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Learning Effectiveness of a Strategic Learning Course

The effectiveness of a postsecondary strategic learning course for improving metacognitive awareness and regulation was evaluated through systematic program assessment. The course emphasized students' awareness of personal learning through the study of learning theory and through practical application of specific learning strategies. Students assessed personal gains through pretest and posttest assessments of both metacognitive awareness and regulation. Pretest-to-posttest gains were statistically significant with large, meaningful effect sizes for program participants, including students with disabilities. Evidence supports the effectiveness of the program and, by extension, the value and importance of learning strategies instruction as a powerful educational intervention for students with disabilities.

Educators attempt to empower learners with self-awareness and strategies for areas of need, which consequently lead to learners' increased reliance on strategic approaches to the process of learning. Learning strategies include procedures for note-taking, reading textbooks or articles, organizing thoughts prior to writing, managing time, test-taking and many other skill areas. Learning strategies are not tricks or shortcuts; instead, strategic learning focuses on matching specific approaches, processes or strategies to the individual's learning needs. Most learning strategies also involve metacognitive processing, which involves intentionally thinking about one's learning strengths or needs and actively applying a strategy to regulate some aspect of one's learning. Educational researchers advocated that post-secondary learners should actively employ individualized strategies that meet the learner's personal learning preferences, strengths, weaknesses, and even disabilities (Davidson & Sternberg, 1998; Gamache, 2002;

Hacker, 1998; Minskoff & Allsopp, 2003). Importantly, postsecondary students who approached learning with higher metacognitive awareness or self-regulation showed greater academic performance (Davidson & Sternberg, 1998; Highley, 1995; Ruban, McCoach, McGuire, & Reis, 2003; Schraw & Dennison, 1994; Sungar, 2007; White & Kitchen, 1991; Wolters, 1997). Furthermore, research has consistently provided evidence for the effectiveness of various learning strategies for postsecondary learners, especially in increasing self-regulation (Minskoff, Minskoff, & Allsopp, 2001; Peterson, Lavelle, & Guarino, 2006; Van Blerkom, D.L., Van Blerkom, M.L., & Bertsch, 2006).

The value of learning strategies in improving performance outcomes, such as grades or specific curriculum-based measures, is established by the previous research. Furthermore, existing research demonstrated the connection between learning strategies and metacognition. This study goes one step further to explore the challenges of creating effective interventions that increase students' metacognitive self-awareness and consequently lead to students' successful independent implementation of learning strategies in their academic careers. Specifically, this study investigates whether a learning strategies course could improve metacognitive regulation beyond gains made through typical maturation, with special interest in gains made by students with disabilities.

Previous Research

The review of the literature discussed below describes studies that focus both on the importance of learning strategies and the outcomes of various learning strategy interventions employed at the postsecondary level. Additionally, the literature that informs the current study deals with the impact that metacognition has on postsecondary learning. Further studies investigate the effectiveness of specific learning strategies or strategy programs for postsecondary students with learning disabilities.

Importance of Learning Strategies

Content knowledge requires mastery of facts and reasoning in a specific field or topic. The process of learning itself reaches beyond content knowledge to encompass the way a student learns with ever-increasing effectiveness. The improvement of learning, not just content knowledge, is an important outcome of postsecondary education. Various researchers connected the successful employment of strategic learning to aspects of metacognitive awareness and/or regulation (Braten & Stomso, 2005; Carnell, 2007; Dahlin, 1999; Garner, 1990; Hanley, 1995; Sungar, 2007; Wolters, 1997). For example, a student who was more aware of his or her learning strengths and weaknesses demonstrated greater readiness to

employ strategies related to these strengths and weaknesses. Numerous universities such as Louisiana State, Stanford University, and Muskingum College have implemented programs or courses to teach learning strategies (Louisiana State, 2007; Muskingum, 2007; Stanford, 2007). Various data supported implementation of learning strategies to assist in meeting the complex learning requirements inherent in postsecondary education (Ryan & Glenn, 2004; White, 1991). Furthermore, freshmen who participated in a learning strategies seminar during their first semester as opposed to participating in a socialization style seminar or no seminar at all had higher retention rates into their second semester of college (Ryan & Glenn). Moreover, in the same study, it was found that learning strategies training improved performance measures for freshmen regardless of prior ability. These scholars present a strong body of evidence supportive of learning strategy interventions for postsecondary learners primarily for performance outcomes. Additionally, this body of evidence showed that metacognitive awareness and regulation are connected to learning strategies use.

Outcomes of Implementing Various Learning Strategies Interventions
The successful implementation of learning strategies into one's academic pursuits is predicated on learning and using specific techniques. Some of the key components of successful metacognitive training include modeling, active student participation and self-monitoring (Alsopp, Minskoff, & Bolt, 2005; Deshler & Shumaker, 1986; Swanson, 1989; Trainin & Swanson, 2005; Vogel & Adelman, 1992; Zimmerman, 1989). Furthermore, students who implemented metacognitive processing demonstrated superior knowledge acquisition and stronger self-efficacy (Ford, Smith, Weissbein, Gully, & Salas, 1998).

Previous research implemented a required course for at-risk students focusing primarily upon regulatory strategies with some coverage of motivational theories. A study of this course found intercorrelations among metacognition, student organization and elaboration, but with limited statistical significance (Highley, 1995). Garcia and Pintrich (1991) studied postsecondary learning within one semester and demonstrated relationships between personal and behavior influences, such as motivation and metacognitive characteristics and performance, but there were no interventions in that particular study. Zimmerman, Bandura and Martinez-Pons (1992) investigated causal relationships between various constructs, including self-regulated learning on final grades. That study demonstrated a significant causal link between "self-efficacy for self-regulated learning, efficacy for academic achievement, and academic attainment." In that study, self-regulatory factors accounted for 26% of the variance in performance outcomes.

Development of Metacognition

Metacognition, the act of monitoring and evaluating one's learning, and implementing intentional strategies to regulate learning beneficially impacts learning by increasing either effectiveness, efficiency or both (Pintrich, 2002; Schraw & Dennison, 1994). Researchers have differentiated two important aspects of metacognition: the awareness of learning and regulation of metacognition (Pintrich, 2002; Schraw & Dennison, 1994). The *awareness of learning*, also termed metacognitive awareness, includes three components: (a) declarative knowledge: awareness of strengths, weaknesses and resources; (b) procedural knowledge: knowing steps to various strategies; and (c) conditional knowledge: knowing when and why to use those strategies. Metacognitive regulation is comprised of five components: (a) planning; (b) information management, involving how one organizes new information; (c) monitoring, the act of checking for understanding or strategy effectiveness during a learning event; (d) debugging, "fixing" those learning behaviors which are not working; and (e) evaluation, checking for understanding or effectiveness after a learning event; (Nietfeld, Cao, & Osborne, 2005; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Metacognitive strategies include intentional strategic approaches to learning such as monitoring one's attention, reading specific styles of text, taking lecture notes, and thinking critically. Studies show that metacognitive awareness may be an important component in metacognitive regulation. Researchers have shown strong connections between declarative knowledge (such as knowing specific weaknesses in organizing one's writing) and conditional knowledge (such as when and why to use a specific writing strategy) and successful implementation of regulation strategies (Kuhn, Garcia-Mila, Zohar, & Anderson, 1995; Vermunt, 1998). One key finding is that learning strategies or metacognitive training programs are most effective when instructors encourage students to practice the strategies with college course content and reinforce the benefit of this practicing, in part because sufficient practice tends toward the development of new habits (Kuhn et al., 1995; Van Blerkom & Van Blerkom, 2004). Most importantly, students do demonstrate improvements in academic achievement with participation in learning strategies training (Butler, 1995; Minskoff et al., 2001; Tuckman, 2003). Thus, research shows metacognitive learning approaches are beneficial to postsecondary learners for performance outcomes such as specific skills, grades, or retention.

Developing metacognitive awareness may involve student exploration of other contributing factors in learning. A positive relationship has been demonstrated between self-regulation and college students'

readiness to change. Consequently, we should expect one student who is already actively seeking a new reading comprehension strategy to demonstrate greater effectiveness in self-regulated reading than a peer who is only just beginning to be aware that he needs a new approach to reading. Thus, students' exploration of their own readiness to change is an important component in programs designed to develop self-regulation (Jakubowski & Dembo, 2004).

Evidence of Strategy Effectiveness for Students with Learning Disabilities

Importantly, researchers have provided substantial evidence for the connection between successful strategy use and academic success for postsecondary students with learning disabilities (McGuire, Hall, & Litt, 1991; Minskoff et al., 2001; Ruban et al., 2003). McGuire et al. established a hierarchy of transition needs for students with learning disabilities in which study strategies ranked first (including time management, organization and test-taking strategies); specific training in written expression ranked second in need. Swanson (1989) established principles for instruction to promote strategy development. Swanson's work clearly connected high quality strategy programs to metacognitive aspects such as procedural and conditional knowledge and self-regulatory monitoring. Specifically, college students with learning disabilities who exhibited high strategy use were successful in compensating for their disabilities (Butler, 1995; Minskoff et al., 2001; Trainin & Swanson, 2005). In a study by Barga (1996), students with learning disabilities reported that their colleges did not typically meet their academic support needs, and Barga thus challenged college instructors to develop skills to teach a variety of learning strategies and self management techniques for a continuum of learners while challenging students to become more self-determined in finding learning supports. Vogel and Adelman (1992) suggested that the learning strategy support programs developed specifically for postsecondary students with learning disabilities may benefit additional populations of students, such as athletes or students from lower socioeconomic backgrounds. With increasing numbers of students with disabilities pursuing postsecondary education, this evidence is compelling for the specific value of learning strategies for the academic success of postsecondary students with disabilities.

Training students in specific learning strategies can positively influence common postsecondary outcomes including retention, students' grades in specific courses, or students' overall GPAs. Metacognitive regulation is an important indicator of postsecondary student learning and contributes to student success. Importantly, researchers have found

evidence that training in specific strategies has a positive impact on the development of specific components of metacognitive regulation. The importance of learning strategies to student success is clear, yet the mechanism with which students can effectively learn these strategies is not. For example, one significant gap in the literature is whether course-based training in several specific learning strategies can lead to significant gains in metacognitive regulation. Moreover, it is as yet unknown if the impact of such training differs between populations of students with and without disabilities.

Despite the established relationships between metacognition and various desirable learning outcomes, research demonstrated that explicit training is necessary to influence the metacognition of learners (Allsopp, Minskoff, & Bolt, 2005; Nietfeld, Cao, & Osborne, 2005). A study of postsecondary learning strategies by Allsopp et al. resulted in the establishment of a learning strategies program for students with disabilities. Initially, this program offered one-on-one lessons and accountability by a graduate student trained in learning strategies as a free service to students with learning disabilities or ADHD. In response to increasing demand, a special educator specializing in learning strategies was hired as full-time faculty, offering expanded opportunity for an increasing number of students to participate. This postsecondary learning strategies program then further expanded to offer a strategic learning course open to any student at the university. Sanford (1966) asserted, "There is nothing quite so practical as good theory and nothing so good for theory-making as direct involvement with practice" (p. ix). Heeding this perspective, instructors designing this course integrated educational theory with practical learning strategies. The program upon which the course had been based emphasized primarily regulation, with limited attention to personal awareness and no learning theories instruction to the participants. Thus, integration of learning theory with training in learning strategies was a new approach. While there is correlational evidence connecting metacognition with learning strategies, and evidence of effectiveness of strategies courses, there is limited empirical data in the literature demonstrating that such a course could positively affect the metacognitive skills of targeted populations, particularly students with disabilities. Specifically, this study seeks to determine if postsecondary students with disabilities will benefit from learning strategies instruction in a course format. If so, we furthermore seek to determine how the growth in metacognition experienced by students with learning disabilities compares to the growth experienced by students who are not learning disabled. This study answers the following questions:

1. For students who participate in the course, are posttest scores on the two aspects of metacognition significantly higher than students' pretest scores? In other words, can students' metacognitive awareness and regulation improve through instruction?
2. Do students with disabilities gain similarly on the two aspects of metacognition due to participation in the course, compared to students who participated in the course but did not identify themselves as having disabilities?
3. Do students who complete the strategic learning course score higher on the regulation aspect of metacognition compared to students from the general student population?
4. Are students who self-select to take this course different in metacognitive regulation compared to students from the general student population?

Method
Students and Setting
Students who participate in this course are from a mid-sized mid-Atlantic four-year university that offers student-focused services and strong teaching. Nearly 90% of the 17,393 students at the university are undergraduates. The average combined reading and math SAT score of incoming freshmen is 1,140. The four-year graduation rate for undergraduate students is 67%, and 80% graduate within six years. Males comprise 38.5% of the student population. The student population is 83.71% White. A total of 78 undergraduates participated in the Strategic Learning class over the first four semesters. Each semester, an average of 20 students complete the course (see Table 1 for details by semester). Most participants were in their freshman or sophomore year and, given the traditional nature of the university, were between 18 and 20 years old (three course participants were non-traditional adult degree seeking students). Sixty-two percent of the course participants were female, and 44% had documented learning disabilities. This course is credit-bearing but voluntary for all participants. Course participants tend to learn about the course through targeted marketing efforts that focus on freshmen advisors, the university's athletic student services office, the university's office for students with disabilities, a high demand scholarship program, and through an academic support program for students on academic probation.

The effectiveness of the course is evaluated for the specific sample of students with disabilities. For the purpose of this study, a student with a disability is defined as a student who is formally registered with the

institution's Office of Disability Services with a qualifying disability. Forty-four percent of course participants registered with a mild cognitive disability at the Office of Disability Services. In order to register with the Office of Disability Services, the student must present current comprehensive documentation meeting guidelines based upon the DSM-IV criteria for the applicable disabilities. The disabilities of course participants were varied; most students in the course reported a qualifying learning disability (i.e., dysgraphia, dyslexia, or reading comprehension disabilities), Attention Deficit Hyperactivity Disorder, depression, or anxiety. One student with a mild hearing loss and related language impairments also completed the course.

Procedure
The strategic learning class, a 16-week, three-credit academic course, covers prominent learning theories; students' personal assessment of their learning styles, strengths and weaknesses; and practical application of strategy and theory. Learning theories include academic goal orientation, goal setting, change theory, multicultural perspectives, memory and forgetting, multiple intelligences and metacognition. Students are required to relate the theories to personal experience or perspective through written reflection, class discussion, and projects. Theory instruction is balanced with practical strategies. For example, after learning several strategies and principals of mnemonics, students work in small groups based upon their other courses to invent mnemonic strategies to meet specific needs, such as reasoning through scenario test questions. Students are challenged to then try their invented strategies and report back to the class. Additionally, there is evidence that students learn to use the strategies taught in the course because of an application-based assignment that requires students to demonstrate employment of one specific strategy in other coursework outside the learning strategies class. For example, students may show notes taken in a psychology course using a note-taking strategy or the use of a planner that demonstrates the student broke down long-term assignments into manageable steps.

   Strategies include note-taking, task analysis, time management, complex thinking, planning for writing, use of assistive technology for writing, editing tools and resources, techniques for reading textbooks and articles, research approaches, memory-improvement skills, test-taking strategies, and others. Instruction emphasizes strategies that followed a system of connections with theory or prior experience, explanation, modeling, guided practice and opportunity for independent practice (Minskoff & Allsopp, 2003). Assignments stress the application of

theory as well as specific strategies to personal learning, especially in coursework for other classes. For example, the first paper in the course requires students to reflect on results from various learning assessment tools and examples from academic experiences. The assessment tools completed by students address learning styles (measured by the Index of Learning Styles; Felder & Silverman, 1988), academic goal orientation (measured by the Achievement Goal Questionnaire; Finney, Pieper, & Barron, 2004), metacognitive awareness and regulation (measured by the Metacognitive Awareness Inventory; Schraw & Dennison, 1994), and multiple intelligences (as measured by a multiple intelligences inventory; Gardner, 1993).

The consistent approach of the course is to require students to intentionally apply strategies to personal learning. For example, one class assignment requires students to further expand personal awareness through participation in any two activities from a list of career and academic exploration activities, ranging from taking a career assessment inventory to participation in a career exploration workshop. In a creative research project, training for the project includes research, reading and writing strategies. Grading then reinforces demonstration of those specific strategies. Points are earned on each test for visible evidence of memory or test-taking strategies employed *during the course of the test*, such as jotting down a mnemonic strategy in the margin of the test or by circling key words such as "except" in a test item. The final project in the class requires students to create a resource notebook that includes five sections: (a) reflection on personal learning strengths, weaknesses and changes over time; (b) career and academic exploration and the connection between such exploration and specific strategies; (c) academic goals written in measurable terms with specific strategies delineated to meet them; (d) a collection of specific strategies that were found personally useful in current or future courses; and (e) resources from various campus, community or on-line learning supports.

While a bulk of the course is consistent from semester to semester, the instructor ensures flexibility to address specific student areas of need. For example, when a majority of students identify planning as a need, additional emphasis is given to explicit training in time management and organizational strategies. When more students find monitoring strategies to be a need, the instructor gives more emphasis to explicit training and modeling of monitoring strategies in every lesson. Early in the course, students learn to write measurable goals addressing identified areas of weakness, some of which are then addressed during the current semester. Reflection on achievement of those goals is included in the final project.

Using four self-report tools, each student in the strategic learning course assessed personal learning styles, learning preferences, and learning strengths and weaknesses. The learning assessments in the course set the stage for early evaluation of personal learning and personal application of learning theories. The Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) was administered at both the beginning and end of the semester. Students used this specific tool to identify both strengths and target areas for improvement over the course of the semester with regard to metacognitive skills (a major component to the course curriculum). In the thirteenth week of the course, students reassessed their awareness and regulation of learning by again completing the MAI and then reflecting on changes from the beginning of the semester to the end of the semester.

For the purposes of this study, the independent variables analyzed include course participation and disability status. The dependent variables for the first three research questions are scores on an assessment of metacognitive awareness and regulation. A simple *t*-test was conducted to test the fourth research question and compare for differences between the students who took the course and those who did not.

Instrumentation

The assessment tool used to assess metacognitive awareness and regulation was the Metacognitive Awareness Inventory, the MAI. This tool is a 52-item self-report measure designed to assess metacognition in adults (including the collegiate population) using two subscales: (1) Knowledge of Cognition (referred to as the "Awareness" subscale; 17 items) and (2) Regulation of Cognition (referred to as the "Regulation" subscale; 35 items). Students rate each item on a five-point Likert-type scale from "always false" to "always true." Schraw and Dennison (1994) found acceptable psychometric properties for the instrument: reliability (Cronbach's coefficient alpha) was consistently greater than .90 and evidence supported a two-factor scoring solution. For the purpose of this study, the instrument subscales were analyzed separately.

Results

Research Question 1: For students who participate in the course, are posttest scores on the awareness and regulation aspects of metacognition significantly higher than students' pretest scores?

The gains of each specific semester cohort were compared. A statistical test to compare the slopes from pretest to posttest for the four semesters found that there were no statistically significant differences among the slopes of the four semesters on either Awareness ($F(3,74)$ = 2.34, *p*

= .080, η_p^2 = .09) or Regulation ($F(3,74)$ = 1.63, p = .189, η_p^2 = .06). The lack of a statistically significant difference across the four semesters in which the class was offered indicates that combining the data across all four semesters is permissible.

Pretest and posttest scores on the Awareness subscale of the MAI were subsequently examined to see if students' scores significantly increased during the Strategic Learning course. A repeated-measures ANOVA was used to test the null hypothesis that students' increase from pretest to posttest was significantly different than zero. There was both a statistically significant increase from pretest to posttest ($F(1, 77)$ = 76.33, p < .001) and a practically significant increase from pretest to posttest (η^2 = .50), indicating that students' metacognitive awareness scores did increase from pretest to posttest (see Figure 1 and Table 1).

The Regulation subscale of the MAI was next examined to determine if students increased significantly in their scores from pretest to posttest. A repeated-measures ANOVA was again used to test the null hypothesis that students' increase from pretest to posttest was significantly different than zero. There was both a statistically significant increase from pretest to posttest ($F(1, 77)$ = 35.16, p < .001) and a practically significant increase from pretest to posttest (η^2 = .31), indicating that students' metacognitive regulation scores did increase from pretest to posttest (see Figure 2 and Table 1).

Research Question 2: Do students with disabilities gain similarly on the awareness and regulation aspects of metacognition due to participation in the course compared to students who participated in the course but did not identify themselves as having disabilities?
MAI responses were analyzed using a repeated measures mixed ANOVA to test the null hypothesis that postsecondary students with disabilities increased their scores on each of the subscales of the instrument from pretest to posttest, similar to students without cognitive disabilities. The within-subjects effect was the students' pretest/posttest scores and the between-subjects effect was whether or not a student had a cognitive disability.

Students' pretest and posttest scores on the MAI's Awareness subscale were addressed first. An interaction between the status of having a cognitive disability and students' pretest/posttest Awareness scores was not found ($F(1, 76)$ = .01, p = .937, η^2 = .00). This finding indicates that disability status did not explain a significant amount of variance in pretest/posttest gains on the Awareness subscale. In other words, students with disabilities gained similarly to students without disabilities on the Metacognitive Awareness subscale of the MAI. Disaggregating

Figure 1 Awareness Pretest to Posttest Gains Made by the Last Four Cohorts
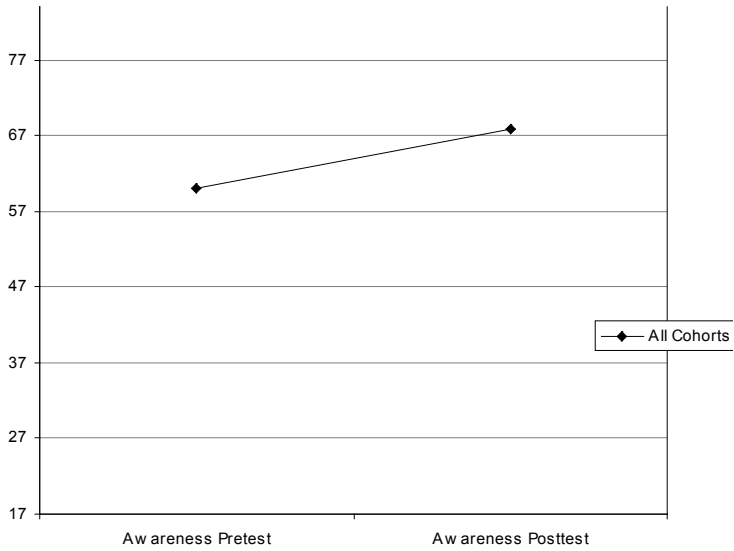

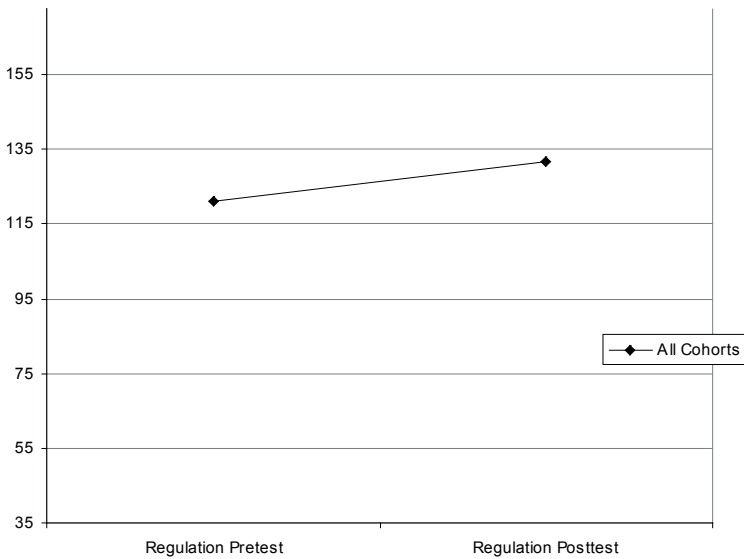*Figure 2 Regulation Pretest to Posttest Gains Made by the Last Four Cohorts*

Table 1 Pretest and Posttest Scores on Both MAI Subscales[a]

Cohort	N	Metacognitive Awareness[b]			Metacognitive Regulation[c]		
		Pretest Score	Posttest Score	Gain	Pretest Score	Posttest Score	Gain
Fall 05	17	61.82	70.24	8.41	127.12	133.94	6.82
		(8.68)	(6.69)	(7.91)	(17.04)	(16.46)	(14.72)
		(47 – 76)	(53 – 79)	(-3 – 29)	(89 – 158)	(99 – 156)	(-11 – 40)
Spring 06	18	58.94	70.22	11.28	117.44	134.78	17.33
		(8.03)	(7.53)	(8.34)	(17.34)	(13.87)	(17.38)
		(43 – 74)	(52 – 81)	(-5 – 26)	(77 – 146)	(110 – 160)	(-13 – 53)
Fall 06	27	60.85	68.11	7.26	124.67	133.15	8.48
		(9.89)	(7.40)	(6.91)	(17.51)	(16.50)	(16.28)
		(44 – 79)	(56 – 81)	(-9 – 23)	(89 – 164)	(101 – 161)	(-22 – 49)
Spring 07	16	58.06	62.44	4.38	113.75	124.13	10.38
		(8.58)	(7.60)	(8.16)	(19.89)	(17.32)	(12.51)
		(42 – 70)	(48 – 72)	(-9 – 27)	(71 – 146)	(80 – 146)	(-6 – 43)
All Cohorts	78	60.05	67.90	7.85	121.29	131.85	10.55
		(8.90)	(7.76)	(7.93)	(18.28)	(16.28)	(15.72)
		(42 – 79)	(48 – 81)	(-9 – 29)	(71 – 164)	(80 – 161)	(-22 – 53)
Not Disabled	44	59.70	67.61	7.91	119.64	130.68	11.05
		(8.79)	(7.99)	(7.71)	(20.12)	(17.18)	(16.58)
		(42 – 79)	(48 – 81)	(-9 – 27)	(71 – 164)	(80 – 161)	(-22 – 53)
Disabled	34	60.50	68.26	7.76	123.44	133.35	9.91
		(9.17)	(7.56)	(8.33)	(15.61)	(15.16)	(14.74)
		(43 – 77)	(52 – 80)	(-9 – 29)	(89 – 158)	(103 – 156)	(-13 – 45)

[a] Standard deviations are listed below score in parentheses; observed score ranges are listed below standard deviations in parentheses

[b] Possible range of Metacognitive Awareness Scores from 17 to 85

[c] Possible range of Metacognitive Regulation Scores from 35 to 175

students by whether or not they have a disability does not provide explanatory utility in explaining pretest/posttest scores, thus a more parsimonious model in which Awareness pretest and posttest scores are evaluated without disability status as a between-subjects predictor is more appropriate. In the absence of a statistically significant difference between students with and without disabilities, the results demonstrate that students with and without disabilities made similar gains on Metacognitive Awareness.

Similar results were found for the model in which students' scores on the MAI Regulation subscale were examined by cognitive disability status. As with the Awareness subscale, an interaction between whether or not a student had a cognitive disability and students' pretest/posttest Regulation scores was not found ($F(1, 76) = .10$, $p = .754$, $\eta^2 = .00$). This indicates that disability status did not explain a significant amount of variance in pretest/posttest gains on the Regulation subscale. In other words, students in the course with disabilities gained similarly to students without disabilities in the course on the Metacognitive Regulation subscale of the MAI. Disaggregating students by disability status did not provide additional predictive utility in explaining pretest/posttest scores; thus, a more parsimonious model in which Regulation pretest and posttest scores are evaluated without disability status as a between-subjects predictor would be more appropriate. This study demonstrates that students' disability status did not interact with gains made in Metacognitive Regulation.

Research Question 3: Do students who complete the strategic learning course score higher on the regulation aspects of metacognition compared to students from the general student population?
A purpose of the strategic learning course is to increase course participants' knowledge and skills related to adaptive metacognitive behavior. One would thus hypothesize that students who complete the strategic learning course would score higher on the MAI than students who do not take the course. For the purpose of this research question, researchers examined only scores for the Regulation subscale, as these items address positive behaviors that one would observe in a general population of students who have not completed a study skills or learning strategies-type course. In other words, comparing Awareness scores of students who participated in the course to students who did not participate in the course is not appropriate because the awareness dimension of metacognition includes specific knowledge not commonly encountered by members of the general student population. Students were sampled from the university population ($N = 1463$) to complete the Regulation

subscale under standardized, proctored conditions at two points in time: once when the students were freshmen and again 18 months later when the students were sophomores. Scores from the general student population were not obtained during the same time frame as scores from the strategic learning course participants (the elapse time between pretest and posttest for the learning course participants was approximately 13 weeks); accordingly, inferences should be made with caution.

Posttest scores on the Regulation subscale for students who participated in the strategic learning course ($N = 78$) were compared to scores for students from the general population who completed the same subscale ($N = 1463$) using a repeated measures mixed ANOVA (see Figure 3 and Table 2). Due to the unequal sample sizes, Type III Sums of Squares were employed and F-max was evaluated at a permissible level (i.e., an F-max value less than 3.0 is permissible for a standard mixed ANOVA) for the variances of all applicable comparisons, providing evidence that no adjustments were necessary to conduct the analysis. Students who were in the strategic learning class experienced larger gains over the 13-week period compared to students in the general population over an 18-month period (i.e., an interaction was present) $F(1,1539) = 28.74$, $p < .001$, $\eta^2 = .02$). In other words, strategic learning course participants gained on the Regulation subscale at a greater rate than would be expected due to simple maturation over the first two years of college (see Figure 3 and Table 2), thereby lending evidence to the worth of the strategic learning course.

It is important to stress that the interval between pretest and posttest measures taken for course participants was one semester only, while the interval between pretest and posttest measures for the general student population was just over three semesters. The results of this specific question are important in demonstrating that students who participate in a course with a metacognitive approach to teaching learning strategies do show gains in metacognitive regulation which are significantly greater than peers who do not participate in such a course. The difference in intervals between pretesting and posttesting raises additional questions for future study, such as the longitudinal benefits of metacognitive regulation after course participation.

Research Question 4: Are students who self-select to take this course different in metacognitive regulation compared to students from the general student population?

It is important to note that the results from an additional analysis reveal that the average *pretest* score for students who participated in the strategic learning course was statistically and practically significantly *lower*

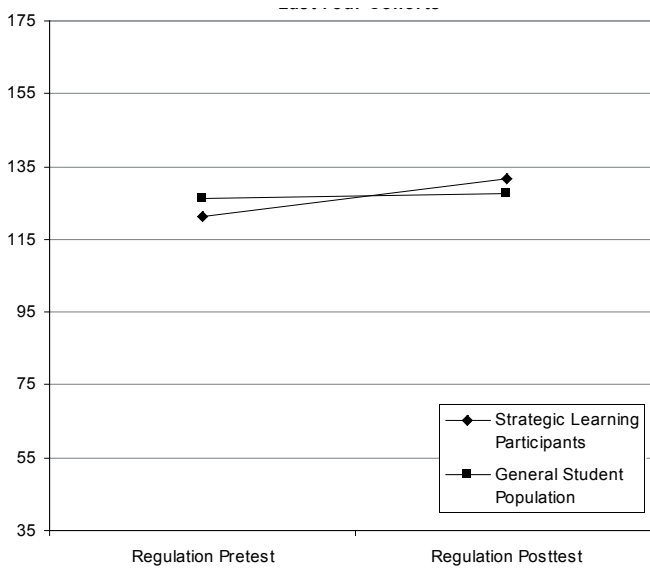*Figure 3 Regulation Pretest to Posttest Gains Made by the Last Four Cohorts*

Table 2 Descriptive Statistics for Regulation Subscale: Participants versus General Student Population

Cohort	N	Pretest Score	Pretest SD	Pretest CI	Posttest Score	Posttest SD	Posttest CI
				Metacognitive Regulation			
Learning Strategies Participants	78	121.29	18.28	117.23 to 125.35	131.85	16.28	128.24 to 135.46
General Student Population*	1463	126.14	15.221	125.36 to 126.92	127.57	17.327	126.68 to 128.461

* Time between the pretest and posttest for the general student population is 18 months.

than the score on the Regulation subscale obtained from the general population ($t(809)$ = 2.418, p = .016, d = .288; see Figure 3 and Table 2). In other words, students who participated in the strategic learning course *started* with Regulation scores significantly lower (.288 pooled standard deviations lower) than the general student population, and *completed the course* with Regulation scores significantly higher than those of the general student population. Importantly, the much lower starting rate at which course participants used strategies to regulate learning gives additional evidence that the strategic learning course provides students with a powerful and beneficial learning experience. Given the lower starting scores of their students on metacognitive regulation, instructors might be satisfied to help students achieve regulation at levels similar to their peers, yet these course participants reached post course levels of regulation significantly higher than peers who did not take the course.

Implications
Results of this study indicate that students enrolled in a postsecondary course combining learning theory with practical application of learning strategies show significant gains in both metacognitive awareness and regulation. Students who took the course made regulation gains significantly greater than the general student population. Most significantly, students with disabilities demonstrated metacognitive gains in both awareness and regulation similar to gains made by students without disabilities. In this case, an intervention had positive results for both students with and without disabilities, demonstrating a good model for postsecondary intervention for students in at-risk groups regardless of disability status. Whereas many skills taught at universities are specific to various fields, students who increase their metacognitive skills gain a critical *foundational* skill set not often taught in postsecondary education. Students with greater metacognitive skills are potentially more adept at higher-level processing, implying greater academic success.

While many universities have implemented programs or courses to promote use of learning strategies, none has thus far reported a course integrating theory with practical strategies. For students who experience academic challenges, we recommend course-based support with the integration of theory and practical learning strategies within the context of the course. Future research should investigate effectiveness of a similar instructional approach with different populations or in a different context. Future research should also explore longitudinal gains in metacognition and impact on grades for students who take such courses compared to students who do not. Studies that vary the

theory and strategy content related to specific areas of gain (e.g., varying emphasis on specific theories or strategies such as goal setting or information management across different semesters) may gain valuable insight into components of this approach which are most effective in improving student learning. Indeed, such research could be extended to explore the structure of knowledge for all postsecondary learners who experience academic challenges.

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