cognitive Profile Type for Treatment and Control Group (%)

	No Change			Positive change			Negative Change	
Type	I	II	III	II to I	III to I	III to II	I to II	II to III
Treatment	0	46	9	20	2	16	0	7
Control	15	26	4	44	0	0	11	0

control group students moved from Type II to I and 11% experienced a negative change moving from Type I to II.

Self-Esteem

The Culture Free Self-Esteem Test was administered to the treatment and control groups. This test includes five scales, namely: (a) general, (b) social, (c) academic, (d) parental, and (e) overall. The repeated measures ANOVA was used for analyzing the self-esteem data. Results for all five scales indicated no significant difference between the treatment and control groups on the pretest and posttest ($p < .05$). There was no significant interaction between group and time and no significant difference across time for the treatment group ($p < .05$). However, a significant difference ($p < .05$)

was found for the control group between pretest (mean = 3.44) and posttest (mean = 3.84) on the social scale.

School Attitude Measure

The School Attitude Measure (Level I/J), was administered to the treatment and control groups. This test includes five scales, namely: (a) motivation for school; (b) self-concept, performance-based; (c) self-concept, reference-based; (d) sense of control over performance; and (e) instructional mastery. A repeated measures ANOVA was used for analyzing the School Attitude Measure. Results for all five scales indicated no significant difference between the treatment and control groups on the pretest and posttest ($p < .05$). There was no significant interaction between group and time and no significant difference across time for the treatment groups ($p < .05$). Results for instructional mastery indicated a significant difference between treatment and control groups ($p < .05$). While in each case, there was no significant interaction between group and time, the difference in pretest (treatment, mean = 40.93 and control, mean = 44.42) and posttest (treatment, mean = 38.81 and control, mean = 42.52) was significant, irrespective of the group ($p < .05$). No significant difference across time was found between the treatment and control groups ($p < .05$).

Canadian Test of Basic Skills (CTBS) - Math Scores

The repeated measures ANOVA, used for analyzing the CTBS raw scores in math, showed a significant difference in performance between the treatment and control groups ($p < .05$). There was also a significant interaction between group and time ($p < .05$). While the difference in performance from pretest (mean = 20.03) to posttest (mean = 24.68) for the control group was significant, there was no significant difference ($p < .05$) in the treatment group from pretest (mean = 14.44) to posttest (mean = 15.62).

Canadian Test of Basic Skills (CTBS) - Reading Scores

The repeated measures ANOVA, used for analyzing the CTBS raw scores in reading, indicated a significant difference in performance between the treatment and control groups ($p < .05$). There was also a significant interaction between group and time ($p < .05$). Analysis of the pretest results showed a significant difference ($p < .05$) between the treatment (mean = 19.61) and control (mean = 25.52) groups. A significant difference ($p < .05$) was also found between the treatment (mean = 21.77) and control (mean = 31.62) groups on the posttest. The difference in performance from pretest to posttest was significant ($p < .05$) for both the treatment and control groups.

Follow-up of CBIS Students

The underlying assumption of this project was that many students drop out of school because they are unable to cope with the information-processing demands inherent in school learning. It was further assumed that if these students are empowered with enhanced learning skills, school learning would become a rewarding experience and they would be likely to stay in school. A follow-up study was, therefore, conducted two and one half years after the initial project implementation. The purpose was to provide additional evidence regarding the effectiveness of the CBIS as a dropout prevention strategy. All four schools involved in the CBIS project were surveyed in order to determine the status of the CBIS students. Three out of the four schools responded to the follow-up survey. Therefore, data were available for 30 out of the 44 CBIS students. Only 3 out of these 30 (9.9%) at-risk students had dropped out of school. One of these students had been required to withdraw because of irregular attendance, although he was performing well academically and socially. The other two students had behavioral problems and one of them had encountered problems with the law. Further analysis of the school survey indicates that nearly all of the other 27 CBIS students were doing well academically and only four were experiencing some difficulties with their school work. The majority of these students was demonstrating a positive attitude toward school and was not experiencing significant behavioral problems.

Discussion

The purpose of this study was to determine if the CBIS can assist at-risk students to stay in school by helping them enhance their cognitive skills, self-esteem, academic performance, and attitudes toward school. Results showed that 38% of the treatment group students experienced a positive cognitive skills change and that a net gain of 10 Type I students occurred among that group. Twenty percent of students in the treatment group moved from Type II to I, 2% moved from Type III to I, and 16% moved from Type III to II. These results support the contention that cognitive skills are modifiable through augmentation and transfer training. This positive result is diminished somewhat by the significant number of students who registered no overall change in profile designation.

Contrary to previous studies, results of this study did not support the claim that cognitive augmentation and transfer training can significantly improve self-esteem, attitudes toward school, and mathematics and reading scores on standardized tests. These results could have been anticipated, given the magnitude of the registered improvement in cognitive profile type. The lack of significant difference may suggest that the instruments used in this study were not sufficiently sensitive to detect small but important changes. Although no significant differences were found in academic performance, further analyses of the data indicated that many students experienced a positive change in mathematics (57%) and reading (73%). This absence of significant differences in academic performance cannot be attributed exclusively to a lack of effectiveness of the augmentation and transfer strategies. Post-debriefing interviews indicate that many teachers believed that they needed more training and practice in cognitive-based learning in order to be able to fully implement the program. Many teachers also reported that they did not have sufficient time to cover the augmentation and transfer training for all seven cognitive skills.

Results of this study showed a discrepancy between the dropout prediction test and teachers' perceptions of students who are at-risk of dropping out of school. While all of the 44 students involved in the treatment group were identified as at-risk of dropping out by their respective teachers, only 8 of these students met the cutoff level criterion on the dropout prediction scale. This finding suggests that, in attempting to identify at-risk students, one should triangulate indicators from various sources, including teachers' reports.

Although all the CBIS students were pretested and classified as Type I, II, or III on each of the seven cognitive skills prior to the intervention, this information was not used to determine their needs for cognitive augmentation. In order to be classified as Type I, a student also had to be classified as Type I in at least four out of the seven cognitive skills. Since students were subjected to augmentation and transfer training, irrespective of their specific cognitive skills type, many students, who were already Type I on some cognitive skills spent time attempting to improve their abilities on these dimensions. The validity of this approach must be questioned seriously given that time appears to be a scarce commodity and a relatively important issue for the CBIS program. Given that the potential for improving the ability of a student who is already a Type I on a specific cognitive skill is limited, augmentation and transfer strategies should focus on deficiencies in cognitive skills where the potential for improvement is greatest.

Results showed marked differences in cognitive skills change from pretest to posttest. While there was an important gain in the number of Type I students, sharpener (29%), analytical (21%), and reflective (20%), there was little movement to Type I on focus (4%) and complex (4%), and no positive gains on narrow and tolerant. Examination of overall change in cognitive skill performance also confirmed greater positive change in sharpener, analytical, and reflective (in descending order). These results may suggest that some cognitive skills have a greater potential for improvement. Consequently, in attempting to help Types II and III students to move to a Type I profile, the augmentation and transfer training should focus on the cognitive skills having the highest potential for improvement. Based on the results of this study, it appears that the cognitive skills *sharpener*, *analytical*, and *reflective* are more amenable to significant change. This finding has important implications for the cost-effectiveness of CBIS intervention. However, it should be interpreted with caution because it does not take into account the time-on-task factor, the amount of training time spent on individual cognitive skills, and the level of teachers' proficiency in cognitive-based learning.

While none of the treatment group students were classified as Type I on the pretest, 35% of these students had a Type I profile for the cognitive skill of *analytical* on the pretest. This finding is of significance given that 35% of performance in school work can be explained by well-developed analytical skills. Moreover, many of these students had highly developed focusing (49%) and reflective (29%) skills as measured by the pretest. Although CBIS teachers spent most of the training time on the augmentation of analytical and focusing skills, the movement to Type I was only 21% on analytical and 4% on focusing. This finding raised important questions regarding the implementation of the CBIS program:

1. Are all the cognitive skills of equal importance for academic performance?

2. Is the relative importance of the seven cognitive skills subject-matter specific?

3. In what order should the augmentation and transfer of the seven cognitive skills be carried out?

4. Are some of the cognitive skills more difficult to modify than others?

Although results of this study indicate that the cognitive skill of *tolerant* is less amenable to change, teachers' reports suggest that tolerance of ambiguity is the most important cognitive skill required to succeed in school learning. The teachers also recommended that the CBIS program should begin with the enhancement of the cognitive skill of tolerant.

The CBIS training had considerable impact on most teachers' teaching strategies as well as students' learning strategies. During the debriefing interviews, nine teachers indicated that they had changed their teaching strategies as a result of their participation in the CBIS training. They all felt that they were better prepared to meet the demands of their students and were much more conscious of the way they present materials. "It made me look at different ways of how we study and learn," observed one teacher. Two teachers stated that they are not taking teaching and learning for granted the way they used to do. "You can't assume kids have a certain knowledge. I teach more carefully, more systematically and I go at a pace that is reasonable and sensible. I now engineer for the cognitive skills and I do a cognitive analysis before I develop content." Two other teachers felt that the CBIS has given them a new window on the learning situation or, as one put it, "I look at the task students are asked to do and then I break down the curriculum in such a way that they'll understand." One teacher admitted that, before his participation in the CBIS project, he was short on knowledge of how children learn. To cap it all, one teacher summarized the experience by indicating that "I will never be able to teach the same way again...never before have I felt so sure that some of the decisions I am making are sound and valid, and with all my educational training I was never, before this time in my career, able to say that with as much confidence."

Seven teachers indicated that they have observed positive changes in their students' learning strategies. "They have learned to tackle problems one step at a time and they have cut down on their natural impulsivity," observed one teacher. "They ask for help now instead of giving up right away," said another teacher. A third teacher noted that his students now worked more sequentially and two other teachers stated that their students made more use of analysis. These positive results are reflected in students' comments such as these: "it helped me learned better;" "difficult subject, like math, became easier;" "it helped, because I broke the work up in fragments;" "before I could not care less, I felt unwanted. After this I am tempted to work;" "I was told I am stupid. The group told me I was smart;" and "the project made things a lot easier. I am feeling like a new man." Perhaps one student best summarized the dilemma of the human conditions which necessitates projects like CBIS and all the works it involves by asking, "Why are we not all born smart"?

These results suggest that the CBIS has some important implications for the teaching of at-risk students. However, the implementation of the CBIS will require a fundamental shift from a heavy dependence on the behavioral paradigm to a gradual adherence to a cognitivist paradigm. Such a shift will require significant shifts in teachers' philosophies and beliefs about teaching and learning. Unlike the behavioral paradigm, the CBIS model not only focuses on teaching content, but it also assists students in learning how to learn this content. The CBIS has the potential for empowering at-risk students to cope with the information-processing demands imposed upon them by school learning.

All of the CBIS teachers felt that they were not prepared adequately to work with at-risk students. Most believed that they were not empowered to work with students who were experiencing information-processing difficulties. This suggests that teacher education institutions should include cognitive-based learning therapy as well as learning how to learn as part of undergraduate teacher education programs.

Many students from the control group experienced some positive gain in cognitive profile type. While this result was unexpected, debriefing reports indicated that the teachers also were applying CBIS principles in their classrooms. This finding suggests that CBIS training may be employed as a large group intervention. Given the psychological, sociological, and financial implications of this finding, additional research is warranted.

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