The Roles of Goal Setting and Self-Monitoring in Students'

Self-Regulated Engagement in Tasks

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Running Head: Goal Setting and Self-Monitoring in Self-Regulated Learning

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Recent characterizations of effective learners suggest that they are self-regulating. Unlike their less proficient counterparts, self-regulated learners actively analyze the tasks that are presented to them, set productive goals, select strategies to achieve their objectives, monitor their progress in relation to task criteria, and adaptively adjust strategic approaches to foster success (Butler & Winne, 1995; Zimmerman, 1989; 1994). A challenge is therefore presented to educators interested in promoting effective learning, particularly by students with learning difficulties. This challenge centers on how to structure instruction optimally so as to promote students' development of self-regulated approaches to tasks.

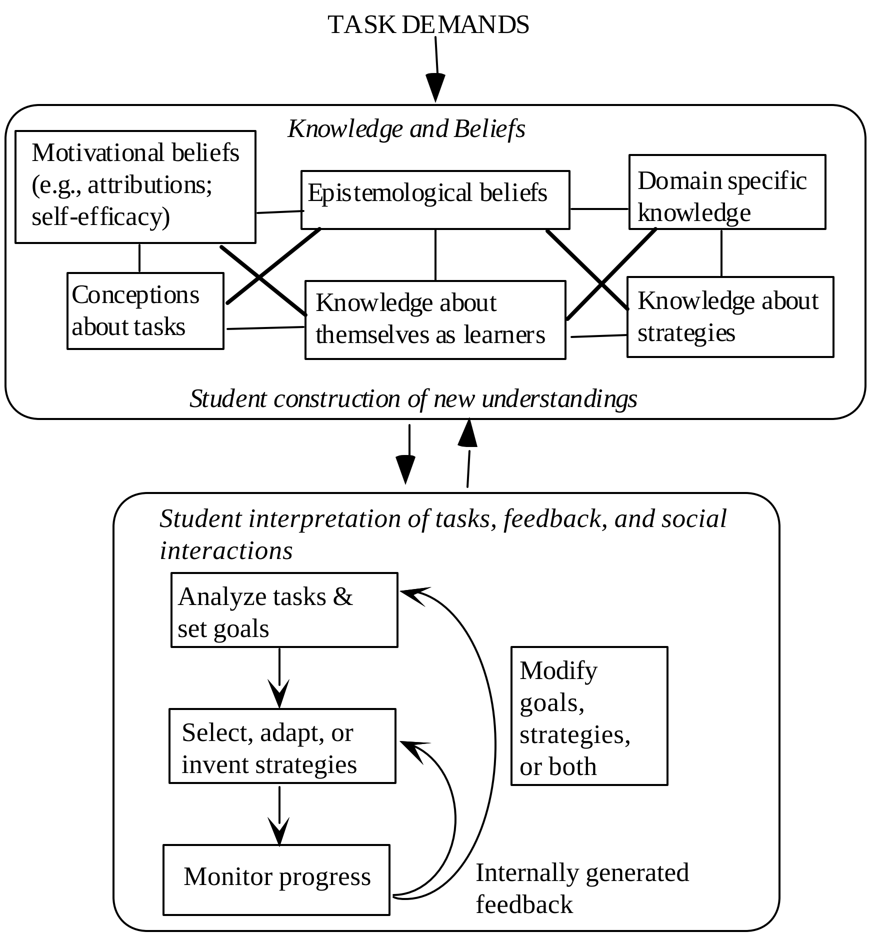
This paper describes research evaluating one intervention model designed to promote self-regulated learning by post-secondary students with learning disabilities, the Strategic Content Learning (SCL) approach. Discussion begins with a theoretical analysis of self-regulated learning. Specific attention is paid to clarifying the interactions between goal setting, self-monitoring, self-evaluation and other strategic activities (e.g., strategy selection and use). Subsequently, the SCL instructional method is described, as are the ways in which goal setting and self-monitoring are fostered as part of that approach. Next, results from four studies on SCL efficacy are reviewed. These findings reveal consistent improvements in participants' task performance; metacognitive understandings about tasks, strategies, and the process of monitoring; perceptions of self-efficacy; attributional patterns; and adoption of strategic approaches to tasks. Finally, implications for theory and practice are described.

A Simplified Model of Self-Regulated Learning

To assist in clarifying the complex interrelationships between students' knowledge, beliefs, and strategic approaches to tasks, a simplified model of self-regulated learning is presented in Figure 1 (Butler, 1996; Butler & Winne, 1995; Carver & Scheier, 1990; Corno, 1986; 1993; Zimmerman, 1989; 1994). To begin, when faced with an academic task, self-regulated learners actively analyze task demands to clarify requirements for learning. This task analysis is critical for several reasons. First, when students analyze task requirements they interpret their purposes for learning (e.g., to memorize details in a text; to read for main ideas). Students then base their choice of strategic approaches on their perceptions of task requirements (Butler & Winne, 1995; Wong, 1985). Second, perceived task demands determine the criteria students set for monitoring their performance. These criteria are used to judge both progress towards desired outcomes and the utility of task approach strategies. Finally, students' perceptions of task requirements interact with motivational beliefs, particularly perceptions of self-efficacy, to determine the goals that are set. Ideally, this interaction will lead students to adopt productive learning goals (Dweck, 1986), if they identify task demands that they feel competent to reach. However, if students lack confidence (i.e., low perceptions of self-efficacy; Bandura, 1993), and they lack effective motivation control strategies (Corno, 1986), they may focus on performance goals rather than learning goals (Dweck, 1986), or even abandon the task.

Students' perceptions of task requirements are influenced by numerous interacting factors, including the clarity of task descriptions (i.e., presented instructions or directions; Wong, 1985), the strategies they utilize for interpreting task demands, their previous conceptions about tasks (Baker & Brown, 1984), and whether or not they even recognize that task analysis is something that they should undertake (Butler, 1994). For example, young students with learning disabilities often interpret reading tasks as requiring decoding words, rather than reading for meaning (Baker & Brown, 1984). These students then adopt strategies matched to that purpose (i.e., reading words one by one rather than constructing an understanding across words) and judge the success of their efforts in those terms (i.e., that they can say every word rather than pull out main ideas). Similarly, students' analysis of specific task requirements (i.e., for a given writing assignment) is jeopardized if they lack effective strategies for interpreting assignment directions. In response to these problems, intervention researchers currently assist students to construct adequate metacognitive understandings about tasks (e.g., Paris & Byrnes, 1989). Investigators have also taught students to use self-instructions to remind themselves to decipher task requirements (e.g., Harris & Graham, 1996).

Figure 1. A simplified model of self-regulated learning.



Once task requirements are determined, self-regulated learners select, adapt, or even invent strategic approaches to meet established goals. In some cases, students' selection and implementation of strategies may proceed without conscious deliberation, particularly when tasks are familiar and strategy use is relatively automatized. Often, however, the tasks students encounter are not entirely familiar; they vary in some important respect from tasks encountered previously (e.g., complexity of content, type of writing required). It is in these cases, when learners are presented with task variants, that *strategic* learning is required (Borkowski, 1992; Brown, 1980; Butler, 1995). In these cases, students must flexibly and deliberately adapt familiar strategies to meet fluctuating task demands.

Effective self-regulation thus requires coordinating strategy use in light of perceived task requirements (Wong, 1985; 1991-b). This point is reminiscent of Resnick and Glaser's (1976) characterization of steps in problem solving. In their model, effective problem solving requires both searching for strategies (or pieces of strategies) that might solve a given problem *and* rethinking or reframing the problem as necessary to aid in the search for strategies. This description of adaptive problem solving has three important implications: (1) self-regulated learners have knowledge of a range of strategies or heuristics that they might select or adapt and of when, where, and why those strategies might be useful (Borkowski, Carr, & Pressley, 1987); (2) effective strategy implementation requires learners to engage recursively in cycles of strategy identification and task analysis; and (3) supporting strategic processing requires assisting students to coordinate task analysis activities with strategy selection, implementation, and evaluation.

Central to self-regulated learning is self-monitoring. Students self-monitor when they reflect on various aspects of their performance and generate internal feedback regarding progress (Butler & Winne, 1995). Students can self-evaluate numerous aspects of their performance. For example, students may compare outcomes (cognitive or behavioural) against established learning goals (Butler & Winne, 1995). Or, students might focus attention on evaluating learning activities, for example, by judging the efficacy of a particular strategy or whether *rates* of learning are satisfactory (Carver & Scheier, 1990). Learners may also self-evaluate progress in relation to a variety of goals. For example, students who set learning goals may monitor the relationship between outcomes and task requirements. In contrast, students who set performance goals will evaluate success by whether they have successfully looked competent to others. Students who set goals to master particular learning activities (e.g., how to use a writing strategy) may self-evaluate achieved mastery of a targeted strategy (Kitsantas, 1997; Schunk & Swartz, 1992).

Based on their perceptions of progress, self-regulated learners make deliberate decisions about how to proceed. In cases where students perceive satisfactory progress, feelings of competence may be strengthened (Schunk, 1997) and current task approach strategies may be evaluated positively. In contrast, when faced with unsatisfactory progress, students' perceptions of self-competence may be threatened and they must decide how to revise activities to foster greater success. Ideally, students will attribute their lack of success to factors within their control (i.e., choice of strategies or inefficient strategy use) and will adaptively modify learning activities to redress problems perceived (Schunk, 1997). However, if students do not feel efficacious or attribute a lack of success to uncontrollable factors (e.g., low ability), they are less likely to persist in the task (Bandura, 1993). In sum, during self-monitoring students self-evaluate various aspects of performance to generate internal feedback regarding progress. Those judgments interact with extant knowledge and beliefs, such as perceptions of self-efficacy and attributions for performance, to shape further decisions about how to proceed. In this respect, self-monitoring can be described as the "the hub of self-regulated task engagement" (Butler & Winne, 1995, p. 275). Decisions made during self-monitoring drive subsequent learning activities, acting as pivots around which successive cycles of self-regulated processing turn.

This description of self-monitoring highlights the interdependence between task analysis, goal setting, self-evaluation, and students' extant knowledge and beliefs. For example, accurate task analysis is critical if students are to self-evaluate performance in relation to acceptable performance criteria (Butler & Winne, 1995). As Brown (1978) suggested in an early discussion of metacognition, "it is not that young children are bad and adults good at checking the adequacy of their performance, but that inadequate checking will be manifested at any age if the subject does not fully comprehend the nature of the task (p. 104)". Further, during monitoring, students focus attention on the goals they have established (e.g., to master material, to look good to others, to master a strategy); those goals set the criteria against which progress is judged. In addition, not only do goal setting and task analysis influence self-evaluation, but, in turn, students' perceptions of progress shape modifications to goals and strategy use. Finally, students' extant knowledge and beliefs influence decisions made during self-monitoring. Yet students' self-evaluations also lead to revisions of knowledge and beliefs (e.g., about the efficacy of a particular strategy; about their own self-competence). Then, these revised understandings are influential in shaping further self-regulated processing.

Thus, promoting self-regulation is a complex endeavor. It requires supporting students to flexibly and recursively engage component activities (e.g., analyzing tasks, setting goals, learning strategies, self-evaluating, self-monitoring) while working through meaningful tasks. It also requires promoting students' construction of a range of knowledge and beliefs (e.g., conceptions about tasks, knowledge about strategies, attributions, perceptions of self-efficacy) that support effective self-regulation (Borkowski & Muthukrishna, 1992; Paris & Byrnes, 1989).

The SCL Intervention Approach

During the 1980's, instructional approaches were designed to teach students to use learning strategies. Researchers often started by observing the strategies used by effective learners, outlining the strategies as a series of steps, and then teaching those strategies to less proficient students, primarily through direct instruction (e.g., Pressley, Snyder, & Carglia-Bull, 1987). These approaches to promoting strategic performance were generally judged to be effective, when success was measured in terms of increased task performance and/or specific strategy mastery. However, researchers quickly recognized that instruction about strategies alone often failed to promote *independent* strategic performance, as evidenced by the infrequency of maintenance and transfer effects (Brown, Campione, & Day, 1981; Pressley et al., 1995; Wong, 1991-a).

Attention in the past decade has focused on identifying multicomponential instructional approaches designed to promote maintenance and transfer more effectively (e.g., Borkowski & Muthukrishna, 1992; Ellis, 1993; 1994; Harris & Graham, 1996; Pressley et al., 1995; Pressley et al., 1992). For example, some researchers incorporate instructional components targeted at revising students' attributional beliefs or perceptions of self-efficacy (e.g., Groteluschen, Borkowski, & Hale, 1990; Reid & Borkowski, 1987; Schunk & Cox, 1986). Other researchers argue for adding explicit instruction in self-questioning to promote self-regulated performance (Brown, 1978; Flavell, 1976; Sawyer, Graham, & Harris, 1992; Wong, 1985; 1991-b) so that students learn to ask themselves questions (either instructor or student generated) that cue task analysis (i.e., "what am I supposed to do here?"), strategy use (i.e., "what should I do?"), monitoring (i.e., "how am I doing?"), self-evaluation (i.e., self-recording of specific outcomes), and/or self-reinforcement (i.e., giving oneself a "pat on the back") (Harris & Graham, 1996; Wong, 1985). The key role of social interaction in promoting self-regulation also has been emphasized (e.g., Brown, 1980; Palincsar & Brown, 1984; 1988; Pressley et al., 1992; Stone, in press; Vygotsky, 1978). Therefore, scaffolded support is provided to students as they implement strategic approaches in the context of meaningful tasks, and students are encouraged to internalize the self-regulated processing supported and/or modeled by others (so that they move from other- to self-regulation). Researchers have also stressed students' active role in interpreting social feedback (Butler & Winne, 1995) and in constructing knowledge and beliefs based on multiple experiences with tasks (e.g., Harris & Pressley, 1991; 1994; Paris & Byrnes, 1989). Interactive discussions about strategic processing (e.g., Strategic Analysis Activities; Ellis, 1993) are thought to promote students' construction of knowledge and beliefs that support, rather than undermine, self-regulation (Borkowski & Muthukrishna, 1992).

The Strategic Content Learning (SCL) model was developed based on a thorough review of strategy intervention research in tandem with theoretical reviews of self-regulation and of mechanisms associated with transfer. Consistent with other instructional models (e.g., Harris & Graham, 1996), SCL aims to teach students to engage recursively in the full set of activities central to self-regulation. This is accomplished by providing student with calibrated (or "scaffolded") support as they self-regulate their engagement in tasks. Also consistent with other emerging strategy training models, in SCL instruction is provided via interactive dialogues in the context of meaningful work. These interactive discussions focus on all aspects of performance: cognitive, metacognitive, and motivational. Further, by focusing discussion on a range of self-regulating activities (i.e., task analysis, goal setting, strategy selection, self-evaluation, and self-monitoring), students are supported to construct knowledge and beliefs (about tasks, strategies, self-efficacy, attributions, themselves as learners, the process of learning, etc.) that promote successful interactions with tasks.

At the same time, SCL differs from many instructional models in that explicit instruction about pre-defined strategies (or self-instructional statements) is not directly provided. Instead, instructors use comments or questions to guide students' processing as they struggle to build strategies for themselves. These comments or questions push students to examine presuppositions and/or support students' judgments at key decision making points (e.g., when figuring out performance criteria, when setting goals, when identifying or selecting strategy options, when self-evaluating progress, when adjusting approaches to tasks). Consistent with descriptions of "dialectical constructivism" (Harris & Pressley, 1994; Mercer, Lane, Jordan, Allsopp, & Eisele, 1996), in SCL instructors rely "more on scaffolding and guiding or prompting than on explicit modeling or discovery alone" (Harris & Pressley, 1994, p. 1). Further, like most current intervention models (e.g., Harris & Graham, 1996; Pressley et al., 1992), the SCL model is designed to capitalize on the interplay between social (i.e., interactive discussions and scaffolded support) and individual (i.e., sense making and knowledge construction) influences on students' development of self-regulated approaches to academic tasks (Butler, in press-a; Butler, in press-b).

SCL Instruction: An Overview

In this section, SCL instructional activities are outlined with a particular focus on strategies for supporting task analysis, goal setting, self-evaluation, and self-monitoring. In the studies completed so far, SCL has been implemented as an individual tutoring model for adult students with learning disabilities (LD's). Therefore, the description that follows explains how SCL instructional principles were adapted for use in that context.

At the postsecondary level, students generally bring to support services pressing problems drawn from their actual coursework. Thus, to provide support as realistically as possible, SCL participants selected the tasks they would work on (typically variants of reading, writing, studying, and math tasks). At each meeting, students priorized assignments based on requirements of actual courses, and SCL tutors provided calibrated assistance as students self-regulated completion of those tasks. Instructors generally met with each student two to three times per week (for two to four hours per week) over the course of a single semester.

During each SCL session, support was provided via interactive discussions focused alternately on completing the targeted task (e.g., brainstorming ideas for a writing assignment) and on the process of learning (e.g., the benefits of brainstorming ideas in the writing process). To promote discussion about knowledge, beliefs, and self-regulated learning activities, instructors responsively cued students' shifts between these cognitive and metacognitive levels of analysis. Further, during each session, both process and outcome goals were continually in focus. On the one hand, students and instructors were sensitive to the demands of students' coursework, so that learning goals were emphasized. On the other hand, it was made clear from the first intervention that a primary goal was for students to develop strategies that would help them, not only immediately, but also when facing similar tasks in the future. Students were continually asked to articulate emerging understandings about all facets of learning that would help them on subsequent tasks.

For each selected assignment, instructors began by supporting students to analyze the task, articulate performance criteria, and set specific goals. At this (and every other) stage of the process, support was calibrated and targeted at individuals' needs. For example, if students initiated learning activities without considering the requirements of the task, the instructor asked questions or made comments that cued task analysis (e.g., by asking how the student would judge the quality of his or her work; by suggesting that the student interpret instructions on an assignment sheet). If a student held misconceptions about tasks that interfered with identifying realistic performance criteria, the instructor supported the student to scrutinize task descriptions or assignment exemplars to abstract more accurate conceptions of tasks. In some cases instructors assisted students to develop strategies for deciphering task requirements (e.g., for interpreting assignment descriptions).

Next, instructors supported students to select, adapt, or invent strategies based on task requirements. In early sessions, students were encouraged to try out familiar approaches, to monitor their effectiveness, and to maintain or revise them as required. As a result, in the majority of cases, students developed new strategies that were founded on approaches they already knew. In cases where students offered no initial ideas, or when familiar strategies were clearly inadequate, students and instructors worked together to brainstorm and evaluate alternatives (based on task criteria). In these discussions, instructors sometimes contributed suggestions. However, it was always the students' responsibility to evaluate alternatives and to make final decisions about which strategies to select. Whenever students decided on a strategy to try (familiar, revised, or new), they were asked to articulate strategy components in their own words. Strategy descriptions were transcribed verbatim, to facilitate implementation, evaluation, and modification of students' developing approaches.

Once students decided on a strategic alternative, they were supported to implement the strategies and to monitor the success of their efforts. Instructors started by observing students' strategy implementation, so they could support students' cognitive processing "on-line". When obstacles were encountered or at natural breaks in the task, students were encouraged to reflect on their performance, to self-evaluate progress, and to make judgments about how to proceed. As in strategy selection, task criteria generally set the standards against which progress towards learning goals was compared. Students were also supported to evaluate and revise strategies based on an analysis of how goals were, or were not, being achieved.

SCL Instruction: Expected Outcomes

Based on the theoretical foundations underlying the SCL approach, the following outcomes were expected to be associated with students' participation in the intervention. First, it was expected that students would build effective strategies for learning that would lead to improved task performance. Second, it was expected that engaging students in reflective discussions about the process of learning would contribute to revisions of metacognitive knowledge about tasks, strategies, and strategic processing. Third, because students were cued to observe the relationship between strategy use and outcomes, it was expected that they would build positive perceptions of self-efficacy (e.g., Schunk & Cox, 1986; Schunk, 1994; 1996; 1997), feel more in control over outcomes, and recognize the relationship between the effortful use of strategic approaches and successful performance (e.g., Borkowski, Weyhing, & Turner, 1986; Schunk & Cox, 1986). Fourth, it was expected that the strategies students constructed would be individualized, because they built from what students already knew, were founded on their processing preferences, capitalized on their strengths, circumvented their weaknesses, and were described in the students' own words. Finally, it was expected that students would learn how to select, monitor, adapt, and even create strategies based on their perceptions of task demands. This competency was expected to be reflected in students' active involvement in strategy development during intervention sessions and in their transfer and maintenance of strategic approaches across contexts, time, and *tasks*.

Research on SCL Efficacy

This paper summarizes results from four studies evaluating SCL efficacy as a model for providing individualized tutoring for postsecondary student with LD's (Butler, 1992, 1993, 1995, 1996, in press-a, in preparation). In the first study ("SCL 1993"), one instructor provided individualized tutoring to six postsecondary students at three different college and university campuses (Butler, 1992; 1993; 1995). In the second ("SCL 1994"), three SCL instructors provided tutoring to 13 students with LD's (Butler, 1996; in preparation). The third and fourth SCL studies ("Innovations Year One"; "Innovations Year Two") were completed between September 1994 and May 1996 under the auspices of a large pilot project funded by the British Columbia Ministry of Skills, Training and Labour. As part of this program students received SCL tutoring in addition to remedial instruction on basic skill deficits and/or vocational counseling. In each year of the Innovations project, four graduate students were trained to act as SCL tutors. Support was provided to 12 and 9 students, in Years One and Two, respectively (Butler, 1996; in press-a; in preparation). In sum, 36 individuals participated across the four studies (four of whom participated in two consecutive studies). Eleven participants were male; twenty-five were female. Students ranged in age from 19 to 48 years (median age = 32). Instructors met with students for an average of 19.74 hours per study across an average of 17.76 sessions.

Research Design

A primary concern in designing SCL studies was to evaluate the success of the intervention in as realistic a format as possible. Therefore, unique features of the research design were that individual students chose different tasks, and that the assignments addressed were drawn from individuals' programs of study. While students generally chose tasks that required reading and studying (14 students), writing (16 students), math problem solving (9 students), or work organization (1 student), the exact nature of task requirements varied depending on students' programs[1]. Of the 36 participants, four attended university (one graduate and three undergraduate students), 30 attended college, and 2 were between programs. Of the 30 college students, 4 were taking University Transfer courses, 11 were participating in vocational training programs (e.g., training in Diesel mechanics, Early Childhood Education, Family Studies, Nursing), 8 were upgrading their educational background to qualify for vocational programs at other colleges (e.g., taking grade 11 Biology), and 7 were enrolled in Adult Basic Education. Psycho-educational assessments showed that students' initial reading, writing, and math skills were highly variable, ranging from the Grade Four to University level. Students' specific learning disabilities affected different aspects of their performance and some students had concomitant disabilities that also affected their learning (e.g., a visual impairment or attention deficit disorder). Thus, a heterogeneous group of students participated across the four studies. This diversity facilitated evaluating the robustness of the SCL model across students, settings, programs, and tasks.

Figure 2. Study Design: Multiple Parallel Case Studies Across Three Studies (n = 40)

Each Case Study:

Pretest	Intervention Period	Posttest
Questionnaires Interview Observations	Task Performance Records Strategy Records Field Notes & Audio Tapes	Questionnaires Interviews Observations

OUTCOMES
• Task Performance • Metacognition • Self-Efficacy • Attributions • Strategy Development • Transfer of Strategy Use

The research design used in each SCL study is depicted in figure 2. As can be seen, a mixed design was employed. First, to trace the relationship between instructional activities and students' development of self-regulation, each study comprised multiple, parallel, in-depth case studies (Merriam, 1988; Yin, 1994). Changes in students' knowledge and beliefs, strategic approaches to tasks, and task performance were carefully traced within and across intervention sessions. At the same time, to facilitate cross-case comparisons, individual case studies were embedded within a pre-post design. During pre- and posttest sessions, parallel questionnaires, observations, and interviews were employed to measure common effects across students (see Butler, 1995; in preparation).

Research Results

In general, results from each SCL study were consistent with expectations (see Butler, 1993, 1995, 1996, in press-a, in preparation; Butler, Elaschuk, & Poole, in preparation). Improvements were observed in students' task performance, metacognitive knowledge about tasks, strategies, and self-monitoring, perceptions of self-efficacy, and patterns of attributions. Students also developed personalized strategies that addressed their individual needs. Finally, students took an active role in strategy development and transferred strategic performance across contexts and across tasks. For the purposes of this paper, a subset of these findings, those most germane to the topic at hand, will be summarized in more depth. Specifically, attention will focus on findings related to changes in students' knowledge and beliefs (metacognitive understandings, perceptions of self-efficacy, and attributions) and in their strategic approaches to tasks.

Shifts in Knowledge and Beliefs

One of the most consistent findings across the four SCL studies were shifts in students' knowledge and beliefs related to the process of learning. In each study, significant improvements between pre- and posttest were observed in students' ability to articulate focused understandings about tasks, strategies, and the process of learning, and in their perceptions of self-competence and/or confidence. While results regarding students' explanations for successful and unsuccessful performance have been mixed, trends suggest shifts in students' attributional patterns as well. Each of these results will be discussed in more detail below.

Table 1. Dimensional Analysis of Changes in Metacognition: SCL 1994 and Innovations Projects Combined.

Measure	n[1]	Pretest Mean (SD)	Posttest Mean (SD)	t	p<[2]	Effect size[3]
Metacognitive Questionnaire						
Task Description	28	1.54 (.64)	1.86 (.76)	-2.07	.03	.50
Strategy Description	28	1.79 (.57)	2.21 (.79)	-2.71	.01	.74
Strategy Focus	28	1.68 (.61)	2.11 (.74)	-3.28	.01	.70
Monitoring	28	1.75 (.80)	2.32 (.61)	-3.83	.001	.71
Average Rating	28	1.69 (.39)	2.13 (.51)	-5.21	.001	1.13
Strategy Interview: Own Task						
Task Description	20	1.60 (.75)	2.05 (.69)	-2.69	.02	.60
Strategy Description	20	1.85 (.75)	2.55 (.60)	-4.77	.001	.93
Strategy Focus	20	1.65 (.59)	2.30 (.66)	-3.90	.001	1.10
Monitoring	20	2.10 (.72)	2.50 (.83)	-1.90	.04	.56
Average Rating	20	1.77 (.60)	2.33 (.57)	-3.80	.001	.93
Strategy Interview: Other Tasks						
Task Description	19	1.37 (.68)	1.95 (.78)	-2.15	.03	.85
Strategy Description	19	1.79 (.79)	2.26 (.65)	-2.28	.02	.59
Strategy Focus	19	1.68 (.67)	2.16 (.60)	-2.28	.02	.72
Monitoring	19	2.05 (1.08)	2.37 (1.01)	-1.24	n.s.	.30
Average Rating	19	1.67 (.57)	2.16 (.51)	-3.24	.01	.86

[1] Some data were lost due to technical difficulties (e.g., tape-recorder malfunctions); [2] one-tailed test; [3] Effect size calculated using the pretest standard deviation as an estimate of variance prior to the intervention.

Metacognitive Knowledge. Students' metacognitive understandings were assessed at pre- and posttest via questionnaires and interviews. For both of these measures, common criteria were used to evaluate students' responses on each of the following dimensions: (a) task description (students' conceptions of task requirements), (b) strategy description (the clarity of students' descriptions of task-specific strategies), (c) strategy focus (the degree to which described strategies were focused, personalized, and *connected to task demands*), and (d) monitoring (students' descriptions of how they self-evaluate progress and manage learning activities accordingly) (see MacLeod, Butler, & Syer, 1996; Butler, in preparation for more details regarding scoring criteria).

Table 1 presents data pooled across the SCL 1994 and Innovations studies (because scoring criteria were slightly different in the SCL 1993 study, those results are not summarized here; see Butler, 1995). These data show that when asked to describe approaches to completing targeted tasks, students provided better descriptions at posttest than they had at pretest, across all four metacognitive dimensions (ES ranging from .50 to 1.10). In addition, when asked to describe approaches to *non-instructed tasks*, students' descriptions were also significantly clearer at posttest than they had been at pretest for three of the four dimensions (ES =.85, .59, and .72, for the task description, strategy description, and strategy focus dimensions, respectively). Taken together, these findings suggest that improvements in students' ability to describe strategic activities can be associated with participating in SCL interventions. Further, for three of four dimensions, students' increased metacognitive awareness transferred to non-instructed tasks.

Table 2. Changes in Self-Efficacy: SCL 1994 Study.

Measure[1]	n	Pretest Mean (SD)	Posttest Mean (SD)	t	p<[2]	Effect size[3]
Self-efficacy						
Self perceptions	13	2.23 (.58)	2.70 (.62)	-2.81	.01	.81
Task preference	13	2.96 (.79)	3.33 (.56)	-1.61	.07	.47
Total	13	2.50 (.61)	2.94 (.52)	-2.35	.02	.72
Ability rating	12	2.17 (.75)	2.63 (.86)	-2.56	.01	.61
Self-efficacy across tasks						
Own task	13	1.90 (.81)	2.94 (1.04)	-4.30	.001	1.28
Other tasks	13	2.52 (.65)	2.68 (.84)	-.84	n.s.	.25
Overall	13	2.44 (.56)	2.85 (.81)	-2.55	.01	.73

[1] maximum = 5; [2] one-tailed test; [3] Effect size calculated using the pretest standard deviation as an estimate of variance prior to the intervention.

Self-Efficacy. Results from questionnaires measuring shifts in students' perceptions of self-efficacy are presented in Tables 2 and 3, for the SCL 1994 and Innovations studies, respectively (data are presented separately because measures were modified between studies). Consistent with findings from the earlier SCL 1993 study (see Butler, 1995), these data revealed consistent increases from pre- to posttest in students' perceptions of task specific self-efficacy (see also Butler, 1996; in press-a; in preparation). For example, in both the SCL 1994 and Innovations studies, participants' self-perceptions of competence on task-specific skills (e.g., their ability to organize ideas while writing) were higher at posttest than they been at pretest (ES = .81 and 1.01, for the SCL 1994 and Innovations studies, respectively). In the SCL 1994 study, participants also rated their overall ability on chosen tasks to be significantly greater at posttest than they had at pretest (ES = .61), although this finding was not statistically reliable based on data pooled from the two Innovations studies (ES = .38). In the Innovations studies, students were significantly more confident at posttest about their ability to complete specific task requirements (ES = 1.16). However, changes in students' perceptions of global self-efficacy (measured only in the Innovations studies) were not observed.

In the SCL 1994 and Innovations studies, students were also asked to rate the amount of difficulty they experienced across a range of tasks. Students reported experiencing less difficulty at posttest than they had at pretest for the tasks worked on during the intervention period (ES = 1.28 and .87, for the SCL 1994 and Innovations studies, respectively). Pooled data from the Innovations studies (but not the SCL 1994 study) also suggest that students reported significantly less difficulties at posttest with *non-instructed* tasks (ES = .91).

Attributions. In each SCL study, students were asked to think of "the last time" they were either successful or unsuccessful at completing their chosen tasks, and to rate the relative importance of a number of factors to their level of performance (see Butler, 1993; 1995; in preparation). In general, students' responses to these attribution questionnaires were highly variable. Nonetheless, some consistent shifts have been observed across studies. For example, in the SCL 1993 and Innovations studies, students were significantly more likely to attribute successful performance to ability at posttest than they were at pretest. At the same time, in the SCL 1993 and SCL 1994 studies, students were less likely to attribute unsuccessful performance to a lack of ability. These attributional shifts are consistent with the improvements in self-efficacy described earlier. Students were more likely to take credit for success, but less likely to blame failure on low ability (Butler, 1993; 1995; 1996; in preparation).

Table 3. Changes in Self-Efficacy: Innovations Projects—Years 1 and 2 Pooled.

Measure[1]	n	Pretest Mean (SD)	Posttest Mean (SD)	t	p<[2]	Effect size[3]
Self-efficacy						
Global Self-Efficacy	14	3.32 (.69)	3.29 (.69)	.28	n.s.	-.04
Task Specific Confidence	14	2.69 (.62)	3.41 (.61)	-4.50	.01	1.16
Self perceptions	13	2.49 (.67)	3.17 (.54)	-3.53	.01	1.01
Total	13	2.79 (.53)	3.29 (.57)	-3.47	.01	.94
Ability rating	15	2.90 (.71)	3.17 (.66)	-1.17	n.s.	.38
Self-efficacy across tasks						
Own task	15	2.22 (.99)	3.08 (.95)	-4.04	.01	.87
Other tasks	15	2.61 (.69)	3.24 (.80)	-3.04	.01	.91
Overall	15	2.50 (.69)	3.18 (.77)	-3.56	.01	.99

[1] maximum = 5; [2] one-tailed test; [3] Effect size calculated using the pretest standard deviation as an estimate of variance prior to the intervention.

In the SCL 1993 study, students also rated effort as significantly more important to successful performance at posttest than they had at pretest. However, this finding was not replicated in the subsequent SCL studies. Attributions for success to strategy use were higher at posttest than at pretest in both the SCL 1993 and Innovations studies. But this finding was not statistically reliable based on the SCL 1994 data. In sum, although patterns of attributional shifts were not consistent across studies, perhaps in part due to the high degree of variability in students' perceptions of the contributions to performance of different factors, it appears that, to some extent, participants developed more positive attributional patterns.

Students' Strategic Approaches to Tasks

To trace changes in students' strategic approaches to tasks, their strategy descriptions were chronicled over time and related to their specific difficulties with tasks. Analyses of students' final strategies showed that students developed personalized strategies that targeted their individual needs (for examples, see Butler, 1993; 1995; in preparation; Butler et al., in preparation). In addition, students' developing strategies were coded based on the origin of strategy steps. Possible origins included (a) steps students articulated at pretest, prior to intervention; (b) steps that emerged based on collaborative discussions with instructors; and (c) steps that students added independently without input from instructors. Analyses of the origin of students' strategies showed that students were actively involved in strategy development across intervention sessions. All students' strategies were comprised mainly of steps developed collaboratively (where students made all key decisions), but 83% of students also contributed independently to strategy development.

Evidence was also collected of students' transfer of strategies outside of intervention sessions. For example, notes, outlines, or other documents that reflected strategy use were copied, and students' self-reports of strategy implementation at home, in class, or in test situations were recorded. Analyses of these data suggested that 78% of students independently transferred strategy use across contexts. Finally, whenever students spontaneously described applying or adapting strategies for use in non-instructed tasks, their descriptions were summarized. Field notes then served as a guide to a more detailed review of relevant session tapes. Analyses of these data suggested that 73% of students transferred strategic approaches for use across *tasks.*

Developing Self-Regulation

More detailed analyses of the strategy data suggest that SCL participants not only developed and mastered task-specific strategies, but also learned how to self-regulate more effectively. First, the strategies students developed included steps focused on each of the cognitive processes central to self-regulation. For example, Ron's[2] strategies for math problem solving, presented in Figure 3, include steps related to task analysis (e.g., "find out what the problem is asking"), strategy selection, based on problem requirements (e.g., "recognize whether I need to use a formula"), strategy use (e.g., "read slowly"), self-evaluation (e.g., "re-read and think about how my equation compares with information given in the problem"; "redo problem to find where it's wrong"), and strategic adjustments given progress perceived (e.g., "if confused, look at examples or take a break").

Second, as suggested earlier, strategic learning may be best evidenced when students responsively adapt strategic approaches based on task demands (Borkowski, 1992; Brown, 1980; Butler, 1993; 1995). Thus, a good indicator of shifts in self-regulated approaches would be students' independent development of strategies. In the studies described here, students were observed to add steps to their developing strategies that targeted such activities as task analysis, strategy selection, self-evaluation, and self-monitoring. For instance, Hope (in the SCL 1994 study) worked with her tutor to develop a strategy for interpreting writing assignments (i.e., task analysis). She independently added two steps to that strategy, between sessions 10 and 11. These were to ask herself, “what am I going to get out of this?” and “what am I to understand here?”. These self-questions cued Hope to focus on task purpose while interpreting the demands of a task. To the same strategy, she also added a step designed to help her self-evaluate comprehension as she read the instructions. This was to “cover ears and read out loud to hear what I’m saying”.

Evidence for changes in students’ self-regulated approaches was also provided by students’ descriptions of how they transferred strategic approaches for use *across tasks*. In many cases, students described adapting specific strategy steps. For instance, in the SCL 1993 study, Jennifer explained in detail how she adapted her strategy for organizing essays for use when studying for finals:

> Well, I mean ... I know how to get organized for an essay, like, what I have to have to get to a certain point, and what I need to do at a second point. Just, I do that all the time now. Like, if I know too, for like a final exam, first I have all, I have to have all my rough notes, then I have to have more of a general idea, then a more specific idea, then to the point where I can almost, you know, write an essay about everything I've learned...So it's kind of that point, where I just use that strategy with all my schooling, going from very general, to working up to more specific, just on everything.

Similarly, Mike explained how he used a reading strategy to plan content for paragraph writing:

> Like, remember we were saying, that, there’s always going to be a sentence that’s going to be describing what they’re going to be talking about? And um, that’s what I’m doing right now. I’m going to say, OK, this is what I’m going to be talking about. And then I would start, I would say, OK, these are the three steps, or four steps or whatever, right?

In some cases, changes in students’ strategic performance across tasks seemed to be mediated by changes in task analysis and/or task understandings. That is, students modified learning strategies, not by exporting or adapting specific strategy steps, but by altering activities adaptively in light of changing conceptions about tasks. For example, in the first Innovations study, Paul worked with his tutor to develop strategies for writing within a vocational training program. At posttest, he explained how he had analyzed tasks while on practicum, and had focused his efforts accordingly:

> Those are a couple of points that I’ve used in the strategies that we have discussed before. You know, to, to, well, understand the task and ask as much questions to clarify and to confirm that that’s what the person wants. You know, and, it kept playing in the back of my mind, that that’s what I should do—when they assign a task for me to do, you know, that’s what I should do first...So I guess, if I work on things systematically, eventually, you’ll get it done right. You know. But, if you don’t follow a system or a procedure, you’re really stumbling all over yourself...So, that helped me quite a bit, to be honest with you, because otherwise, how would I know how to do it myself?

Figure 3. Ron's[2] Strategy for Math Problem Solving.

1. Solving Word Problems
   - A. read slowly
   - B. recognize from the question whether I need 2 or 3 equations
   - C. recognize whether I need to use a formula
   - D. draw graph or picture if necessary
   - E. write formula I need at the beginning of the answer
   - F. find out what the problem is asking
   - G. identify the variables and translate into an equation
   - H. re-read and think about how my equation compares with info given in the problem

2. Formulas
   - A. when answer is incorrect, substitute right answer
   - B. redo problem to find where it's wrong
   - C. check calculations with calculator

3. Graphing
   - A. when stuck, go to the instructor
   - B. re-examine the problem
   - C. check to see where it's gone wrong
   - D. redo similar questions to check to see if understand concepts being presented

Similarly, Jennifer described how understanding more about writing had helped her to take better notes, relating changes in her note-taking activities to a better understanding of that task:

> It's helped me in my note taking too, just helped me pick out, like, because I'm so concentrating on flow. I can pick up on other people's flow now. So like, you know, the teacher's going on, I no longer write down like, scribbling madly about every single point he makes. But I can almost summarize... my note-taking is better now.

Summary of Findings

In sum, results from the four studies described here suggest that participants benefited from the SCL intervention. Analyses revealed positive shifts in students' knowledge and beliefs central to effective self-regulation, including metacognitive understandings about tasks, strategies, and self-monitoring, perceptions of task-specific self-efficacy, and attributional beliefs. Further, changes were observed in students' self-regulated approaches to tasks. Findings suggested that students improved both in their implementation of component cognitive processes (e.g., task analysis, strategy implementation, self-monitoring) and in their coordination of learning activities. For example, students developed better conceptions of tasks, analyzed tasks more effectively, and adaptively managed learning activities in light of task demands.

Conclusions and Implications

The research summarized in this paper suggests that SCL is a promising approach to providing individualized tutoring to postsecondary students with learning disabilities. The evidence for its effectiveness is particularly compelling given the intervention's success across varied participants, settings, programs, and tasks. At the same time, further research is clearly warranted. Additional research should attempt to replicate the findings with a larger number of participants. Cross-case comparisons are necessary to determine characteristics and/or needs of individuals who do and do not profit maximally from SCL, so as to establish boundaries and/or limits to the model's effectiveness. Future research should also examine how SCL instructional principles can be adapted for use in small or large group instruction. Finally, the applicability of the SCL model for younger students and for students without learning disabilities also needs to be established.

Nonetheless, the research described here suggests that instruction following the SCL model effectively promotes self-regulation. Thus, just as researchers have argued for promoting students' coordinated use of strategic reading activities by scaffolding support as they read meaningful texts (e.g., Palincsar & Brown, 1984; Pressley et al., 1992), it may be that students' coordination of cognitive and metacognitive learning activities can be enhanced by providing calibrated support to students as they self-regulate performance across a range of meaningful tasks.

The findings reported here also indirectly support the importance of targeting task analysis, goal setting, strategy selection, self-evaluation, and self-monitoring within an integrated instructional package (see also Harris and Graham, 1996). Again, most researchers have recognized that mastering task-specific strategies is a necessary, but not sufficient condition, for strategic learning to occur (e.g., Groteluschen et al., 1990; Sawyer et al., 1992; Wong, 1991-a). SCL provides one potential model for efficiently extending instruction to support self-regulation more broadly. Similarly, the research reported here indirectly supports the benefit of focusing students' attention concurrently on process and outcome goals. Over time, students strategically adjusted approaches to both enhance performance outcomes and to develop personalized and effective task-specific strategies. Finally, supporting students to self-monitor the interactions between task criteria, goals, strategies, and outcomes may have been related to observed improvements in students' perceptions of self-efficacy and in their causal explanations for success (Schunk, 1997).

From a practical perspective, the research described here also suggests that theoretical models of self-regulated learning may provide a useful heuristic for diagnosing and redressing individual's learning difficulties, at least for students with learning disabilities. In SCL research to date, functional assessments have been completed on an on-going basis of students' developing approaches to tasks. Students' problems have been quite varied, but it has generally been possible to describe them in terms of a model of self-regulation. For example, while some students' problems stemmed from faulty task analysis or inaccurate task conceptions, other students' difficulties were related more to the inefficiency of strategies or to a range of problems with self-monitoring (see Butler, in press-a; Butler & Winne, 1995). Information about students' extant self-regulation has been very useful when responsively calibrating instruction to promote more effective approaches to tasks.

Models of self-regulation have clearly provided a useful framework for describing the interplay between knowledge, beliefs, and learning activities as students actively manage their performance. As such, they provide a useful description of outcomes profitably promoted in intervention research. At the same time, two key theoretical issues need continued attention, if we are to effectively promote self-regulation. First, a clear description of how self-regulation develops is required so as to fine-tune instructional goals. For example, it has been suggested that, regardless of age, people engage in self-regulating behaviours as they seek to master their environment (e.g., Brown, 1987; Vygotsky, 1978). If this is the case, then no learners enter instruction as self-regulating “blank slates”, and our task may best be conceived as shaping students’ self-regulating activities in the context of school-like tasks. At the same time, it has also been suggested that, over time, children develop the competency to reflect on and explain experiences and to consciously direct their activities (Brown, 1987). Thus, younger learners may require support to reflect on their learning, to abstract understandings, and to learn how to consciously manage their activities. In contrast, older students may already have the competency to reflect on and direct learning activities, and most have probably constructed understandings, productive or not, based on their history of experiences with tasks. For these students, promoting self-regulation may require shaping extant understandings and activities rather than teaching self-regulation per se. This point is consistent with Swanson’s description of students with LD’s as “actively inefficient” rather than deficient in their strategic approaches to tasks (Swanson, 1990).

A second key issue concerns the interplay between social and individual factors in students’ development of self-regulation. For example, central in most current strategy training models, including SCL, is a focus on social interaction as the medium through which learning is influenced. Current descriptions of how students develop self-regulation emphasize their internalization of processes that once were supported and/or modeled in social interaction (in their zones of proximal development; Vygotsky, 1978). At the same time, researchers have also continued to emphasize the mediating role played by individuals’ cognitive processing in their construction of knowledge and beliefs (e.g., Paris & Byrnes, 1989). And, strategy intervention researchers explain that the best strategy training is constructivist (e.g., Harris & Pressley, 1991), and that what students internalize through social support is highly personalized (Harris & Pressley, 1994). It would therefore be helpful to find a means to reconcile two potentially competing images (built on different metaphors for learning; see Butler, in press-b; Stone, in press): one image is of active self-regulators building idiosyncratic understandings coloured by prior knowledge and beliefs; the other is of those same students “internalizing” strategic approaches once supported and/or explicitly modeled by others. Perhaps one way to merge these two visions is to suggest that active learners shape extant approaches to self-regulation based on transactional understandings about learning constructed in social contexts (e.g., Butler, in press-b). Whatever the resolution, what is clearly required is a description of instructional influences that captures the interplay between social and individual forces in students’ construction of self-regulated approaches to tasks (see Butler, in press-b; Stone, in press).

Notes

1 There were 36 participants in the studies, four of whom participated in more than one study. In calculating the number of students choosing tasks in each study, these student were counted twice (for a total of 40), because sometimes they switched tasks between studies.

2 All names used in this paper are fictional.

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