Long-Term Metacognitive Effects of a Strategic Learning Course for Postsecondary Students With and Without Disabilities

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DEDICATION

   This research is dedicated first to Jon, my husband of nearly 25 years. Without you, I would not be who I am today. In partnering with you, I feel empowered to make a difference in this world.

   This work is dedicated secondly to the students I have served in the past and those students I will serve in the future. This research is only the beginning. I hope to continue learning how to improve your learning experiences.

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ABSTRACT

LONG-TERM METACOGNITIVE EFFECTS OF A STRATEGIC LEARNING COURSE FOR POSTSECONDARY STUDENTS WITH AND WITHOUT DISABILITIES

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This dissertation examined long-term metacognitive effects of participation in a Strategic Learning course for postsecondary students with and without disabilities. The researcher integrated existing archival data from three sources, a university-wide assessment program, assessments of 114 students who took a postsecondary Strategic Learning course, and confirmations of disability status with the office of Disability Services. The ex post facto treatment group of 16 students included only those students who actively participated in the Strategic Learning course during freshman or sophomore years for whom both pre-test and post-test assessment data were available. A comparison group of 16 students was matched on demographic factors, high school GPA, and SAT scores. Both groups were similar in freshman measures of metacognitive regulation. Though the small sample size of 32 total students limited results, the most significant finding revealed that students in the ex post facto treatment group made large gains in metacognitive regulation with greater frequency than expected and students in the comparison group made no large gains

in metacognitive regulation. Furthermore, there were no significant differences between the long-term effects for students with and without disabilities, indicating that students with disabilities benefit just as much from participation in course-based metacognitive interventions.

1. Introduction

The population of students attending postsecondary education is growing and changing. With those changes, universities are facing challenges to address needs of varied learners. This study investigated the long-term effectiveness of one approach to meet the needs of struggling postsecondary students, and especially the needs of one specific audience of students, those with disabilities.

Background and Setting

Enrollment in postsecondary education grew tremendously over the past several decades and with such growth came changing demographics. According to 1940 census data, 1.5 million Americans reported enrollment in some form of college education, and 6% held at least a bachelor's degree. By 1990, 17.9 million Americans reported enrollment in college, and 20% held at least a bachelor's degree (U.S. Census Bureau, 1990). By 2007, 27% of Americans reported earning a bachelor's degree or higher (U.S. Census Bureau, 2007a). Of those enrolled in 2007, 34% were minority students (U.S. Census Bureau, 2007b) compared to 29% of those enrolled in college nearly a decade earlier and 16% two decades before that (U.S. Census Bureau, 1999). Just over 10% of college students in 2007 came from families earning less than $20,000 per year (U.S. Census Bureau, 2007c). Furthermore, while disabilities may have been a barrier to college learning in the past, an estimated 10% of college student populations today may

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have disabilities that interact with learning (McGuire & Scott, 2006). Across recent decades, American colleges and universities experienced dramatic growth in enrollment with increasingly diverse students coming to college, reaching across such barriers as race, poverty and disability.

Values of the College Experience

To some, a college education may be part of the "American Dream" of bettering one's circumstances. Certainly, one incentive for pursuit of postsecondary degrees is the income potential afforded by such credentials. Census data from 2007 reports that those with bachelor's degrees earned an average of $46,277 per year compared to high school graduates who earned an average of $26,712 per year. Furthermore, only 4% of individuals holding bachelor's degrees reported incomes below the poverty level, while 42.7% of individuals who attained less than bachelor's degrees reported incomes below the poverty level (U.S. Census Bureau, 2007a). Researchers demonstrated that earning a bachelor's degree contributes more toward economic status than other factors (Grubb, 1992; Pascarella & Terenzini, 1991). Evidence demonstrates that, as a group, college graduates experience economic earning power as one benefit of postsecondary education.

Other values of a college education exist beyond employability or earning power. College success includes outcomes of interest within and beyond the college years. Refining the meaning of college success depends somewhat on underlying values from expanding cutting-edge knowledge through research, pursuing practical outcomes, such as technical skills or employability and future income, to more formative values of student development as life-long learners or citizens. Measures of college success,

therefore, may vary from retention or degree completion to measures of engagement in research or volunteerism to various measures of academic performance. While published mission statements communicate university values to a degree, university values may be further demonstrated by availability of student services, funding allocations to those various student services, and outcomes measured by the service providers.

Learning valued by students and faculty sometimes differs. In a qualitative study of what learning postsecondary students most value, Walker (2008) grouped responses into categories of content, academic skills, and life skills. Some commonality existed in academic skills listed by student respondents in the two separate years studied. In both years, students listed skills in organization, studying, writing, reading, information literacy, and time management. Faculty values of student learning may vary across content areas and types of institution, but may be evaluated through various organizations and studies. Various accreditation agencies assess colleges and universities on a number of student outcomes, but those vary by state and by association (Nettles, Cole, & Sharp, 1997). A national collaboration through the U.S. Department of Education, the National Postsecondary Education Cooperative established a taxonomy of twelve postsecondary student outcomes, which included communication and computational skills, higher order cognitive and intellectual development, content learning, educational success. They made recommendations for including assessment of such student outcomes to inform university policy. In so doing, they strongly encouraged tracking longitudinal value added for specific student outcomes (Terenzini, 1997). A study of student engagement resulted in seven key recommendations, among those to make student success a shared

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responsibility, to feature student success in guiding missions of the university, and to invest in student learning supports and opportunities (Kuh, 2005).

Achievement Gaps in Postsecondary Education

Despite increasing diversity in postsecondary enrollment, gaps exist between enrollment and college completion rates for both race and socio-economic status. In recent years, over half of high-income students completed postsecondary degrees within six years while approximately one fourth of low-income students did so (Terenzini, 1997). Despite rising numbers of low-income degree completers, the gap between high-income degree completers and low-income degree completers nearly doubled between 1970 and 2005. Demonstrating the need for targeted student support, 39% of low-income first-generation students took at least one remedial course in college compared to only 28% of all college students (Engle & Tinto, 2008). In a study of learning communities, Engstrom and Tinto challenged universities to close the income gap in degree completion through intentional restructuring of or development of learning supports, including, but not limited to learning communities. In supporting learning, Engstrom and Tinto (2008) strongly emphasize the key value for universities to construct learning environments that connect students with learning supports and foster learning effectiveness of marginalized student populations.

Some suggest focus may need to shift from college enrollment to college completion and the supports needed both before and after college entrance (Venezia, Kirst, & Antonio, 2003). McGuire and Scott (2006) and Gregg (2007) strongly recommended instruction and learning designed around principles of universal design for

teaching and learning that focus on access, engagement, and demonstration of learning in ways, which accommodate varied learning styles, abilities and cultures. Studying similar higher education diversity issues in Great Britain, Northedge (2003) suggested that the role of educators needs to empower students to participate in the broad learning community of a university as well as specific learning communities within content areas. Therefore, university faculty need to explicitly prepare students with skills of listening, reading, and writing, as well as practice with those skills so students may actively participate in their academic development and learning communities. University programs may need to examine patterns of growth and specific demographic changes as part of the strategic plan to assess and plan for learning supports.

Of particular concern in this study are the specific needs of college students with disabilities who may represent one specific type of postsecondary achievement gap. Various studies demonstrate that university faculty feels particularly ill prepared to teach students with disabilities (DaDeppo, 2009; McGuire & Scott, 2006; Trainin & Swanson, 2005). Students with disabilities may face various barriers to success at the universities they attend including limited access to supports, limited academic preparation, and costly disability documentation requirements (Gregg, 2007). These students are among those who enter college with achievement gaps and may be highly at risk for low retention or poor academic achievement. Compounding the academic challenges of a disability, students with disabilities demonstrated an increased risk of struggles with adaptations to college (Adams & Proctor, 2010). Numerous studies demonstrated effectiveness of various interventions and programs to support learning for students with disabilities, but

such studies are strongest at the elementary and secondary levels (Decker, Spector, &

Shaw, 1992; Deshler & Schumaker, 1993; Fuchs, Fuchs, Mathes, & Lipsey, 2000;

Swanson, 2001; Swanson, Carson, Saches-Lee, 1996; Swanson & Deshler, 2003;

Swanson & Hoskyn, 1998; Swanson & Sachse-Lee, 2000; Wolgemuth & Cobb, 2008).

The difference between evidence of intervention effectiveness for students with

disabilities at younger levels and the more limited evidence for students in postsecondary

education highlights the need to know what works at the postsecondary levels for this

specific population. Furthermore, some studies of interventions for postsecondary

students demonstrate that interventions and programs that work for non-disabled students

may not work as effectively for postsecondary students with disabilities (DaDeppo, 2009;

Gregg, 2007). Thus, this specific population of students with disabilities may require

specialized training or support for them to succeed in postsecondary education.

Efforts to Increase Postsecondary Learning Success

As value for postsecondary diversity begins to include students representing

various populations who may be at greater risk of struggling, many postsecondary

institutions offered greater support services. Following a study of first-generation low-

income students, Engle and Tinto (2008) advocated for increased learning supports

ranging from learning communities, to learning centers and programs. In keeping with

current research, Engle and Tinto encouraged university supports to carefully align

support services with academics and help students transfer new strategies into course

application.

Analyzing 30 years of study, Pascarella and Terenzini (2005) revealed that one specific and single approach to improving postsecondary student learning outcomes, such as critical thinking or judgment, is not as effective as a combined effect of complementary experiences that occur throughout the college experience. In their findings, the single greatest contributor to cognitive change in students was their effort, though faculty can make a difference through intentional approaches to engage students meaningfully in their college learning process. They found greater growth in critical thinking for students who learned in integrated programs with strong connections between courses and field experiences or whose learning required them to make connections between specific courses and larger topics. Furthermore, their data indicated that teaching could be effective in development of critical thinking.

In recent years, postsecondary interventions have targeted development of strategies and/or metacognitive development, which can translate across purposes and settings, be maintained, and continue to grow beyond the period of the intervention. Martinez (2008) demonstrated that use of specific metacognitive learning strategies were significantly correlated with self-rated confidence in English reading ability by postsecondary students for whom Spanish was the first language. Self-assessment strategies, interpretation strategies and reading comprehension strategies were all shown to be significant though the explanation of differences were small.

Various researchers demonstrating short-term effectiveness of learning interventions raised concern for long-term effectiveness of those interventions. For example, in a review of studies of effectiveness of college level tutoring, Hock, Deshler

and Shumaker (1999) found no studies addressing longitudinal effectiveness of such practices. They therefore raised the question of whether tutored students could eventually perform successfully apart from tutorial support. The Association of American Colleges and Universities (2006) prioritized one function of general education coursework as developing student capacity to transfer knowledge and skills to different environments and applications.

Statement of the Problem

Achievement gaps are a growing postsecondary priority. Intervening to narrow those gaps requires informed practice of what works in both the short-term and the long-term. Evidence of what works to promote positive learning outcomes for postsecondary learners in general, and specifically for postsecondary students with disabilities, is limited. In particular, evidence of longitudinal effectiveness for improving learning is very limited. This study will investigate effectiveness of one specific approach to building metacognitive regulation for struggling postsecondary students, including students with and without disabilities. A previous study of a Strategic Learning course demonstrated short-term effectiveness in developing metacognitive regulation (Burchard & Swerdzewski, 2009), but no studies were found investigating a course-based approach to building long-term metacognitive regulation. Therefore, this study extended the earlier study to investigate long-term metacognitive effects of a course-based approach at increasing metacognitive regulation in postsecondary students, including those with disabilities.

Rationale

For the purpose of this study, the researcher focused on outcomes affecting academic learning. The researcher did not investigate cognitive expansion of knowledge, but instead studied metacognitive self-awareness of learning and metacognitive self-control over learning. Most importantly, this study focused on gains in metacognitive learning maintained over time.

This study focused on large questions of changing metacognitive learning for postsecondary students, including both students with and without disabilities. The researcher investigated those questions through analysis of data gathered at one university. For the purpose of this study, the researcher identified that university with a pseudonym, Mountain Valley University (MVU). This particular university assessed student learning at four points: (a) prior to starting the freshman year, (b) mid-way through the sophomore year, (c) just prior to graduation within each degree program, and (d) approximately one year following graduation. MVU students are required to participate in the first three assessments and may opt to participate in the alumnae assessment. Such an assessment program creates a body of data, which may reveal longitudinal effects of participation in various programs.

As postsecondary student diversity grows, so must faculty approaches to effective instruction, particularly those approaches targeted at narrowing achievement gaps. If postsecondary education is to move beyond an admission's focus toward properly preparing diverse postsecondary students for academic success, then university faculty

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must draw from evidence of postsecondary learner needs, including the specific needs of students with disabilities.

Purpose of the Study

The purpose of this study is to examine existing data to ascertain long-term metacognitive effects of a postsecondary learning strategies intervention for students with and without disabilities. An informed exploration of this topic begins with recent changes in postsecondary education, including growing interest in the needs of learners with and without disabilities. Investigation of the knowledge base in various constructs of learning informs the methodology of this study.

Research Questions

In investigating the long-term metacognitive effects of a course-based Strategic Learning intervention, the current study asked the following questions:

1. Is there any difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen or sophomores and demographically matched students who do not?

2. Is there any difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course?

3. What are the interrelationships among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use?

4.   Do participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further long-term gains in metacognitive regulation?

5.   For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?

Significance of the Study

A need exists for further research on effectiveness of interventions on the outcome of metacognitive regulation for postsecondary learners. An even greater need exists for investigations of long-term effects of such interventions. Differences found between who takes such a course and who does not can reveal interesting questions to explore further. For example, are there certain factors that could be assessed early in a student's postsecondary career that could predict benefit from Strategic Learning interventions? Findings of long-term gains in metacognitive regulation for those who participate in such a course may encourage development of similar courses at other universities. Examination of interrelationships between factors (achievement goal orientation, demographic characteristics, etc.) may contribute to greater understanding of the development of metacognitive regulation in postsecondary learners. If course participants continue gains in metacognitive regulation beyond course participation, the specific approach to this Strategic Learning course may be recommended as worthy of replication at other universities. If further gains are not made, new questions are raised

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concerning what might enhance long-term benefits of participation in such courses, such as follow-up services.

Importantly, no such studies exist specific to one population of students who may be at high risk of struggling with college-level learning, students with disabilities. Therefore, results of this study add to the limited body of research on postsecondary learning interventions for students with and without disabilities. Any revelation about differential benefit of participation in such a course may be important for disability service providers as they develop appropriate learning interventions and supports for postsecondary students with disabilities. Findings of this study contribute to general knowledge of postsecondary educators and postsecondary disability service providers.

Definition of Terms

The researcher defines the following variables for the purposes of this specific study.

Achievement Goal Orientation—The orientation of a student toward a learning event or experience may influence how the student interacts or processes, and what they take away from the learning experience. Achievement Goal Orientation is one way of categorizing such orientation. For the purposes of this research, Achievement Goal Orientation encompasses the five-construct model demonstrated to be efficacious with postsecondary learners including those with disabilities. In that model, the five orientations are mastery approach, mastery avoidance, performance approach, performance avoidance, and work avoidance (Campbell, 2007; Finney, Pieper, & Barron, 2004; Pintrich, 2004).

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Disability--For purposes of this study, a student with a disability is one who is registered

with the office serving students with disabilities at the university. Such registration

requires current comprehensive documentation demonstrating a substantial limitation to

one or more of life's major activities, including learning (Americans with Disabilities Act

Amendments Act, 2008). Individuals eligible for services include, but are not limited to

students with hearing, visual, speech, psychological, ADHD, and learning disabilities.

Procedures for registration with a disability at this university follow the national

postsecondary model established in by the Association for Higher Education and

Disability (AHEAD), an organization supporting disability services and service providers

in postsecondary education (Shaw, 2005). Though specific guidelines vary depending

upon the disability, all guidelines for registration with a disability through that office

require the following in accordance with AHEAD's model. First, the diagnosing

professional provides a clear diagnostic statement including the date of the most recent

diagnostic evaluation and the date of the original diagnosis. Second, the documentation

includes descriptions of the diagnostic tests, methods and criteria. Third, establishment

of the substantial limitation to a major life activity is essential, including test results and

narrative interpretation concerning impact on one or more major life activities, especially

in relation to the specific context of college. Fourth, the documentation describes current

treatments, accommodations and assistive devices. Fifth, the documenting professional

must describe the expected progression or stability of the impact of the disability over

time, particularly over the next five years. Finally, the credentials of the diagnosing

professional must be clear, and must establish qualifications to document the specific disability.

Learning strategy-- Learning strategies are strategic approaches to learning, not simply study skills (Deshler & Schumaker, 1986; Minskoff & Allsopp, 2003). Instruction in strategies goes beyond remediation or compensation to promote learning awareness and independent control over learning processes and tasks. Learning strategies may be specific, such as a reading strategy for dense texts; or learning strategies may be more general, such as time management. Learning strategies instruction focuses on modifiable learning characteristics, and allows the student to be actively involved in learning processes (Swanson, 1989).

Metacognition--Defined by Flavell (1979) as thinking about ones' thinking, metacognition is divided into two scales, metacognitive regulation and metacognitive awareness.

Metacognitive Awareness—Researchers (Schraw & Dennison, 1994; Schraw & Moshman, 1995) describe metacognitive awareness as including declarative knowledge (including knowing one's strengths, weaknesses and resources), procedural knowledge (knowing strategies and the specific steps in those strategies), and conditional knowledge (understanding when and why to use specific strategies).

Metacognitive Regulation—The dependent variables in this study are scores or gains on a measure of metacognitive regulation. Metacognitive regulation involves intentional control over the act of learning. Those actions encompass planning, information management (including internal and organizing of new learning), monitoring (checking

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one's understanding and strategy use during a learning event), debugging (fixing what is not working in a learning event), and evaluation (Schraw & Dennison, 1994; Schraw & Moshman, 1995).

Self-regulation—Self-regulation grew out of the study of metacognitive regulation. Studies of self-regulation include students regulating behaviors and emotions in various tasks or contexts, not limited to learning situations (Zimmerman, 1989).

Self-regulated learning-- Zimmerman and others applied self-regulation studies specifically to learning environments and tasks. Zimmerman defines self-regulated learners as students who are motivated about their learning, exhibit behaviors of control over their learning, and engage in metacognitive regulation of their learning (Zimmerman, 1989; Zimmerman, Bandura and Martinez-Pons, 1992).

Strategic Learning course—The independent variable in this study is participation in a Strategic Learning course. This specific course integrated instruction in learning theory, development of personal awareness, and explicit training in learning strategies. Students earned three elective credits for course participation. Though open to all students at the university, the course was specifically marketed to various populations of students with special needs, such as students with disabilities, students on academic probation, student athletes, and students on a full scholarship for low socio-economic status.

Assumptions

The researcher approaches this study with several assumptions.

1. The students provided accurate answers to self-rating scales.

2. The students accurately interpreted the questions on each of the self-rating scales.

3. The course participants self-selected participation in the course.

4. All students had the same opportunities to access learning supports beyond this course-based intervention.

Summary

In recent decades, the number of students pursuing postsecondary education has grown tremendously. By 2007, 27% of Americans reported earning a bachelor's degree or higher (U.S. Census Bureau, 2007a). A postsecondary education adds social value such as increased earning potential (Grubb, 1992; Pascarella, & Terenzini, 1991). With growth in numbers, postsecondary institutions are also experiencing growth in diversity, including but not limited to students of varied socio-economic status, students of minority backgrounds, English language learners, and students with disabilities. McGuire and Scott (2006) estimate that 10% of postsecondary learners have some sort of disability that affects learning.

Despite increasing exposure to and experience in teaching students with disabilities, research has demonstrated that postsecondary faculty members feel ill prepared to teach and accommodate students with disabilities (McGuire & Scott, 2006; DaDeppo, 2009; Trainin & Swanson, 2005). Postsecondary students with disabilities may have specific needs beyond those of non-disabled students (Trainin & Swanson) that may not always be met through interventions found to be effective with general populations (DaDeppo; Gregg, 2007).

Recent research promotes explicitly addressing cognitive and metacognitive development of postsecondary learners. Engle and Tinto (2008) and Kuh (2005) strongly encourage postsecondary institutions to invest in student learning supports and opportunities. Some researchers advocate switching focus from supporting diversity in entrance to college to supporting success within and success in progressing out of college (Venezia, Kirst, & Antonio, 2003). Numerous researchers demonstrate the importance of addressing the specific needs of postsecondary students with disabilities with intentional and deliberate approaches (DaDeppo, 2009; Gregg, 2007; McGuire & Scott, 2006; Vogel, Leyser, Wyland, & Brulle, 1999).

Furthermore, when prioritizing development of characteristics of life-long learning, practices effective in the short-term may not be enough. The Association of American Colleges and Universities (2006) prioritized transfer of knowledge and skills to multiple environments and applications. To meet the challenges of expanding access to postsecondary education, especially for students with disabilities, it was important to investigate what postsecondary interventions make a long-term difference for students with and without disabilities.

2. Literature Review

The purpose of this study is to examine existing data to ascertain the long-term metacognitive effects of a postsecondary learning strategies intervention for students with and without disabilities. Research in the past two decades exposes the importance of specific learning characteristics for postsecondary student learning outcomes, such as grades, retention and metacognitive gains. Learning factors found to be important to learning outcomes include academic goal orientation, awareness of learning, and use of learning strategies.

Needs of Postsecondary Students

Enrollment in postsecondary education is growing, including enrollment for students who may struggle with the challenges of postsecondary learning. University students may need support or training in order to progress successfully through programs and graduate. Research on what programs or interventions improve learning outcomes for postsecondary learners suggest that targeted interventions may support learning success especially for struggling students. Pascarella and Terenzini conducted research for over 30 years on the needs of postsecondary students (1991, 2005), which emphasized such priorities as developmental programming and especially student engagement. Vermunt (1998) demonstrated that postsecondary students do not simply become better learners through the process of maturity, but do respond to interventions aimed at

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improving learning. Other researchers demonstrated the connections between learning strategies use and other factors such as executive functioning or grades (Petersen, Lavelle, & Guarino, 2006; Proctor, Prevatt, Adams, Hurst, & Petscher, 2006). Research on learning processes and outcomes for postsecondary students with disabilities is limited, but existing research strongly supports interventions focusing on metacognitive regulation and/or learning strategies (McGuire, Hall & Litt, 1991; McGuire, Norlander, & Shaw, 1990; Yost, Shaw, Cullen, & Bigaj, 1994). Investigations of learning outcomes for postsecondary students with and without disabilities are typically limited to immediate results with limited evidence of program benefit to students over extended periods of time. Some researchers are beginning to examine long-term effects of learning interventions (i.e. Allsopp, Minskoff, & Bolt, 2005; Justice, Rice, Warry, 2009), but long-term research at the postsecondary level is quite limited.

Postsecondary Learners

Following their first 20 years of study on postsecondary learners, Pascarella and Terenzini (1991) concluded that interventions could make a difference in positive long-term outcomes of cognitive growth for postsecondary students. Furthermore, they concluded that those positive outcomes did not occur just because the students were maturing or were enrolled in college. Pascarella and Terenzini suggested that instructional interventions, including such interventions as instruction in learning strategies, might significantly enhance the academic and psychosocial engagement of postsecondary students, which in turn contribute toward the positive long-term benefits of cognitive growth.

Historically, struggling postsecondary students accessed content specific tutoring. Studies of college tutoring raised ethical concerns primarily related to the ability of tutored students to perform independent of support, employ self-regulation for learning apart from accountability relationships, and problem-solve when faced with challenging academic tasks (Carlson, 1985; Hock, Deshler, & Shumaker, 1999). As tutoring was questioned, researchers directed attention to studies of interventions that developed greater self-regulation and independence. In a study of 717 total students, including both non-traditional adult distance-learning students and typical on-campus undergraduate students, students did not simply mature over time in development of self-regulated learning processes. The implications discussed included explicit instruction in self-regulated learning strategies, higher order thinking and processing strategies, with emphasis on intentionally transferring control of learning from the instructor to the student (Vermunt, 1998).

The National Survey of Student Engagement (NSSE) revealed annual patterns in postsecondary student needs. The 2006 survey revealed the importance of student engagement, and gender differences with males interacting with faculty more easily than females. Students who needed to work also interacted less frequently with faculty. Faculty and student responses concerning academic expectations revealed a gap with faculty expecting much higher levels of performance than students expected of themselves. Students with the highest expectations of themselves also valued deeper levels of reasoning and reflection. Results also indicated that students of lower socio-economic status with greatest incoming gaps were less likely to engage in campus

activities likely to narrow those gaps (National Survey, 2006). The 2007 NSSE demonstrated that greater levels of high school academic preparation were strongly correlated to intention to graduate (National Survey, 2007). The 2008 NSSE discussed the value of taking assessment beyond gathering data to develop university programs to promote active engagement for all students. Most importantly, the surveyors asserted that universities must evaluate the range of needs, not just the mean of survey results, with intentional efforts to support struggling students, especially toward success through the first year of college-level learning, and promotion of reflective writing (National Survey, 2008).

Williams and Worth (2001) synthesized research to examine specifically the relationship between critical thinking skills and college success. Most research they found on this learning construct was in the areas of math, science or psychology. Most interventions they studied involved critical thinking strategies embedded in content courses, though that approach typically resulted in weak gains. Some studies they reviewed were specifically for development of critical thinking, typically part of general education curricula. They reported that critical thinking studies consistently reported stronger outcomes, and that critical thinking may be better used as a predictor of college success than as an outcome of learning interventions; however, they added that courses specifically targeting development of learning are the best way to change critical thinking.

Petersen, Lavelle, and Guarino (2006) investigated study strategies and learning strategies in relationship to executive functioning in a sample of 81 psychology students.

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Among other findings, lower scores in executive functioning were correlated with struggles with anxiety, concentration, time management, and test-taking strategies. Petersen et al. suggested that executive functions such as planning and decision-making are important components of most learning strategies, and self-regulated employment of strategies. Furthermore, they suggested that weaknesses in executive functioning lead to weaknesses in employment of self-regulatory learning strategies.

When comparing study skills of 43 struggling college students with those of 220 typically achieving peers, Proctor, Prevatt, Adams, Hurst, and Petscher (2006) found that students with lower GPAs also demonstrated lower use of learning strategies. Students with higher GPAs demonstrated greater concentration strategies, higher motivation, stronger strategies in reading for main ideas, and stronger test-taking strategies. Thus, Proctor et al. demonstrated strong connections between specific types of learning strategies and academic performance as measured by grades.

Postsecondary Learners with Disabilities

In the past decades, institutions of higher education served increasing numbers of students with disabilities (Janiga & Costebader, 2002; Yost, Shaw, Cullen, & Bigaj, 1994). Many disabilities continue throughout the lifespan and do affect college students (Kato, Nulty, Olszewski, Doolittle, & Flannery, 2006; McGuire, Norlander, & Shaw, 1990), thus, creating new teaching challenges for postsecondary institutions. In 1990, Hughes and Smith called for empirical research to establish effective interventions and accommodations for this population. In 1994, Yost et al. surveyed postsecondary disability service providers at 510 universities across North America. Their results

established the early growth in programming designed specifically for that population, but programming varied from new approaches to specific accommodations to support groups to beginning efforts at learning supports.

McGuire, Hall, and Litt (1991) studied the needs of 40 postsecondary students with learning disabilities and revealed that 60% of the students reported needing some degree of training and support in learning strategies. Two decades ago, Nelson and Lignugaris-Kraft (1989) conducted a literature review concerning postsecondary education for students with learning disabilities. In that review, they called for research on services and interventions effective toward outcomes of performance or retention. Mull, Stillington, and Alper (2001) synthesized the literature on postsecondary education for students with disabilities and determined that 65% of the literature recommended explicit training in learning strategies covering a number of skill areas such as time management, memory strategies and organizational strategies. They called for research on the effectiveness of programs and interventions for postsecondary students with disabilities and studies to investigate if interventions that work at the secondary level would also work at the postsecondary level.

Various researchers have studied needs of postsecondary students with learning disabilities. Researchers and disability service providers called for more agreement in eligibility standards for identification of learning disabilities for accommodations and services (Nelson & Lignugaris/Kraft, 1989; Shaw, 2005). Based upon studies, various researchers recommended services including case management, counseling, specialized advising, academic accommodations, policy flexibility, tutoring, and transition

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programming (Gajar, 1992; Nelson et al., 1989; Vogel & Adelman, 1992). Following a review of 20 years of research on postsecondary education services, Hughes and Smith (1990) called for increased research on educational supports, specifically in support of reading, writing, math and learning foreign languages. Barga (1996) and Shaw (2005) advocated for expansion of educational services such as strategy development programs as well as greater universal design in instruction and development of self-advocacy skills. Shaw's study eventually became the basis for establishment of 90 national performance standards by the Association of Higher Education and Disability including program assessment, support for student development in learning and self-determination, and partnerships with faculty (Shaw, Brinkerhoff, Kistler, & McGuire, 1991).

Proctor et al. (2006) compared learning strategies used by 79 postsecondary students with disabilities to those used by 139 students without disabilities. In general, the students with learning disabilities scored lower on the measures of learning strategy use than did their non-disabled peers. This study was part of their larger study comparing learning strategies use of struggling learners with that of typically achieving students. Not all students with learning disabilities were struggling students, yet, students without disabilities scored higher in concentration, information processing, motivation, selecting main ideas, and use of test-taking strategies. Students with learning disabilities did demonstrate higher use of study aides. This aspect of their study demonstrated that the learning strategies weaknesses were similar between students with learning disabilities and struggling students without learning disabilities. Further research is needed concerning the effectiveness of specific learning strategies and learning strategy

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programs. The studies thus far indicate a need for further learning strategies

interventions targeting postsecondary students with disabilities.

<p align="center">**Achievement Goal Orientation and Metacognition**</p>

Teachers may be able to change not only the content knowledge of students, but

also their ways of learning. Learning is quite complex, impacted by varied contributing

factors and resulting in various outcomes. Two factors demonstrated to be significant in

both the contribution to learning and the outcomes of learning are a student's orientation

to learning and the student's metacognition.

Achievement Goal Orientation

It may be wise to consider motivation factors, specifically orientation to academic

learning, when assessing effectiveness of interventions for postsecondary students. Goals

help situate an academic pursuit by connecting a student's motivations and plans for the

future with specific academic tasks. Pintrich (2000) developed a frequently used concept

of academic motivation, which describes academic motivation in terms of orientation

toward achievement goals across two interacting constructs. First, a student may be

motivated either internally or externally. A more internal motivation is termed mastery

while a more external motivation is termed performance. Students may also be motivated

to work towards positive consequences or negatively to avoid negative consequences.

Working toward a goal is an approach motivation style while avoiding consequences is

an avoidance motivation style.

Interacting, these motivational factors create five distinct types of achievement

goal orientation: mastery approach, mastery avoidance, performance approach,

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performance avoidance, and work avoidance (Pintrich, 2000). An individual who is primarily motivated by mastery approach goal orientation is most motivated by internal appreciation of the learning process, may desire to learn more than required, and frequently pursues learning independent of requirements. When mastery avoidance goal orientation drives a student, the student may enter a new learning situation seeking to prevent loss of skill, such as taking a course in an area of previous learning. Students with performance approach goal orientation may be motivated by good grades, praise, or positive feedback in valued relationships. Conversely, students with performance avoidance goal orientation are typically more motivated to avoid poor grades, disapproval, or negative feedback. Students motivated by work avoidance want to extend as little effort as possible. All types of achievement goal orientation may have positive impact on academic performance, though studies demonstrate most positive effects on learning for mastery approach and performance style orientations (Harackiewicz, Barron, Pintrich, Ellit, & Thrash, 2002; Wolters, 2004), and less support for benefits of mastery avoidance goal orientations (Pintrich & Blazevski, 2004).

When specifically researching effects of performance style orientations for college-aged populations researchers have examined the frequently competitive nature of college learning and grading which may increase the benefits of both performance orientations for this age group (Harackiewicz et al., 2002). Grant and Dweck (2003) investigated the impact of performance goals and their various interactions with other components including college student performance. Among numerous conclusions, the researchers concluded that competitive strivings "buffer" students when faced with

failures or setbacks and outcome focused goals increased help-seeking behaviors. Goals specifically directed toward learning did predict higher intrinsic motivation, course grade and deeper processing (Grant & Dweck, 2003).

In an investigation of the effectiveness of a pilot program for postsecondary students with serious learning disabilities, Bireley and Manley (1980) determined motivation was one key factor in student success. Motivation was also identified as a key component in predicting student success through a qualitative study of disability service providers' perceptions of student characteristics that contribute to success (Hicks-Coolick & Kurtz, 1997). In a review of achievement goal orientation research, Pintrich and Blazevski (2004) concluded that the body of research provides strong evidence that the research on achievement goal orientation, which is most applicable to students with disabilities, include connections with strategy use and metacognition, though he stresses the need for further research on this topic with populations of students with disabilities.

Metacognition

Educators commonly define metacognition simply as *thinking about thinking* or *learning about learning,* yet metacognition is much more complex than those simple explanations. Nelson (1999) defines metacognition in relation to cognition and as a subset of cognition, because it requires awareness or somehow controlling one's own cognition. Metacognition involves awareness of who one is as a learner, including strengths, weaknesses, resources, processes of learning, and conditions in which specific processes work or do not work for the learner. Metacognition also involves intentional control or self-regulation over learning behaviors.

Metacognition was most notably explained as a learning construct by Flavell (1979) when he defined metacognition as being composed of two primary constructs of metacognitive knowledge and metacognitive experiences. He presented metacognitive knowledge as including knowledge of person, task and strategy. He presented metacognitive experiences as learning situations in which the learner carefully processes conscious thinking, such as during a novel learning experience or a challenging problem-solving situation. Metacognitive experiences could lead to goal revisions, revisions to metacognitive knowledge, and activating cognitive strategies. Flavell's model is foundational to the view of metacognition investigated in this study.

It is important to note the differentiation between metacognitive regulation and self-regulation, self-regulated learning or strategy use. Self-regulation is an individual's ability to self-manage behaviors or emotions. Self-regulation may or may not be applied to the actions of learning (Zimmerman, 2000). Self-regulated learning requires application of that self-management to learning (Pintrich, 2004; Zimmerman, 1989; Zimmerman & Kitsantas, 2005). Strategy use is one way individuals may employ self-regulation or self-regulated learning. Metacognitive regulation includes, but is broader than self-regulation, self-regulated learning, and strategy use. While components of metacognitive regulation encompass self-regulation, self-regulated learning, and strategy use, metacognitive regulation also encompasses reflective self-evaluation, and planning in addition to employing self-regulatory or even strategic learning behaviors (Flavell, 1979; Lajoie, 2008; Schraw & Moshman, 1995).

Experts divide knowledge or awareness of learning into three components of declarative knowledge (awareness of one's strengths, weaknesses and resources), procedural knowledge (steps for actual strategies) and conditional knowledge (when and why to use particular strategies). Planning, information management (organization of new information), monitoring (checking for understanding and strategy success during a learning event), debugging ("fixing" what strategies are not working) and evaluation (checking for strategy success after a learning event) make up the five components of metacognitive regulation. These same experts established valid and reliable measurements for both metacognitive awareness and regulation (Pintrich, 2002; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

In a study of 178 juniors, seniors and graduate students in a teacher education program, Young and Fry (2008) demonstrated a strong correlation between metacognitive knowledge and metacognitive regulation. They further demonstrated that 20% or more of the variance in students' GPA's could be explained by the total Metacognitive Awareness Inventory (MAI) score, and separate scale scores for metacognitive awareness and metacognitive regulation. In fact, the MAI and metacognitive regulation scale also explained 19% and the metacognitive awareness scale explained 20% of the variance in final course grades for the specific teacher education courses in which the instrument was administered. Though there was not a significant difference in the way undergraduates and graduates rated themselves on the metacognitive awareness scale, there was a significant difference between self-ratings by graduates and undergraduates on the metacognitive regulation scale. This supported

Young and Fry's conclusion that this instrument should distinguish between effective learning regulation of more and less experienced students. In fact, because the scale was so strongly correlated to course grades, they suggest this instrument could be used by college instructors as a pre-screening tool to identify students in need of learning supports.

Since defining those constructs, various studies explore how development occurs in metacognitive awareness and metacognitive regulation of postsecondary learners. The interest in metacognition in connection with needs of postsecondary students with disabilities has grown more consistent since a 1994 survey of 510 postsecondary disability service providers in North America revealed that the term "metacognition" was unfamiliar to many respondents at that time (Yost, Shaw, Cullen, & Bigaj, 1994).

Metacognitive awareness. Gamache (2002) advocated teaching strategies and skills individualized to match the learning styles and needs of the individual learners. He proposes that the first step in such a constructivist approach is for the student to assess personal *assumptions about learning* and then move to self-reflection. He encourages teaching theory in conjunction with specific individualized active strategies, without so much emphasis on the theory as to create just one more thing the student needs to learn. This approach requires students to understand their individual learning needs and to become more active in the development of self-regulatory strategies.

In a study of freshman learning experiences, Dahlin (1999) demonstrated that students feel greater metacognitive awareness in learning especially when given opportunities to apply or experience new learning. Freshmen in general recognize a

gradual change in awareness of their own learning, with a process of actively participating in constructing their new knowledge. The freshmen reported a progression in their metacognitive awareness from a more external awareness of such things as resources to a more internal awareness of themselves as learners.

Nietfeld, Cao, and Osborne (2005) prompted 27 teacher education students in a psychology course to use metacognitive monitoring during each of four tests. Without explicit training in monitoring strategies, variance in accuracy was best explained by item difficulty and incoming ability of the students. Struggling students recognized their academic weaknesses, but did not seem to know what to do to address those weaknesses.

Various studies have shown that students develop metacognitive awareness in response to interventions specifically targeting awareness. For example, researchers demonstrated connections between students' metacognitive awareness of vocabulary and academic performance as measured by grades. All students in the studies increased both vocabulary knowledge and awareness of their vocabulary knowledge, but gains were more notable for students with above average grades in English courses (Everson and Tobias, 1998). A 2005 study by Achacosa demonstrated that explicit teaching of error analysis after a test improved student metacognitive awareness, from an awareness of the level of thinking required in a question according to Bloom's taxonomy, to recognizing the source of learning required by a question, to awareness of processes to be used in the future (Achacoso, 2005).

Metacognitive awareness holds significant benefit to postsecondary students with disabilities. Participants in a transition course studied by Chiba and Low (2007) reported,

among other factors, a statistically significant understanding of learning style, and strengths and weaknesses. These researchers demonstrated that a course-based intervention model improved student understanding and acceptance of disability. Within a study of a critical thinking course, Hanley (1995) determined that metacognitive awareness was significantly related to ratings of both happiness and success.

As a body of research, these studies demonstrate that over time, college students may experience change in metacognitive awareness, a student's ability to assess thinking, know learning strengths and needs, understand available resources, and know strategies and when to use them. More importantly, these studies demonstrate that students with and without disabilities respond positively to measures of metacognitive awareness in response to explicit training designed to improve metacognitive regulation and other learning outcomes.

Metacognitive regulation. Postsecondary students with and without disabilities benefit from development of metacognitive regulation. King (2004) states that many postsecondary tasks require more than knowledge of strategies, but complex metacognitive regulation to monitor and adjust, especially in new learning situations. She points out that metacognitive regulation is particularly evident in the typical writing process of planning, drafting, revising and editing. King stresses the importance of metacognitive strategies for all college learners. Vermunt (1998) emphasized the importance of process-oriented teaching for instructors who wish to improve student learning. Berardi-Coletta, Buyer, Dominowski and Rellinger (1995) encouraged instructors to embed metacognitive processing during instruction in problem-solving

tasks in order to improve generalization of learning to new tasks. Recent research has demonstrated that higher levels of metacognitive regulation are a significant predictor of grades for students with and without disabilities (Proctor, Prevatt, Adams, Hurst, & Petscher, 2006; Ruban, 2000).

A key difference between postsecondary students with and without learning disabilities is the indirect path through self-regulatory strategies from perceived usefulness of strategies to grades. Ruban, McCoach, McGuire, and Reis (2003) demonstrated use of self-regulated learning strategies has a larger positive impact for students with learning disabilities than it does for students without disabilities. Similarly, a 2005 study by Trainin and Swanson suggested a compensatory path through successful regulatory strategies in academic success. These researchers explored use of metacognitive strategies in compensation for phonological processing deficits. Their study found statistically significantly higher regulation of learning by students with disabilities than by students without disabilities. Results of this particular study demonstrated that students with disabilities who also had high strategy use also demonstrated higher achievement as measured by grade point averages than did peers without disabilities. Because these researchers found that students with learning disabilities benefited more from high strategy use than students without disabilities, they suggested a possible compensatory value of regulatory learning strategies in the learning process.

Many cognitive or socially situated disabilities include disorders of executive functioning or may actually be characterized by a struggle with various aspects of

executive functioning. Executive functioning includes but is not limited to, the ability to manage life, to make decisions, or to set goals. Garner (2009) demonstrated that three aspects of executive functioning predicted metacognitive strategy use in college students with disabilities. In fact, all five tested components of executive functioning, strategic planning, impulse control, organization, motivational drive, and empathy explained the variance in scores on metacognitive regulation. One conclusion drawn from this study is that to change metacognitive strategy use in college students with disabilities, it seems wise to address executive functioning explicitly.

Interactions between Achievement Goal Orientation and Metacognition

A long-accepted model of metacognition proposed interactions among metacognitive knowledge (awareness of one's learning processes), metacognitive experiences (practices of conscious regulation of learning, especially self-monitoring), goals, and strategies (Flavell, 1979). Various studies have begun to examine inter-relationships between the constructs of metacognitive awareness and regulation as well as inter-relationships between achievement motivation and constructs of metacognition. Numerous researchers demonstrated relationships between external factors such as teaching techniques or interventions, and internal learner characteristics such as strategy use and self-regulation (Ford, Smith, Weissbein, Gully & Salas, 1998; Hall, & Webster, 2008; Hammann, & Stevens, 1998; Vrugt & Oort, 2008; Zimmerman, 1989). Jakubowski and Dembo (2004) assessed self-regulation related to beliefs about identity and motivation to change academic behaviors. Assessment of motivation to change was based upon the assertion that students must be motivated to change academic behaviors

in order to become self-regulated. Their study targeted measurement of pro-active

learning strategies, which require contemplation and effort and focus on organizing

external information. Results showed that students who reported stronger identity also

reported higher self-regulation scores. Additionally, students with stronger motivations

toward change scored higher on self-regulation (Jakubowski et al., 2004). In a study of

non-traditional adult postsecondary learners, Spitzer (2000) demonstrated significant

interactions between self-regulated learning strategies and motivation, self-regulated

learning strategies and GPA, and motivation and GPA.

In the last decade, researchers have begun to explore these questions situated in

specific fields of study. In 1998, two separate studies examined relationships between

learning factors such as motivation and strategy use among psychology students. Ford et

al. demonstrated the importance of various factors including metacognition and mastery

orientation academic goal orientation in developing generalization of learning.

Importantly, in this study, metacognitive activity was the most important learner

characteristic toward transfer of learning (Ford et al., 1998). Braten and Stromso (2005)

examined the relationship between such factors as motivation and strategy use for

postsecondary students in Business and Education programs. These researchers found a

significant relationship between belief about the control of knowledge acquisition and

theories of intelligence. Importantly, the speed of knowledge acquisition was a predictor

of mastery goal orientation for all participants.

Various researchers and theorists have connected motivated goal setting processes

to self-regulated learning. Many studies of metacognitive regulation or self-regulation

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start with the assumption that goals motivate and guide the process of self-regulation (Pintrich, 2000; Zimmerman, 2000). Goal setting has been isolated as an important early factor in processes of self-regulation or metacognitive regulation (Pintrich, 2004; Zimmerman & Kitsantas, 2005).

In a study of postsecondary students, both mastery goal orientation and regulation of cognition were statistically significant predictors of test performance when testing counted for grades. In regression analysis, motivation and regulation of cognition accounted for 39% of variance in performance in the consequential condition. Mastery motivation (desiring to learn intrinsically) and a student's value for the task were predictors of performance in the non-consequential condition and accounted for 40% of variance in performance in the non-consequential condition. An additional difference in the two conditions was the use of strategies, which increased in consequential conditions. Additionally, students with higher mastery motivation performed more successfully on the non-consequential test. Task value was highly predictive of performance in the non-consequential condition. This study is significant in connecting the interaction between metacognitive regulation and mastery motivation as predictors of performance (Sungar, 2007).

Vrugt and Oort (2008) conducted a study involving over eight hundred first semester university undergraduates, which examined the interacting factors comparing students who were effective self-regulators with those were less effective self-regulators. A path analysis for effective self-regulators found that performance avoidance goal orientation had a small negative effect on metacognition. Conversely, a mastery goal

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orientation had a strong positive effect on metacognition and significant positive effects through metacognition on each of the strategy types examined. Furthermore, the path through strategies involving self-regulation had positive effects on exam scores. For ineffective self-regulators in their study, there was no mediation through metacognition. They concluded that students who focus on mastery goals are naturally more metacognitive in their learning processes (Vrugt & Oort).

A review of studies of learning outcomes for postsecondary students found that older students generally demonstrate stronger interrelationships between use of learning strategies and motivational factors. This review did not make causal conclusions whether this strength in relationship was due to simple maturity, learning experiences, or other factors (Vermunt & Vermetten, 2004). In a study that examined various interrelationships, including metacognitive monitoring, metacognitive regulation and goal orientations, researchers demonstrated that students' individual affective experiences with learning impacted such interactions (Koriat, Ma'ayan, & Nussinson, 2006). In a study that examined interrelationships between various learning outcomes for undergraduate students, including Achievement Goal Orientation (as measured by the Attitudes Toward Learning This Semester, ATL) and metacognition (as measured by the MAI), variables predicting metacognition included performance avoidance, mastery approach, and mastery avoidance. In contrast to previous studies, results in this study demonstrated that metacognition did not contribute to performance outcomes; however, in this study, performance was measured by high school and college GPAs, which was discussed as a possible weakness of the study (Coutinho & Neuman, 2008).

A 2008 study by Hall and Webster included postsecondary students with and without learning disabilities. They compared various learning characteristics including aptitude, achievement, executive processing and use of metacognitive skills. In contrast to results of other studies, this study found no significant differences between students with and without learning disabilities in use of metacognitive skills or interrelationships between metacognition and other learning constructs. One significant limitation of this study identified by the researchers was the manner in which participants with learning disabilities were recruited, requiring volunteering and scheduling of multiple appointments. Such recruitment may have excluded students with learning disabilities who struggle most with metacognitive regulation, thus limiting conclusions and generalization of these study results to postsecondary students with learning disabilities who may struggle more with metacognitive regulation (Hall & Webster).

Learning Strategies Interventions

Interventions for postsecondary learners can include strategies related to technology use, self-regulation for non-academic performance tasks, and learning strategies. While some developmental courses may emphasize remediation of skills in reading, writing, or math, few college level courses or programs included instruction in learning strategies that typically involve well-planned systematic approaches to learning. Most learning strategies included steps or stages to increase learning awareness and independent control over learning processes and tasks. Learning strategies may be general, such as time management, or learning strategies may be more specific, such as a reading strategy for dense texts (Minskoff & Allsopp, 2003; Burchard & Swerdzewski,

2009). Learning strategies instruction actively engages students to learn new approaches for specific tasks with measurable outcomes of change in learning processes, characteristics or behaviors (Swanson, 1989).

Foundational research established general frameworks and guidelines for ideal approaches to teaching of learning strategies to postsecondary students with learning disabilities. Weinstein and Mayer (1986) developed an early framework for teaching learning strategies at all levels. Their model included both the role and behaviors of the teacher and the learner. Swanson (1989) synthesized the findings of key articles on learning strategies for all age levels. He concluded that effective strategy instruction includes a continuum from highly structured processes about which the student could be aware, such as modeling and feedback, to automatic strategy use that occurs without the student's awareness, such as monitoring and information processing. Swanson emphasized matching different strategies to different purposes at different times, and metacognitive development.

Deshler and Shumaker (1986) established principles for learning strategies instruction that included an emphasis on modeling during the teaching of strategies. This approach for teaching learning strategies to students with disabilities or those who simply struggle with learning emerged from the Center for Research on Learning at University of Kansas and is known as the Strategic Instruction Model (SIM) (Deshler & Lenz, 1989; Center for Research on Learning, 2009). For over two decades, the SIM model has been the premier model for teaching struggling students, especially adolescents and older, and especially students with disabilities (Center for Research on Learning, 2009; Deshler &

Schumaker, 1993; Deshler, Schumaker, & Lenz, 1984; Deshler, Schumaker, Lenz, & Ellis, 1984).   The SIM model requires training for instructors with strong emphasis on fidelity of practice. Their 5-step model for teaching learning strategies move through (a) pretest and make commitments, (b) describe, (c) model, (d) controlled practice, and (e) feedback (Center for Research on Learning, 2009; Tollefson & Neduchal, 2000). Furthermore, students learning strategies taught through the SIM model learn ways to remember the steps of each strategy, typically through mnemonic devices and steps to regulate learning.

Research Base of Learning Strategies Use

Students may employ some degree of learning strategies without explicit training or prompting. One study evaluated how students use strategies differently based upon their perceptions of course difficulty. Lynch (2008) investigated how students employed strategies in postsecondary learning, specifically in courses the students considered most difficult. In those courses, students rated higher uses of elaboration, rehearsal, and organization. Lynch encouraged faculty to intervene early with learning strategy instruction in the freshman year, but continued emphasis on learning strategies specific to content, especially within core courses in a major program of study.

Several studies emphasized the need for learning strategies training for postsecondary students with learning disabilities (Brinkerhoff, 1996; Brinkerhoff, Shaw, & McGuire, 1992; Hicks-Coolick & Kurtz, 1997; Siperstein, 1988). Unfortunately, a national study of postsecondary disability services found that only 47% of disability service programs offer any training in metacognitive thinking, even less in such common

strategy areas as memory, test-taking strategies, and time management. In fact, though they stated generally high value for training in self-advocacy, speaking up for one's rights and needs, the participants of this study reported relatively low engagement in training students in component strategies such as listening, and communication. Though disability service providers spoke of empowering students, this study revealed that 71% of disability service providers believed they should correct papers for students with disabilities (Yost, Shaw, Cullen, & Bigaj, 1994), perhaps reflective of the occasional mismatch between values and actions in service fields.

Kirby, Silvestri, Allingham, Parrila, Rauno, and La Fave (2008) demonstrated that postsecondary students with dyslexia reported weaker employment of strategies for selecting main ideas, and test-taking strategies, with students with disabilities performing up to two standard deviations below the mean. The lower scores in selecting main idea and test-taking strategies also explained 25% or more of the variation in reading rate and reading comprehension. In contrast, the students with disabilities reported stronger use of study aids, and time management, indicative of students with dyslexia learning more compensatory strategies to attain postsecondary levels of learning. Furthermore, they call for specific interventions to explicitly train students with dyslexia in specific learning strategies in such areas as reading comprehension, note-taking and test-taking (Kirby et al., 2008).

Results confirmed similar findings in a study comparing learning strategy use of postsecondary students with learning disabilities, ADHD, or no disability (Reaser, Prevatt, Petscher, & Proctor 2007). These researchers found differences in strategy use

between all three groups. Students with learning disabilities demonstrated higher use of study aids than students with no disabilities. Students with ADHD demonstrated lower scores than students without disabilities in strategy uses of time management, concentration, information processing, selecting main ideas, self-testing and test-taking. This study also found that students with ADHD were less effective in strategy use than peers with learning disabilities, with students with ADHD scoring lower in time management, concentration, selecting main ideas, use of study aids, and test-taking. Thus, this study demonstrated that postsecondary students with disabilities may have weaker learning strategies use in a number of areas than students without disabilities. Furthermore, students with ADHD may have even weaker strategies use than students with learning disabilities.

Numerous researchers also emphasized the importance of explicit training in learning strategies with fading support to levels of independence and generalization. They noted that students with learning disabilities are less likely to develop strategies without explicit training and are even less likely to generalize strategies to new tasks or environments (Brinkerhoff et al., 1992; Brinkerhoff, 1996; Minskoff et al., 2003; Swanson, 1989; Weinstein et al., 1986). Various studies demonstrated the connection between successful strategy use and academic success for postsecondary students with learning disabilities (Minskoff, Minskoff, & Allsopp, 2001; Ruban et al., 2003). Swanson (1989) concluded that while strategies that worked for students with disabilities may be helpful to students without disabilities, strategies found successful for students without disabilities were not necessarily effective for students with disabilities. He

cautioned that learning effective strategies use does not eliminate the disability, nor do the strategies automatically lead to levels of expertise or automaticity.

Trainin and Swanson (2005) surveyed college students with learning disabilities to see how they used metacognitive learning strategies. One key finding of this study was a correlation between strategy use for students with learning disabilities and higher grades. In other words, the higher the strategy usage, the higher the grades. They attributed compensation for learning disabilities to use of self-regulatory learning strategies. These researchers also emphasized the importance of individualizing learning strategies to meet the needs of individual learners who have changing needs throughout postsecondary education.

Approaches to Learning Strategies Instruction

Experts have long agreed that the settings in which strategies are learned and employed impact effectiveness on various outcomes for elementary and secondary learners (Putnam, Deshler, & Schumaker, 1993). Unique demands of college-level learning may require students to employ approaches to learning that are revisions of past approaches, more intense uses of past strategies, or completely new strategies. At the collegiate level, instructors seem to teach learning strategies using one of four approaches. Some may teach specific strategies as the focus of short workshops, isolated from content requirements. For example, students may attend a workshop on general time management. Some instructors may teach strategies addressing specific demands of courses or academic programs embedded within courses. This seems quite common in writing or communication courses, but may also occur in other content areas such world

languages. Within individualized programs for struggling students, strategies may be included in various combinations to meet the specific needs and course challenges of individual students. In other cases, universities may offer courses with special focus on a combination of learning strategies.

Learning Strategies Workshops. With growth in the practice of learning intervention programs, and especially the practice of teaching learning strategies to postsecondary students, some researchers questioned effectiveness of learning strategies for postsecondary populations (Barsch, 1980; Bireley & Manely, 1980; Gajar, 1992; Geib, Guzzardi, & Genova, 1981). Yet, more recent research demonstrated effectiveness of various learning strategies for postsecondary learners (Gaddy, 2004; Ruhl, Hughes, & Gajar, 1990; Ruhl, & Suritsky, 1995; & Van Blerkom, Van Blerkom, & Bertsch, 2006). The workshop format facilitates experimental and quasi-experimental investigations of effectiveness of specific learning strategies at the postsecondary level.

In the workshop format, Ruhl, Hughes, and Gajar (1990) taught and studied effectiveness of note-taking strategies. In two examples of such studies, they taught volunteers the pause procedure, requiring a college lecturer to pause for two minutes at three structured intervals, and requiring specific processing and note-taking strategies of students during the lectures and during the pauses. The first of those studies offered foundational empirical evidence of the use of postsecondary learning strategies. In that study, volunteers with and without disabilities listened to three videotaped lectures with outcome measures of immediate free recall, delayed free recall and scores on a multiple choice test one week after each lecture. Researchers collected notes as an additional

outcome measure. After one baseline lecture and assessment, researchers trained half of the participants in the pause procedure, teaching them to discuss main ideas and key points during the pauses and to improve notes based upon those discussions. After one more cycle of lectures, the researchers trained the remaining students in the pause procedure. This study demonstrated use of the pause procedure to be effective for immediate free recall and delayed objective tests. Additionally, students did better on note-taking and two of the outcome measures when using the pause procedure.

In a similar study, Ruhl and Suritsky (1995) compared effectiveness of the pause procedure with effectiveness of a lecture outline and effectiveness of the pause procedure combined with a lecture outline. All participants in this study were undergraduates and graduate students with learning disabilities. In this study, they used outcome measures of free recall in addition to analysis of notes. In order to more accurately simulate helpful interactions during the lecture pauses, the researchers trained students without disabilities to serve as excellent note-taking model participants in each experimental session. Students in the outline group watched a videotaped lecture and were instructed to take notes like normal. Students in the pause procedure group and those in the pause plus outline group watched the same videotaped lectures with three two-minute pauses in which students strategically discussed main ideas and details and improved notes. Results demonstrated significant effect of grouping with students in the pause procedure group demonstrating greater effectiveness in free recall compared to both of the other groups. When analyzing accuracy of notes, both groups who were taught the pause procedure group took superior notes compared with the outline group demonstrating that

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the pause procedure leads students to greater accuracy in the notes recorded. One

limitation of this strategy is that it requires commitment on the part of the instructor to

train students and consistently pause for two minutes at intervals in the lecture; and is,

therefore, not totally in the control of the student.

In a different study investigating effectiveness of postsecondary reading

strategies, Van Blerkom, Van Blerkom, and Bertsch (2006) demonstrated that active

reading strategies were more effective than passive reading strategies. A total of 109

college students were randomly assigned to one of four groups, one in which they read

and copied a passage, one in which they read and highlighted a passage, one in which

they were trained in highlighting and note-taking, and one in which they were trained in

highlighting, note-taking and generating reflective questions. The two strategy groups

with training received 25 minutes of training prior to the reading session. On the 20-item

performance test, students in the highlighting group outperformed those in the copying

group. Students in the note-taking group outperformed students in the copying group.

Better yet, students in the generating questions group outperformed both the copying

group, and the highlighting group. This study demonstrated the value of active reading

strategies and explicit training in such strategies.

Investigating reading strategies specific to a content area, Gaddy (2004)

demonstrated the effectiveness of text-structure strategies for postsecondary students with

learning disabilities for gains in reading comprehension using expository science texts

about life sciences or physical sciences. The researcher randomly assigned forty students

with learning disabilities to either a strategies workshop group or a traditional instruction

group. All participants used a workbook to guide them through the sessions. Students in the traditional instruction group used the workbooks to guide them through traditional questions following each passage studied. Students in the strategies group learned a text-structured strategy as well as a compare-and-contrast strategy that prompted them to find main ideas or similarities and differences and put those in their own words. Participants in this study met individually with an instructor for four separate sessions: session one included pre-testing followed by thirty minutes of instruction on a main idea passage; session two involved thirty more minutes of instruction comparing and contrasting two concepts; in session three, students completed immediate tests; session four occurred two days later in which students completed delayed tests. All students in either group had the option of listening to a tape of the passages as they read. Gaddy measured students' retells of the content of two main ideas and two compare and contrast passages. Results showed that mean gains were large and similar for all participants in immediate measures, but instruction in text-structure strategies did improve reading comprehension on delayed retell of compare-and-contrast passages for postsecondary students with learning disabilities.

Through learning strategies workshops specifically for students with learning disabilities on the campus of a historically black college, Nicholas (2002) investigated effectiveness of a structured writing strategy for expository writing tasks. Researchers randomly assigned participants to one of two workshop groups, each lasting approximately 60 minutes. In the control group, students learned about available supports. In the experimental group, students also learned a structured writing strategy,

guiding them through stages of brainstorming, formatting, and drafting with explicit instruction in each component of writing measured in the study. Measures in this study included self-efficacy, and performance measures of clarity, supporting details, organization, mechanics, and global impression. Students who received training in the structured writing strategy demonstrated mean gains on all subscales of the writing assessment. In comparison, participants in the general group showed a mean decrease on all subscales of the writing assessment. Results revealed a difference in measures of supporting details favoring the strategy trained group but differences in other measured constructs were not significant. Limitations of his study included short-term focus and teaching the strategy separate from content applications; however, Nicholas demonstrated effectiveness of training in a specific writing strategy in improving writing for a population of students typically considered to be dually marginalized in most postsecondary institutions.

Workshop formats seemed to facilitate investigation of specific strategies and access to training with limited time commitment; however, learning strategies taught in workshop formats raise concerns for some researchers. Hadwin and Winne (1996) expressed concern that learning strategies work best the more closely connected they are to course content, but most approaches to learning strategies training are not closely connected to course requirements. Peterson et al. (2006) strongly advise against teaching learning strategies isolated from content requirements. In fact, they raise concern about evidence that students may not transfer learning strategies learned in isolation from content to application in content-specific tasks.

Learning Strategies Embedded in Courses. Some postsecondary strategies programs occur directly connected to courses or academic programs. In one such program, instructors coached at-risk students in critical thinking skills and strategies within introductory level biology courses. Chaplin (2007) tested effectiveness of modeling and coaching active studying across three conditions. Fifteen students in the coached condition were those who sought help from the professor. Twelve students interacted with the professor during labs but did not seek additional help. Fifteen additional students were identified based upon similar initial test scores to those students in the coached condition. Students in the coached condition participated in error analysis of exams, demonstration of active study strategies, and practice for upcoming exams. Learning strategies modeled included concept mapping with vocabulary, illustrating textually described concepts, or writing about illustrated concepts using new vocabulary. Students in the coached group also developed pretests as a group and pre-tested one another prior to exams. Students were encouraged to write test items consistent with knowledge, application and analysis levels of thinking typically tested by the instructor on exams. The coached group improved mean exam performance, scoring within one point of the mean for the students in the lab contact group. Students in the coached group who recognized the levels of thinking required in their error patterns on past exams reported adjusting study strategies accordingly. Adding the control group of those students who engaged in informal contact with the professor during lab times, demonstrated that instructor contact alone was not the factor that made a difference; instead, it was the explicit instruction in error analysis and matched learning strategies.

Chaplin encouraged university professors to help students assess content gaps, and error patterns and then model and coach those students in developing learning strategies, which specifically address those learning weaknesses.

In a quasi-experimental investigation of developing critical thinking skills, seventy-five total students, nineteen with learning disabilities, enrolled in an undergraduate literature course. Each of students received the same content instruction, but varied strategies training depending upon their specific class period. One class period received typical instruction and served as the control group. One class period received explicit training in critical thinking strategies. The third class period received explicit training in critical thinking strategies plus the use of icons, which were symbolic of different types of thought. When evaluating writing samples for evidence of critical thinking, Rose (1997) demonstrated effectiveness of explicit instruction in critical thinking strategies though the addition of icons made no statistically significant difference.

In order to better prepare Masters-level students to problem-solve in the work world, one academic program embedded problem-based learning in coursework. In this approach, the professor lectures less and presents case studies that allow students to activate prior knowledge and apply learned principles in a collaborative group problem-solving fashion. A qualitative analysis of students' comments about this instructional approach revealed some learning strategies benefit such as self-control of the study schedule, and metacognitive benefit of better understanding one's own strengths, weaknesses, and resources (Cheong, 2008).

In recent years, one popular application of learning strategies programs occur within the context of language courses, especially in English as second language courses. Some studies examined the effectiveness of learning strategies in second language learning for postsecondary students. Situated in an English teaching university in China, Zhi-hong (2007) studied use of learning strategies by postsecondary students learning in a second language. Zhi-hong demonstrated that effective use of learning strategies positively benefited the students in reading comprehension in their second language in measures of cognitive strategies, metacognitive strategies and social-affective strategies. In a related study of postsecondary learners of English as a foreign language, researchers found that there is no benefit when instructors employ similar strategies as the students, but there is benefit for academic achievement when the strategies taught by the teacher differ from the strategies employed already by the students. With no other statistical information provided, they reported large effects for the academic benefit of differences in learning strategies used by the instructor and the students. The researchers explained this as expanding the number of strategies the students may ultimately use. These researchers recommended including learning strategies instruction in foreign language instruction toward an objective of effective learning. Furthermore, these researchers encouraged a diagnostic prescriptive approach in which instructors assess the current learning strategies of their students and flex their teaching approaches to embed explicit instruction in strategies in areas of weakness with ongoing assessment and formative feedback on strategy development, not just content learning (Saricoban & Saricaoglu, 2008).

One value in learning strategies training is connectedness to course content. Garner (1990) concluded that strategies must be applied conditionally and are sometimes specific to domains. She called for greater study of setting and context in research on strategies. In an investigation of differences in study activities, investigators demonstrated that strategies most predictive of success in each course were different. Gamache observed that learning skills remediation programs conducted out of the context of course content seemed less effective than those embedded in course content.

Individualized Learning Strategies Programs. One advantage of learning strategies programs is a typically individualized approach. Many universities offering learning strategies training do so through programs targeting either struggling students or students registered as having disabilities. One such program is the SALT program, an early model learning support program for postsecondary students with learning disabilities. An investigation of services through the SALT program primarily supported the value of specialized computer labs for students with learning disabilities including availability of assistive technology (Keim, 1992). Other researchers have demonstrated greater success.

One study compared effectiveness of individualized learning strategies programs with individualized tutoring. Twelve postsecondary students with learning disabilities who struggled with writing were randomly assigned to either the tutoring condition or the learning strategies condition, six in each group. Those in the tutoring group met one hour each week over twelve weeks and received traditional individualized tutoring support from a college instructor experienced in both writing and learning disabilities. Those in

the learning strategies group met one hour each week over twelve weeks and received

individualized explicit instruction in a specific sentence writing strategy with pacing

determined by mastery of each stage of the strategy. Mean gains on the Test of Written

Language were statistically better for participants in the learning strategies group (Faieta,

1989). The promise of this study is that learning strategies training, designed toward

purposes of empowering autonomous effectiveness in learning, appears more effective

than tutoring, which typically has shorter-term focus specific to immediate academic

demands.

Butler (1994), creator of the Strategic Content Learning Model (SCL),

demonstrated support for focusing learning strategies training on the development of

strategic approaches and connection to a student's current course content. In this model,

students do not simply discover strategies, nor do instructors simply teach a selection of

strategies. The emphasis in her model is to promote processes of strategic thinking, goal

setting, and problem solving applied to content. The SCL model teaches strategies, but

more importantly, teaches students to analyze tasks, select strategies, monitor progress,

and adapt strategies to fit specific needs. SCL training requires all students to apply

newly learned strategies and the SCL approach to course content. One qualitative study

of six adult students with learning disabilities emphasized students articulating their

strategies and their process in adapting strategies to specific purposes. Butler concluded

that participants adapted strategies across content areas, sometimes creating a strategy

that worked for more than one class. She concluded that the process of adapting

strategies focused on problem solving, which also promoted students views of the

learning strategies as tools in the problem solving process. She further concluded that requiring students to articulate their problem-solving processes and strategy creation promoted construction of knowledge of strategies. Finally, Butler concluded that teaching a strategic learning process promotes transfer of learning more applicable to learning across task requirements.

In further study of the SCL model, Butler (1995) employed a single subject design with these same six participants, all of whom had learning disabilities. At individual introductory meetings, each selected tasks of importance and set goals related to those tasks. For each of the six participants, the researcher plotted average ratings on tasks prior to SCL instruction, and during the intervention period. Achievement graphs for five of the six participants illustrated gains from pre-instruction phase into and through the instruction phase. Maintenance data were graphed for two of the six participants indicating a level of maintenance of achievement beyond the instruction period. Limitations to this study included a small number of participants, and varied performance requirements. Butler did not detail the method of equating performance measures that varied from tests to papers to projects. Another limit to this study was recording the improvements of participants in their course requirements apart from perspective of the improvements of their classmates in those same requirements. Data were provided only for one participant. Therefore, results of this study indicate that individual students made gains in academic performance when engaged in SCL instruction, but it is unclear what those gains looked like in comparison across content areas or in context of gains made by peers not engaged in SCL instruction.

Butler (1998) further investigated effectiveness of the SCL method. In a report of three studies, 26 of 30 students, 87% made gains in performance. Students made gains when working on reading, writing, or math tasks. This series of studies by Butler on the SCL model suggests that training in learning strategies, particularly in personal adaptation of learning strategies, benefits academic performance of postsecondary students with learning disabilities.

Some researchers investigated effectiveness of specific strategies within the context of learning strategies programs. One such study by Holzer, Madaus, Bray, & Kehle (2009) investigated the effectiveness of a specific test-taking strategy employing a single subject design. Five students participated, all with learning disabilities. After baseline data, each student participated in three to four one-hour training sessions on the specific stages of the strategy. For strategy use, all students improved with no overlapping data and maintained improvement into a follow-up stage. In contrast, only one student demonstrated positive gains on performance measures. Four of the five students, however, reported less test anxiety when employing the test-taking strategy. Therefore, Holzer et al. demonstrated this specific strategy may be valuable for students with test anxiety and could be studied further in content applications.

Allsopp et al. (2005) investigated effectiveness of a program offering one-on-one strategies training, which first assessed the student's specific needs within the student's current courses and then taught procedures to establish long-term strategic academic behaviors. These researchers demonstrated effectiveness of this diagnostic prescriptive approach on measures of grade point average gains and academic good standing.

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Students from two universities and one community college participated. All participants had documented learning disabilities or ADHD. Of the participants, 32 participated for only one semester while 14 continued the program through a second semester. There was no control group in this study. Allsopp et al. compared immediate results following the first semester and found that overall grades increased from those earned just prior to program participation to overall grades immediately after participation in the program. Further analysis revealed a medium effect on grades within the semester of program intervention and a small effect on overall grades. When students received training in a strategy specific to a particular content area (history for example), Allsopp et al. compared grades in previous courses in that content area with grades earned in that content areas during the semester of program participation. In that comparison, they found a large effect on course-specific gains. Allsopp et al. also evaluated changes in academic standing. Students who started the learning strategies program in poor academic standing as indicated by suspension or probation made medium gains in grades.

The Allsopp study (2005) was a key postsecondary learning strategies study in that it established a body of strategies addressing needs in varied content areas from overall organization strategies to reading comprehension strategies. Allsopp et al. published the strategies with tips for use by instructors and/or students requiring no specific training. Their study resulted in establishment of a learning strategies program at one public institution, and incorporation of more learning strategies training into an existing learning support center service at one private institution. This research resulted in a learning strategies text, which appears to be the only one based upon research and

targeting strategy needs of students and instructors at both secondary and postsecondary

levels (Minskoff & Allsopp, 2003).

Learning strategies programs are one service that seem to be growing at the

postsecondary level, both for students with disabilities and for all students. Certainly,

these programs offer an advantage of one-on-one individualized services. Nevertheless,

because students enter such programs from varied majors and with varied needs working

on varied areas of learning strategies, assessment of effectiveness apart from use of

grades remains a challenge.

Learning Strategies Courses. One approach to postsecondary learning strategies

instruction has been to offer courses with an emphasis in learning strategies. Some such

courses may have grown out of learning strategies programs while others may have

grown out of freshman seminars or developmental courses in specific content areas such

as reading, writing or math. Priorities and outcomes measured by such courses vary.

Some researchers began studying learning strategy or metacognitive outcomes

within the context of remedial or developmental courses. Caverly, Nicholson, and

Radcliffe (2004) examined effectiveness of postsecondary developmental reading courses

at a southwestern state university. In the first study, thirty-six freshmen who failed a

state mandated reading skills test enrolled in a developmental reading course. Instruction

emphasized text structure using texts with varied structures from typical college

textbooks. Researchers measured comprehension using a comprehension test covering a

ten-page chapter as both pre-test and a post-test measure. The state reading skills test

served as a second cognitive measure. Based upon Weinstein and Mayer's categories of

effective reading, the researchers developed a checklist of 27 effective and 3 ineffective

reading strategies, which students completed as a pre- and post- test of metacognitive

reading strategies. An additional pre- and post- survey measured self-efficacy,

persistence with challenging tasks, and perceptions of attributes such as luck or effort.

The final measure evaluated follow-up interviews about transfer of reading strategies into

a general education history course which required intensive reading. Students made

significant improvement on comprehension measures from the beginning of the course to

the end of the course though students still scored a mean grade on the posttest that would

not have been a passing grade. Students demonstrated mean score improvement on the

standardized state reading test, and metacognitive measures, indicating that students used

more strategic reading approaches after the course than before. In follow-up interviews

with eighteen participants, seventeen students reported reading strategies as the most

important concept they learned. Fifteen students reported using the strategy in courses

outside the reading course, with twelve specifically reporting use into the following

semester. All fifteen reported adapting the strategy to specific purposes. Twelve also

claimed that reading strategies helped improve their grades. One weakness of this study

was the lack of a control group to investigate how similar students would have done

without instruction. Nevertheless, students who took this developmental reading course

did show significant improvements across the semester and importantly reported transfer

into a reading intensive course.

Then Caverly, Nicholson, and Radcliffe (2004) conducted a larger study of

effectiveness of the developmental reading strategies course. In the second study, they

compared fifty-one students who passed the developmental reading course with seventy-eight matched students who did not take the course but who had failed the state mandated reading test. Students who took the reading course score significantly better than peers who did not take the course when retaking the state mandated test. Thus, the course appeared beneficial for purposes of improving performance on the state mandated reading test. The researchers further examined performance in the reading intensive history course for reading course participants compared with non-participants. Comparison of history grades revealed students who took the reading course outperformed the control group. Course participation also contributed to class rank.

Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, and Evans (1979) investigated effectiveness of a 2-credit postsecondary learning strategy course on performance on tests of comprehension and memory in a psychology course. They compared 24 course participants with 233 students in two control groups who were also enrolled in the general psychology courses but who were not enrolled in the strategies course. On tests in the psychology course, participants in the strategies course made greater gains from pre-test to mid-point test scores and from pre-test to post-test scores than did their psychology classmates who were not in the strategies class. Additionally, strategies class participants made greater gains in measures of study habits, and ATL. Thus, Dansereau et al. demonstrated that training in specific learning strategies through a course format can positively impact study habits, attitudes, and grades earned in other coursework.

In a quasi-experimental study of self-monitoring strategies used by 44 postsecondary students in an Adolescent Development course compared to 55 struggling postsecondary students in a college study strategies course, researchers found two important results. Students in the study were asked three open-ended questions in the first week of the semester and then at the end of the semester. Answers were scored using rubrics to quantify results. First, not surprisingly, those students who were not struggling started the semester with more elaborate strategies and a greater number of reported strategies than did peers who were struggling students. Second, students who did not take the college study skills made few gains in self-monitoring strategy use across the semester, while those who took the college study skills course made gains in use of specific self-monitoring strategies from the beginning of the semester to the end of the semester. Significant changes for the struggling students occurred in reading assignments, preparing for quizzes, and preparing for tests. Students in the comparison group only reported growth in more sophisticated strategies in preparation for exams. This study demonstrated that while struggling students may demonstrate lower starting self-monitoring strategy use compared to non-struggling peers, they respond favorably to explicit training in such strategies (Van Blerkom & Van Blerkom, 2004).

Ryan and Glenn (2004) compared effectiveness of participation in a strategies course with participation in a freshman seminar. Results showed a benefit to retention rates for participants in the strategies course over both participants in the seminars and the control group who did not participate in either group. These results were consistent even when controlling for variables such as SAT scores, class rank, gender or ethnicity.

Additionally, these results remained true when controlling for good academic standing or academic probation. Therefore, the results showed that for first year university students, the strategy course condition was more retention-effective than the socialization condition and the control group.

Some learning strategies courses have specifically targeted at-risk students, including, but not limited to students with disabilities. Yanok (1993) compared effectiveness of a postsecondary developmental support course for students with learning disabilities and students without learning disabilities considered academically "at-risk". In that study, students without disabilities made greater gains in study skills than the students with learning disabilities which may indicate that students with and without learning disabilities benefit from different strategy training approaches. One university required a learning strategies course for "at-risk" students including students with learning disabilities. A study of effectiveness of that course included weak but significant relationships between task value and self-regulated learning in connection with student achievement (Highley, 1995).

A course taught at two colleges on learning strategies for writing specifically for students with learning disabilities demonstrated effectiveness when compared to gains made by students in the comparison group of more traditional writing courses. Students could only take this course if referred by faculty and if they demonstrated a history of written expression problems or self-reported such difficulties. Instructors taught a sentence writing strategy in eight stages with formulaic approaches to writing sophisticated sentences of varied structures using specific parts of speech such as

conditional phrases or transition words. The five dependent variables measured were

fluency, syntactic maturity, vocabulary, mechanics, and organization. Students in the

strategies course made the largest mean gains in increasing complex sentences.

Participants in the strategies class also made gains in vocabulary that approached

significance while students in the two comparison writing courses did not. Nevertheless,

in this study, when adjusting for pre-test scores in a MANCOVA analysis, none of the

instructional approaches compared were more or less effective in improving writing of

students with learning disabilities. A potential explanation for the results of this study is

that two comparison groups were used at two separate universities while the experimental

group combined students from the two universities (Tulbert, 1993). This study does

reveal that not all postsecondary learning strategies courses result in significant gains for

participants, so attention must be given, not just to offering the course, but also to content

and instruction of the course.

King Ebrahimian (1994) established that learning strategies courses are effective

for postsecondary students with learning disabilities regardless of segregation from or

integration with students without learning disabilities. Twenty-nine postsecondary

students with learning disabilities completed four sessions of a study skills course, which

included explicit training in learning strategies. Eighteen participants with learning

disabilities completed four sessions of a segregated section of the course, including no

students without disabilities. Eleven students with learning disabilities completed all four

sessions of the course in an integrated section that included twenty-seven students

without disabilities. In order to protect confidentiality, researchers did not inform

students of disability status of any classmates. An additional control group of 13 students with learning disabilities interested in the course, but unable to take it, participated as a control group. The university director of a reading learning center taught the course in four two-hour sessions, including explicit instruction in learning strategies. Topics covered included time management, reading comprehension, note-taking, and test-taking strategies. Assignments to practice learning strategies required application to other course content. Pre-test scores did not differ for any of the three groups including on measures of specific strategies, demographics or academic variables. As expected, students who did not participate in explicit training did not show improvement in study strategies or attitudes. Students in the integrated class demonstrated increases in scores on five constructs: anxiety, selecting main idea, use of study aids, self-testing, and test strategies. Students in the segregated class demonstrated increases in scores on six constructs: time management, concentration, information processing, selecting main ideas, use of study aids, and self-testing. Though there were differences in gains for course participants in either condition over the control group, there was no difference in gains made by students in the two separate course conditions. Therefore, this study expands possible options to teach learning strategies through courses in either segregated or integrated options (King Ebrahimian, 1994).

Chiba and Low (2007) evaluated student perceptions of the impact of a course specifically for postsecondary students with learning disabilities and ADHD. They designed a course to facilitate transition to college learning. Content included learning strategies, awareness of campus resources, and self-exploration. Qualitative results

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demonstrated increased understanding of disability, importance of peer support and

positive social adjustment and emphasized the importance of integrating research based

learning strategies and offering such a course pro-actively in early semesters.
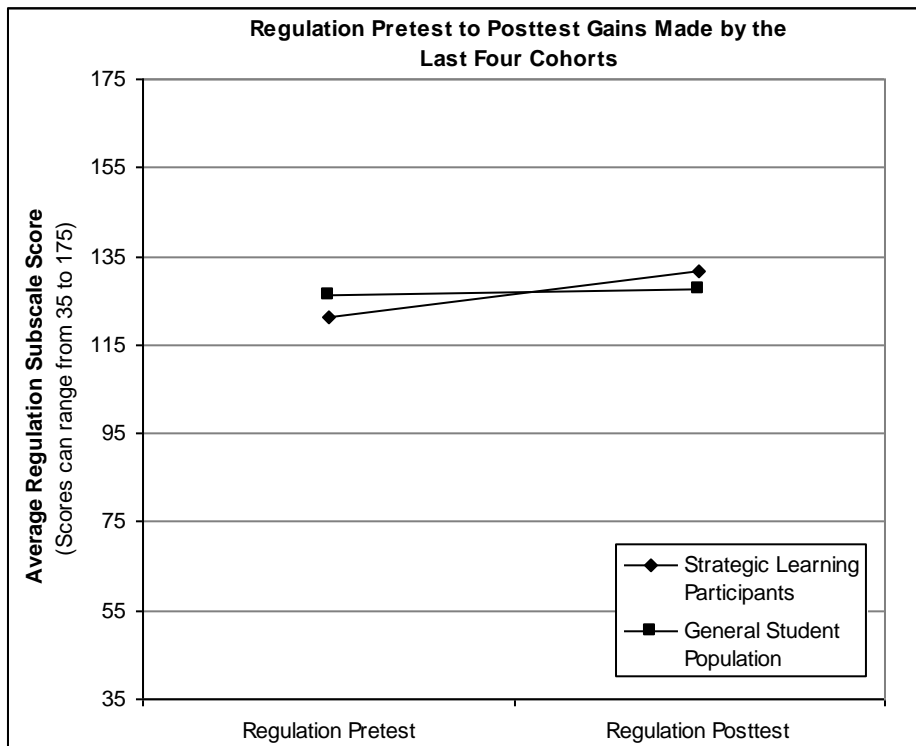
Figure 1: Short-term regulation gains made by course participants compared with long-term gains made by general student population

Burchard and Swerdzewski's (2009) study of a postsecondary Strategic Learning

course, including students with and without disabilities, demonstrated that students who

participated in the course made gains in metacognitive regulation and metacognitive

awareness from the beginning of the course to the end of the course. Repeated-measures

ANOVAS on metacognitive awareness scores demonstrated an increase from pre-test to

post-test. Repeated-measures ANOVA also demonstrated a statistically significant increase from pre-test to post-test on metacognitive regulation scores. As illustrated in Figure 1, students who chose to take the Strategic Learning course started with significantly lower pre-test scores on MAI Regulation than did the general student population. Course participants made greater gains in metacognitive regulation than did students in the general population at that university, though the lapse between pre- and post- measures for course participants was across a 16-week course and the time period for data available on the comparison with all students at the university was 18 months.

This study also revealed that gains by students with disabilities were not different from gains made by students without disabilities, suggesting that students with disabilities benefit just as much as students without disabilities from participation in learning strategies courses (Burchard & Swerdzewski, 2009). Gains demonstrated were immediate with no further evaluation of maintenance or continued gains into future semesters.

Comparison of Learning Strategies Teaching Approaches. Growing evidence demonstrates the effectiveness of learning strategies on various student learning outcomes. As illustrated in Appendix A, general advantages and limitations exist for each approach to teaching learning strategies. Researchers obtained most evidence of which specific strategies work for postsecondary learners through experimental or quasi-experimental studies delivered in a workshop format. Furthermore, the time commitment required for students to attend a workshop may feel less costly than participation in a course or program. For example, some students who would not be willing to enroll in a

course or program may be willing to attend a one-time workshop on time management or writing strategies. Since the workshop approach is typically the most removed from course content requirements, transfer of learning to authentic learning requirements is problematic. In contrast, learning strategies embedded within a specific content course are inherently the most connected to content learning.

Because general learning strategies may be applied so broadly across just about any content area, much more could be done with research of effectiveness of general learning strategies embedded within courses. Because professors with content expertise may not be trained in teaching techniques, development in this area may require university investment in faculty training. Learning strategies programs offer a more individualized approach to assessing needs and teaching strategies to meet those specific needs. Nevertheless, most evidence of effectiveness of such programs is limited to grades, which may be problematic when comparing across courses, instructors, and programs. While the typical one-on-one approach of such programs may facilitate relationships important to engagement of at-risk learners, that delivery method may also require the most intense investment of human resources. In contrast, learning strategies courses may reach more students with more strategies, but unless intentionally requiring application of strategies to other courses may be no more effective in transfer than strategies taught in workshop formats. Each of these approaches may help meet needs of at-risk students, but each also needs further research in transfer and maintenance over time.

Maintenance Effects of Interventions

Most studies of postsecondary learning interventions, including those for students with learning disabilities, are limited to immediate effects of the interventions. A few studies have evaluated longitudinal benefits of interventions with assessment of benefit delayed into following school terms.

Justice, Rice, and Warry (2009) evaluated the transfer of skills from previous participation in a freshman seminar emphasizing general learning strategies and problem-solving skills into writing within the Social Sciences. At a mid-point progression through the program's course sequence, Justice, et al. compared writing of 54 students who did participate in the freshman seminar with the writing of 71 students who did not participate in the freshman seminar. Blind reviewers quantitatively rated the papers using a rubric built around the problem-solving cycle taught in the seminar course. Three findings demonstrated benefit for course participation. First, students in the course demonstrated higher scores in organization scores, focus around the questions, and self-directed learning. Raters then qualitatively analyzed student narratives. Course participants were more likely to describe their research processes using the vocabulary taught in the course. More significantly, seminar students reported more time spent in research. Seminar students also reported more critical evaluation of the research evidence found, more meaningful engagement in the research process, and greater satisfaction with the process. Students who took the seminar course also reported greater levels of consulting with research resources. A key limitation to this study is that students had taken as many as forty courses prior to participation in the study, so it is

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difficult to attribute differences in the groups to participation in just this one course.

Nevertheless, the qualitative aspects of this study indicate that the seminar participants did experience greater satisfaction with the research process and transfer of the problem-solving cycle learned into other coursework. This study provided valuable evaluation of metacognitive transfer beyond immediate effectiveness following training in a specific problem-solving strategy.

The Allsopp et al. study (2005), which established effectiveness of a specific learning program for postsecondary students with learning disabilities, also included long-term tracking of students' performance beyond participation in the program. Students who participated in one semester of the program made grade gains of a medium effect while those who participated through two semesters made grade gains of a large effect. Such results may indicate that participation in one-on-one learning strategies programs for longer periods of time may produce more significant long-term effectiveness.

Tuckman (2003) conducted a study of a five-credit postsecondary learning strategies course. He compared grades earned by 397 course participants across 18 sections of the course over three academic terms with grades earned by 397 students in a demographically matched comparison group who did not take the course. Unlike many other studies of strategies courses, one key feature of this course was transfer of learning to other coursework. He analyzed results including and excluding the grade earned in the course and showed students in the course earned higher grades than the matched sample of students who did not take the course. Including the grades earned in the course, he

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found that students who took the learning strategies course earned higher grades in the academic term in which the course was taken than did students in the control group. When excluding the grades earned in the course, students in the course still earned higher grades in the term of the course than those who did not take the course in that term. Positive impact of course participation on grades continued into the semester following course participation. Thus, Tuckman demonstrated that an elective course on learning strategies could positively affect academic achievement not just in the short-term, but also into the term following the intervention.

Conclusions and Gaps in the Literature

For postsecondary students, research has demonstrated important inter-relationships of learner characteristics, such as academic motivation, metacognitive regulation, and metacognitive awareness (Zimmerman, 1989; Ford et al., 1998; Hammann et al., 1998, Jakubowski et al., 2004; Braten et al., 2005). Research has demonstrated that courses with a focus on learning strategies improve grades as well as metacognitive awareness and regulation both for students with and without disabilities (Dansereau et al., 1979; Highley, 1995; Van Blerkom et al., 2004; Chiba et al., 2007).

As postsecondary programs developed, research emerged on effectiveness of various interventions for populations of students with learning disabilities. Early studies revealed specific research needs. McGuire et al. (1990) called for increasing research concerning what works for postsecondary support programs for students with learning disabilities, especially efficacy studies of programs related to retention and academic performance. Limited studies have demonstrated effectiveness of specific learning

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strategies, strategic learning programs or strategic learning courses for postsecondary students with disabilities (Butler, 1995; Nicholas, 2002; Gaddy, 2004; Allsopp et al., 2005). Consistently, researchers have called for long-term studies of programs (Burchard & Swerdzewski, 2009; McGuire, et al., 1990; Nelson & Lignugaris/Kraft, 1989).

Important gaps have emerged in this review of the literature. First, many constructs of learning, including metacognitive regulation, have only been investigated to limited degrees for postsecondary students, including students with and without disabilities. Postsecondary strategic learning courses were one effective way to reach numbers of at-risk students with helpful intervention, and yet, research on effectiveness of courses is limited. Most importantly, there was limited evidence of longitudinal effectiveness of interventions targeting various learning characteristics for postsecondary students, and especially for postsecondary students with disabilities despite a call for such reasoning half a decade ago (Tuckman, 2003).

This study attempted to address these specific gaps in the literature for postsecondary students through an analysis of existing data. This study therefore, extends the work of Allsopp, Minskoff, and Bolt (2005) that established a body of strategies appropriate for use with postsecondary learners. Furthermore, this study extends the work of Burchard and Swerdzewski (2009), which demonstrated short-term effectiveness of those strategies and others in a course-based intervention. Through this study, the researcher examined the long-term effectiveness of a postsecondary learning strategies intervention for students with and without disabilities. This study extends that previous research across six semesters of freshman and sophomore intervention

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participants into the mid-point of their college careers for the purposes of investigating

any long-term metacognitive effects intervention participants.

3. Method

The purpose of this study was to examine the long-term metacognitive effects of a postsecondary learning strategies intervention for students with and without disabilities. A previous study demonstrated short-term effectiveness for all intervention participants across four semesters of the intervention (Burchard & Swerdzewski, 2009). For the purposes of investigating any long-term metacognitive gains for intervention participants, this study extended the previous research across six semesters of intervention participants into February of the academic year in which they reached sophomore status by credit hours.

Setting

Three components of the setting for this study warrant explanation, the university, one specific course available at that university, and an assessment program at that university. All students included in the study were enrolled at one university, given the pseudonym of MVU. A comparison was made between students who did and did not take a course including instruction in learning strategies. All students in the study also participated in a university-wide assessment program from which the data to be analyzed was taken.

University

      This investigation examined data that is archived at a mid-sized mid-Atlantic four-year university. This university enrolls over 16,500 undergraduates and approximately 18,000 total students. Approximately 80% of the student population is white and approximately 60% of the students are female. The mean composite SAT score (verbal and math combined) of freshmen is over 1,100 (About MVU, 2008). MVU values student-focused learning supports including tutoring centers for writing, communication, math, and science, as well as a program to train students in learning strategies.

Strategic Learning Course

      Beginning in fall semester 2005, MVU offered a course in Strategic Learning. The instructor was a trained special education teacher who also taught learning strategies to struggling students through a learning strategies program operating under that university's services for students with disabilities. Prior to implementation of this intervention, the instructor engaged in formal planning with the assistance of an assessment program at the university. Prior to the first class, objectives were developed and refined. Primary objectives concerned development of metacognitive awareness and regulation. Within each of those key objectives, the instructor identified specific priorities to include understanding one's specific learning strengths and weaknesses, knowing campus resources, and several specific learning and self-regulatory strategies.

      The resulting course plan created a course unique from other models. Unlike courses at other universities, this course did not focus on orientation to the university or

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general study skills. Nor, did the course focus solely on learning strategies. Designed to increase application of specific learning theories and active learning strategies, this course instead integrated the study of learning theory with explicit instruction in learning strategies. Students who took the course learned about metacognition and other specific learning theories, and evaluated and reflected upon how those theories connected with personal experiences in learning. Students in the course explored various supports and resources for learning. Through highly structured course activities, the course taught students to evaluate and apply a variety of specific learning strategies, including but not limited to strategies addressing stress management, time management, listening, note-taking, memory, studying, test-taking, reading, information literacy, and writing. Students used self-assessment information to construct a personal learning plan including measurable objectives and specific strategies to help in reaching those objectives. The purpose, objectives, and core content of the course remained unchanged across six semesters of the course. One lesson in each semester allowed individualization to meet specific needs of students in each class, but most individualization occurred through the personal learning plan created by each student (see the syllabus template in Appendix B).

Course instruction in learning strategies followed the Strategic Instructional Model (SIM) developed and researched by Deshler, Schumaker, and other researchers at the Center for Research on Learning at the University of Kansas (Deshler & Lenz, 1989; Deshler, Schumaker, & Lenz, 1984; Deshler, Schumaker, Lenz, & Ellis, 1984; Deshler & Tollefson, 2006). Each stage of the SIM model was implemented in this Strategic Learning course. The students participated in pre-testing with self-rating scales of

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behaviors related to specific strategies, such as patterns in reading of textbooks. Specific subscales of the various pre-testing instruments used in the course also served as useful perspective prior to teaching strategies. For example, the planning subscale of the Metacognitive Awareness Inventory (MAI) provided useful perspective for students prior to learning various time management strategies. The instructor encouraged commitment through student journaling prior to learning new strategies. The instructor methodically described each new strategy and then modeled use of the strategy. Guiding students through each step of new strategies, the instructor provided opportunity to practice the strategy individually or in small groups within the class sessions. Then the instructor reinforced independent practice in other course requirements by designing each assignment to reinforce and measure implementation of target strategies. The SIM model provided a structure for strategy instruction for all strategies taught in this course.

The instructor explicitly taught a variety of learning strategies during the course. These included some general approach strategies, such as selecting different strategies to read different types of text, or taking notes in the margins to more actively engage in reading, or analyzing errors in test-taking. Most strategies, however, followed explicit steps. Appendix B provides examples of learning strategies taught in the course. The earliest strategies taught included time management, listening and note-taking (Landsberger, 1996; Minskoff & Allsopp, 2003; University of Minnesota Libraries, 2009; Weiser, 2003). For example, students used a time management strategy to break down large papers or research projects into smaller steps with sequenced deadlines. Other strategies included goal-setting (Bucknell, 2009; Kissel, Miller & Young, 2003), and test-

taking (Hughes, Schumaker, Deshler, & Mercer, 1993; Minskoff & Allsopp, 2003). The instructor devoted most time to teaching reading, writing, and memory strategies (Collins, 2008; Miller, 1956; Minskoff & Allsopp; Schmidt, 1985; Schumaker, Denton, & Deshler, 1984; Wilson, 1963; Wong, 2003). Students implemented at least one specific note-taking or reading strategy in at least one of their other courses. Working in groups of students with similar classes, students invented their own first letter mnemonic strategies (Nagel, Schumaker, & Deshler, 1986) to address specific demands in those courses. Using the first letter mnemonic strategy, students For example, a group of students enrolled in a business statistics course created a strategy for reasoning through scenario test questions (see Appendix D) while a group of students enrolled in courses that required reading dense texts wrote a strategy about critical reasoning while reading (see Appendix E).

In an intentional effort to connect theory with practice and to promote growth in personal awareness and reflection, the instructor taught various learning theories and research about learning integrated with instruction in the learning strategies. Appendix F lists example theories taught in the course, including sources for instruction. The instructor taught some theories following student assessments in class in order to facilitate personal connections with the theory. For example, on the first day of class students complete pre-test assessments of Achievement Goal Orientation (Dembo, 2004; Dweck, 2008; Grant & Dweck, 2003; Harackiewicz, Barron, Pintrich, Ellit, Thrash, 2002; Pintrich, 2002; Pintrich, 2004), self-efficacy (Bandura, 2000; Jakubowski & Dembo, 2004; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Kitsantas, 2007)

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,and metacognition (Flavell, 1979; Nelson, 1999; Pintrich, 2002; Schraw & Moshman, 1995; Vrugt & Oort, 2008). Then students learn an overview of Achievement Goal Orientation, self-efficacy and metacognitive theories, and then reflect on what those theories say about such issues as motivational styles, self-efficacy for self-regulated learning, and areas of greatest strengths or weaknesses. Just prior to learning about multiple intelligences (Gardner, 1983; Guignon, 1998), students completed a checklist-style inventory, and then read about each intelligence style, followed by work in groups of students with similar intelligence types to teach the class about their strongest intelligence type. In teaching other learning theories, small groups discussed applications to personal experience. For example, just after learning about Perry's forms of intellectual development (1970), small groups of students discussed their observations of how that theory applies to learners from varied cultures or backgrounds. After completion of an online learning style inventory (Soloman & Felder, 2009), students form groups for a project requiring balance of varied learning styles. For the lesson about Bloom's taxonomy (Anderson & Krathwohl, 2001; Bloom, 1964), students evaluated the goals statements in all their course syllabi. Each semester, students learned about goal theories and how to write measurable personal goals (Field & Hoffman, 1994; Field, Marin, Miller, Ward, & Wehmeyer, 1998; Kissel et al., 2003; Shogren, Wehmeyer, Palmer, Soukup, Little, Garner, & Lawrence, 2008). Then each student wrote personal goals to address challenges in four areas (see an example in Appendix G. Theories of brain function (Sousa, 2006; Sylwester, 2005) then required further research and implementation of specific strategies for research, reading and writing. Some theories

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were connected to specific strategies such as the connection between theories of memory and forgetting (Higbe, 1996; Miller, 1956; Schacter, 2002; Wong, 2003) and various specific memory strategies. As one approach to improving metacognitive awareness, students reflected about personal application of theories, not just application of learning strategies.

Course assignments and assessments reinforced both theory and strategies. In order to promote higher value for specific strategies, additional practice, and possible generalization of learning beyond the classroom, students in the Strategic Learning course showed evidence that they implemented strategies in work for this and other courses or general academic performance. Prior to each test, the instructor taught various memory and test-taking strategies, and then awarded twenty percent of each test grade for evidence of implementing memory or test-taking strategies. Students demonstrated strategy use through mnemonics written in the margins, circling key words in test questions, or other strategy use. After learning various strategies for writing, reading and research, students wrote a research paper on their choice of topics about learning. Grading of that assignment emphasized evidence of strategy use in the various stages of research and writing. Throughout each semester, students reflected on changes in strategy use and intentional practice of metacognitive behaviors connected with use of those learning strategies.

Each semester, faculty and staff of campus learning supports collaborated in various presentations, activities, or assignments. Early in each semester, a panel representing campus resources shared about campus learning supports. This regularly

included representatives from two campus writing centers, a speech center, a science and math center, a tutoring program for historically challenging courses, and a learning strategies instruction program. Each semester a professor in Occupational Therapy taught specific stress management strategies, typically prior to the mid-term season. Two faculty members from the campus career and academic planning center collaborated on creation and support of a career exploration assignment. Early in each semester, a representative from that center presented about their varied services and supports available for the specific options of the career exploration assignment. All students completed two activities from a choice of several career exploration options ranging from completion of an interest inventory to attending a resume workshop. A university librarian collaborated to develop a series of integrated lessons and an assignment reinforcing university-level priorities of information literacy. Importantly, she also collaborated with the instructor and student learning strategy specialists to develop a systematic research strategy appropriate for college level research, shown in Appendix H. During each semester of the course, in the library setting, the librarian taught a lesson on asking researchable questions, navigation of the university databases and resources and use of the research strategy.

The Strategic Learning course was open to all undergraduate students. The course was marketed through campus disability services, a full scholarship program for students of low socio-economic status, athletics, the office serving academically struggling students, and the office for academic and career planning services. Beginning fall 2006, information about the course was included in a presentation by Career and

Academic Planning to all incoming freshmen prior to course registration. None of the students who participated in this Strategic Learning course received follow-up support connected with the course. Any student at the university could choose to participate in strategy training or support offered by its various learning support centers: a learning strategies program, writing centers, a speech center, or a science and mathematics support center. Some students in the scholarship program for lower socio-economic status took advantage of mentorship and/or tutoring options available through that program. In addition, team athletes accessed various academic support programming available through Athletic Services including tutoring.

Assessment Day

One program at MVU has conducted regularly scheduled student assessments of all undergraduates at four stages of the academic career focusing on large sample measurement. The first of these four stages occurred prior to instruction. The second stage occurred at the mid-point of the undergraduate career when students have earned between approximately 40% and 60% of total required credit hours. The first two assessments were more general, including measures of core knowledge addressed through general education courses as well as various measures of such constructs as motivation, and metacognition. MVU has required all incoming freshmen to participate in the first assessment day during the week of freshman orientation with oversight for participation supported by freshman advisors. MVU has cancelled classes one day in mid-February of each year to accommodate sophomore assessments. The third and fourth assessments, occurring near graduation and one-year post-graduation, assess

specific priorities of academic programs in which the students concentrate. Participation

by students in the first, second or third assessments is of institutional consequence; failure

to participate results in academic "holds" that prohibit course registration and other

processes. With such a system, the assessment program experiences a participation rate

close to 100%. In such a culture of assessment, the university expects programs to

demonstrate effectiveness of program objectives, including content outcomes as well as

more general learning outcomes. Data obtained through Assessment Days is essential to

this specific study.

Study Sample

The study sample in this study was intentionally selected from an archived data

set at MVU. Inclusion criteria for this study required membership in an ex post facto

treatment group or membership in a demographically matched sample extracted from

existing Assessment Day data.

Treatment Group (ex post facto)

The specific data extracted from the ex post facto treatment group data required

participation during the freshman or sophomore year in one of six semesters of a

Strategic Learning course offered at MVU, fall 2005 through spring 2008. Students who

took the Strategic Learning course during fall 2008 or later were not included because

they had not yet participated in the second Assessment Day data collection, and therefore

had no long-term post-test scores. The researcher was the instructor for students from

which the ex post facto data for the treatment group were selected. A total of 114 students

participated in the Strategic Learning course during one of those six semesters.

Exclusion criteria from the analysis of ex post facto data for students who took the Strategic Learning course included junior academic year or above, those who were forced to take the class, poor class attendance, and one extenuating circumstance. First, the researcher excluded students who took the course in their junior year or later as data for those students would not include post-test data required by the questions of this study. Additionally, some students who returned from academic suspension were required to take the course. The researcher did not include their data because those students did not self-select to take the course and initial motivation in taking the course could confound results, but those students were excluded from this study automatically as all of those students were juniors or seniors. The researcher also excluded those students who started the course but missed three or more class sessions, as those students did not benefit from the full treatment. Such an exclusion eliminates two students who withdrew for medical purposes from the university during the semester they took the course, and two students with very low attendance (in each case missing much more than three class sessions). Finally, this study excluded data on one student who suffered a severe brain injury in the semester immediately after taking this course. Upon her return to the university, she received intensive and extended strategies support from multiple faculty and support services. Considering the severity of her injury and the intensity of interventions and because no comparison was available, inclusion of her data could confound results. Application of the exclusion criteria limited the dataset of course participants to 59 students. Of those 59 students, only 16 students had both pre-test and post-test scores in

the existing dataset on the measure of metacognitive regulation. Thus, the treatment group was narrowed to only 16 students.

Both students with and without disabilities enrolled in the course. Out of 114 students in the full ex post facto treatment group, 62 students self-disclosed disability status, which MVU's office of Disability Services confirmed at the time of course participation. In order to register as a student with a disability, students must submit current comprehensive documentation meeting published documentation guidelines consistent with state and national models. In addition, such documentation must demonstrate that the disability substantially limits functioning in one or more major life activities. When the exclusion criteria were applied to the treatment group, out of the 59 students who met inclusion criteria, 47 students who disclosed disabilities fit the inclusion criteria. All of those students disclosed disabilities with limitations to their learning. Students who self-disclosed disability status were included in a separate within-group analysis, compared with students in the treatment group who did not disclose disability status.

Comparison Group (ex post facto)

After the treatment group was narrowed, a comparison group was formed to include 16 demographically matched undergraduate students who did not take the Strategic Learning course. Criterion for inclusion in the comparison group was a similar demographic match to students in the ex post facto treatment group. Analysis of existing demographic data was used to match the comparison group on incoming freshman year, gender, ethnicity, and incoming SAT scores. Furthermore, students in the comparison

group were matched with course participants for dates of pre-test and post-test measures. The researcher had no relationship with students from which the ex post facto data for the comparison group were selected.

Design

In this study, ex post facto causal comparative design was used as recommended by Wiersma and Jurs (2009) because questions remained that could be answered after the fact in examining an existing set of data. Consistent with their ex post facto model, in a sense, the study participants were "surveyed" by asking specific questions of existing self-reported data. The primary independent variable of participation in the Strategic Learning course was not manipulated.

Demographic factors were used to identify an internal comparison group from the same university, first purposefully sampling students from the same pool of freshmen and sophomores and then matching for demographic factors. Intentionally controlling for demographic differences between comparison and treatment groups should help control for confounding factors and therefore, help bring to light any differences resulting in the treatment. Because participation in the treatment group was optional, it was expected that there might be some differences between students who chose such an optional intervention and students who did not. Therefore, the comparison and treatment groups were matched for demographic factors, high school grades and SAT scores, but were not matched for pre-test measures, which might reveal differences in the starting points of demographically similar students who do or do not opt to participate in such interventions. The pre-test measures included three scores, all taken at the same time for

students in either group, just prior to the beginning of courses in fall of the freshman year. The ex post facto data set contained post-test measures administered at the same time in academic progression for students in either group in February of the mid-point of their college career as determined by credit hours. Dependent variables vary for each specific question, but include scores or gains on a measure of metacognitive regulation or achievement goal orientation, in relation to specific factors, such as course participation and disability status.

In conducting this investigation, the researcher employed the five overarching principles of generalized causal inferences recommended by Shadish, Cook, and Campbell (2002). The researcher examined surface similarity in comparing pre-test scores of participants in the two main groups and the one sub-group. Are these groups similar? Second, the researcher ruled out irrelevancies by controlling for matched demographics that might compound effects of the intervention. What differences are relevant to the outcomes? Third, the researcher made discriminations that may limit generalizations. For example, the overall demographic composition of the student population may limit generalizing results to university populations with very different demographic compositions. Fourth, the researcher attempted to interpolate inferences to the population in this study related to important measures not investigated in this study (for example, self-efficacy), or extrapolate results to larger populations (for example, postsecondary students with disabilities). Then, the researcher tested causal explanations to test for long-term effects of a stimulus, in this case participation in a Strategic Learning

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course. As stated by Shadish, et al. (2002), practice of all five of these principles is essential to strong causal conclusions.

This study investigated the following questions:

1. Is there any difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen or sophomores and demographically matched students who do not?

2. Is there any difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course?

3. What are the interrelationships among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use?

4. Do participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further long-term gains in metacognitive regulation?

5. For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?

Data Collection Procedures

Before obtaining data, the researcher obtained custodial permission to access two separate data sets. The present study's data set were compiled from two existing archived data sets at MVU, one in the custody of the office serving students with disabilities, and one in the custody of the university assessment program. After obtaining

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custodial permission to access those two existing data sets, Human Subjects Review

Board approval was obtained from George Mason University.

Strategic Learning Course Instrumentation

During the Strategic Learning course, the instructor used the MAI to assess two

separate constructs of metacognition, metacognitive awareness and metacognitive

regulation. Metacognitive awareness includes three sub-scales of declarative knowledge,

procedural knowledge and conditional knowledge. Metacognitive regulation includes

five sub-scales: planning; information management; monitoring; debugging; and

evaluation (Schraw et al., 1994; Schraw et al., 1995). Pre-test and post-test data on

course participants' responses to the MAI (see Appendix I) were maintained and archived

by the learning strategies program supervised by the disability services office.

Additionally, this data set included disability status on course participants, identifying

which students formally registered with Disability Services as having a disability. This

data set included only ex post facto data on the treatment group of students. Data

included student ID numbers, disability status, and immediate post-scores on the MAI.

Assessment Day Instrumentation

The second existing archival data set was in the custody of an assessment

program at MVU, which conducted scheduled student assessments of all students. This

data set used for all students in the study included demographic data, high school

performance data, and pre-test and post-test scores on the ATL and MAI.

Demographic and Performance Data. Demographic data included gender and

race. Because date of birth is not maintained on all students through this database, an

additional measure of the year a student entered as a freshman was used. The researcher

also obtained high school GPAs, converted to a 4.0 scale, and SAT scores on Math,

Verbal and Writing tests. Data from the ex post facto treatment group was used by the

assessment program to identify demographically matched students who did not

participate in the Strategic Learning course. The comparison group was matched on

factors of year of admission, gender, race, high school GPA and SAT scores. Then the

assessment program merged the treatment group data with data for the comparison group

and created one data set including demographic characteristics, high school GPA, SAT

scores, ATL scores, and MAI scores. Status as a student athlete, a student with a

disability, or a participant in a scholarship program for lower socio-economic status was

included for students in the ex post facto treatment group only, but was not available for

students in the comparison group. To provide anonymity, the merged data set was then

stripped of all student ID numbers, replacing them with random study ID numbers.

Metacognitive Awareness and Regulation. Data for all students in the

Assessment Day data set included MAI scores on from both freshman and mid-career

assessment dates. The full MAI measures both metacognitive awareness and

metacognitive regulation. MVU includes the MAI Regulation scale as part of the

assessment for all students and the MAI Awareness scale as part of the assessment for

selected students.

In two repeated experiments, researchers evaluated the MAI, a 52-item Likert

scale self-reporting instrument, with undergraduate students in an educational psychology

course. Factor analysis of the MAI demonstrated that use of the metacognitive awareness

and metacognitive regulation scales was more reliable than using the eight separate sub-scales of declarative knowledge, procedural knowledge, conditional knowledge, planning, information management, monitoring, debugging and evaluation. The study established both reliability and validity for the factors of metacognitive awareness and metacognitive regulation. The study further demonstrated that this tool was efficacious for use with postsecondary populations in measurement of metacognitive awareness and metacognitive regulation. No separate analysis was conducted on efficacy with postsecondary students with disabilities (Schraw et al., 1994).

Achievement Goal Orientation. An additional assessment tool used during Assessment Day is the ATL. Analysis of one research question included scores on this instrument as one contributing learning characteristic. Scores on five separate subscales were recorded in the data set.

Finney, Pieper and Barron (2004) established the efficacy of the ATL questionnaire in assessment of motivation for postsecondary students. A total of 2,111 first-time freshmen were administered this 12-item assessment tool as part of a university-wide assessment day. The ATL assessed motivation on five scales: mastery approach, mastery avoidance, performance approach, performance avoidance, and work avoidance (see Appendix J). Factor analysis showed reliability of each question. All five motivation types did show as statistically significant distinct constructs. Researchers concluded that the assessment tool does indeed work to measure the five goal orientations in both course-specific and general academic contexts. Campbell (2007) extended this study to show effectiveness of this tool for assessment of postsecondary students with

disabilities. Results of her study demonstrated that postsecondary students with disabilities did not differ significantly on any of the goal constructs from students without disabilities.

Data Analysis Procedures

All data were entered into Statistical Package for the Social Sciences (SPSS) for analysis. The null hypotheses for each research question are illustrated in Appendix K. First, the researcher conducted descriptive statistics to understand the participants in the study. Then, the researcher conducted separate analyses of between group data and within group data. The data type and analysis to test each research question are detailed in Appendix L.

Between Group Analysis

This study used post hoc analysis of archival data relative to two learning conditions (intervention group and comparison group). In the previous study of short-term effectiveness of this course, students who took the course scored significantly lower than students who did not take the course on MAI Regulation pretests (Burchard & Swerdzewski, 2009). Because results of this study indicated that students who took the course were different from those who did not take the course in MAI Regulation pre-test scores, the first research question investigated differences in pre-test scores on both MAI awareness and regulation. In order to address this question, the researcher conducted *t*-tests for students in the separate conditions on initial MAI Awareness, and MAI Regulation scores to see if there are statistically significant initial differences between those two groups. A statistically significant difference between those scores for

participants and non-participants would indicate that students who take a Strategic Learning course are different from students who do not take such a course.

The initial study of this course demonstrated a short-term effect size gain in metacognitive regulation for course participants, as compared to a relatively flat change in metacognitive regulation for all students at the university between the freshman and mid-career Assessment Days. In that study, the comparison between two groups was limited because the time span between pre-test and post-test scores was not the same (Burchard & Swerdzewski, 2009). Therefore, the current study now examined that question with similar time spans and investigated if there is any difference in long-term metacognitive regulation gains made by course participants and non-participants. To test that question, pre-test scores were subtracted from post-test scores on metacognitive regulation to compute regulation gain scores. The researcher conducted *t*-tests between the two groups on metacognitive regulation gains. Then, using Statistical Package for the Social Sciences (SPSS), the researcher computed crosstabulations of Chi-square to determine if any changes in scores varied significantly from what would be expected. The researcher standardized residuals to help determine which outcomes did or did not differ in gains on the MAI Regulation scale between participants and the comparison group. In this computation, the size of the standardized residuals is the residual standard deviation, indicative of the standard deviation from expected frequencies in each cell. The researcher computed Chi-square with standardized residuals for changes in scores on the MAI Regulation scale, clustered into four categories: 1) those students whose scores went down from pre-test to post-test; 2) those students whose scores were unchanged; 3)

those students who gained up to ten points from pre-test to post-test, and 4) those students who gained more than ten points from pre-test to post-test. The researcher computed crosstabulations of category frequencies with standardized residuals to assess the likelihood that such scores would occur (Acastat, 1999; "NIST/SEMATECH e-Handbook", 2010).

Then, the researcher employed a multiple regression correlational method to examine the relationships between two dependent variables and various factors. The independent variables investigated for interacting effects were participation in a Strategic Learning course, high school GPA (converted to a 4.0 scale), SAT scores, and Achievement Goal Orientation scores. The two dependent variables used to investigate interrelationships were post-test scores on metacognitive regulation and gains in metacognitive regulation. In this way, the researcher tested for any correlations and co-variance between specific factors and the outcomes of metacognitive regulation scores and metacognitive regulation gains.

Within Group Analysis

Specific questions were analyzed for the ex post facto treatment group only. An important question for long-term learning benefit to students was whether students who made short-term gains in metacognitive regulation through participation in such a course continue further gains in metacognitive regulation beyond course participation. Therefore, from the ex post facto treatment group data, only those students who made short-term gains were included in analysis for this question. The researcher investigated if course participants who made short-term gains in metacognitive regulation continue to

make further long-term gains in metacognitive regulation when post-test metacognitive

regulation is measured at least one semester after completion of the course. To answer

this question, the researcher subtracted end-of-course MAI Regulation scores from the

MAI Regulation post-test scores for the same students and conducted pairwise *t*-tests and

Chi-square analysis.

For the ex post facto treatment group data, results were further analyzed in two

groups, students with and without disabilities to reveal any differential benefit of such a

course dependent upon disability status. Long-term metacognitive regulation gain results

were compared through *t*-tests for course participants who disclosed disability status

versus course participants who did not disclose a disability.

Limitations

Five important realities limited the generalizability or scope of this study. The

sample size was very small, and all participants were from the same university. Analysis

of sub-populations was limited. Data in the study was limited to self-reported data. In

addition, constructs investigated in the study were limited to those measured in the

university assessment program.

Sample Size

The key limitation to this study was sample size. Such is a potential limitation

when using existing data because the researcher exerts no control over the data. In this

case, the researcher obtained university students' assessment data from orientation week

in early fall of the freshman year and from the mid-point of their college careers.

Conducted at a university that measures large sample learning outcomes on measures of

general education knowledge, motivation, and other learning behaviors, the study lacked matching pre-test and post-test data on many of the specific students in the treatment group. Because the emphasis in those university assessments has been on large sample measurements and not on tracking change over time specific to individual students, the resulting number of students with both pre-test and post-test scores on the target outcome, MAI Regulation, was quite small.

Prior to this investigation, the custodian of the university assessment data discussed the reality that all students were not given all the measurements to be used in this study. It was expected that nearly all the students would have scores on the ATL as that measure is used consistently with close to 100% of the students at the university on both freshman and mid-point assessment dates. The MAI Awareness scale is used for smaller numbers of students on both assessment dates. Therefore, it was expected that low numbers of students with the MAI Awareness scale scores would possibly inhibit research questions using that scale score.

The dependent variables in the current study were scores or gains in scores on the MAI Regulation scale. At this university, the MAI Regulation scale is used with large samples of students on most assessment dates. Therefore, it was expected that most, but not all, students would have scores on the MAI Regulation scale for both freshman and mid-point assessment dates. The researcher was cautioned to expect the students with both pre-test and post-test scores on the MAI Regulation scale to be as low as approximately 30 students.

Though the MAI Regulation was a tool administered to a significant quantity of students, for the specific students who actively participated in the course during their freshman and sophomore years, students with both pre-test and post-test scores on the MAI Regulation scale were much more limited than expected. After the data was obtained, it was discovered that during the fall of 2007 and the spring of 2009, the MAI Regulation scale was not administered to any students. That eliminated all students who participated in the course entering the university in fall of 2007. Of the remaining students, only 16 students actually had both pre-test and post-test scores on the MAI Regulation scale, a disappointing reduction to the sample size.

The smaller than expected sample size required revision to the planned analysis for other research questions. This small sample size is the most serious limitation to the current study. Such a limitation to the sample size did not allow the researcher to estimate whether small gains in MAI Regulation might reach significance. Furthermore, such a small sample size did not allow interpolation or extrapolation functions of this calculation to reveal even more detail.

Same University

All students in this study were from the same university. The population at this university was primarily white and female with little socio-economic diversity. Faculty and student services at this university strongly emphasized teaching and student support. Cultural differences from campus to campus should be expected to interact with long-term metacognitive development in the absence of such interventions, marketing of learning interventions, and implementation of such interventions. Because all students

are from the same university, caution is warranted in application of this study to other university settings.

Low Personal Consequence Assessment

Participants from this study all followed the assessment requirements of the institution. In fact, much of the data analyzed in this study was gathered from required assessments of high consequence to the university but of low consequence to the students. This is a potentially powerful restriction in the data; however, one recent study addressed this specific concern with this specific data set. Researchers used a student opinion scale to measure student perceptions of importance of the assessments as well as effort. Results of that study revealed that while students did not consider the assessment process particularly important (over one standard deviation lower than a program-specific graduation assessment at that same university), the students rated effort quite high and similarly regardless of perceived importance (Thelk, Sundre, Horst, & Finney, 2010). The potential restriction of self-reported data of low personal consequence is limited by the effort students gave to the assessments at this specific university.

Limited Constructs

Because this study employed ex post facto analysis of existing data, learning constructs and information about learning supports were limited to those assessed through the university assessment program. Notable learning constructs such as self-efficacy were excluded. Self-efficacy can be described as the "I can do" attitude of learning, related to confidence to perform, sometimes in very specific learning situations. Recent research has demonstrated the important interrelationships of self-efficacy,

especially self-efficacy for self-regulated learning, with such constructs as motivation and metacognitive regulation, and with various achievement outcomes (Coutinho & Neuman 2008; Jakubowski & Dembo 2004; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Kitsantas, 2005). Because self-efficacy measures were not included in the existing data sets, this study could not include examination of timely questions related to inter-relationships with self-efficacy.

Furthermore, though this university offers numerous and varied learning supports, students in the sample were not surveyed about use of those learning supports. Such information would be expected to interact with metacognitive outcomes as most academic supports teach various elements of self-regulation or specific learning strategies. Therefore, conclusions of causality should be filtered with the expectation that other learning constructs and participation in other programs or supports also contributed to development of metacognitive regulation.

Sub-Populations

The interest in sub-populations was not adequately addressed in this study sample. The sub-population of students with lower socio-economic status was not represented in this study sample. Though a significant number of athletes participated in the course over the six semesters, both pre-test and post-test data were not available on any of the student athletes who participated in the course. An opportunity to study the long-term effect of participation in the Strategic Learning course for this sub-population of students was missed.

Though the sample included the sub-population of students with disabilities, a larger issue for this sub-population was the specificity of status. For the purposes of this study, disability status was recorded broadly, simply recording whether a student disclosed disability status. Because of the variance in disabilities and diverse continuum of impact upon the function of learning, such an investigation of disability only touches the issue of differential effect for students with and without disabilities. A larger and more specific sample is required to answer questions of differential long-term effect for students with specific types of disabilities, such as generalized anxiety disorder, specific learning disabilities, or ADHD (Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti, 2005).

Additionally, students with disabilities were overrepresented in the treatment group sample. When compared to the expected 10% of college students with disabilities (McGuire & Scott, 2006), 87.5% of students in this treatment group is a very high percentage of students with disabilities. The disproportionate representation of students with disabilities reduced the ability within the treatment group to compare metacognitive effects between students with and without disabilities.

4. Results

The purpose of this study was to examine existing data to ascertain long-term metacognitive effects of a postsecondary learning strategies intervention for students with and without disabilities. This study integrated data from three sources, records on college student participants in a university Strategic Learning course, confirmation of disclosed disabilities through the office serving students with disabilities, and data from a university student assessment program. Information was analyzed including demographic characteristics, disability status, and student scores on self-rated assessment instruments measuring achievement goal orientation, and metacognitive awareness and regulation.

Overview of Treatment and Comparison Groups

Initial data on 114 students who participated in the Strategic Learning course included demographic characteristics, disability status, athlete status, and participation in a scholarship program for low socio-economic status. Before integrating data sets, inclusion and exclusion criteria reduced the ex post facto treatment group data to 59 students, including students who participated in the Strategic Learning course during freshman or sophomore years, and excluding students with poor attendance, those forced to take the course, and one student who experienced a brain injury followed by intensive interventions. In integrating the existing course data for those 59 students with university

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assessment data, the sample was further narrowed to include only those students for whom both pre-test and post-test scores on the Metacognitive Awareness Inventory (MAI) Regulation scale existed. Figure 2 illustrates application of exclusion and inclusion criteria of students from the original course participants to the final sample.
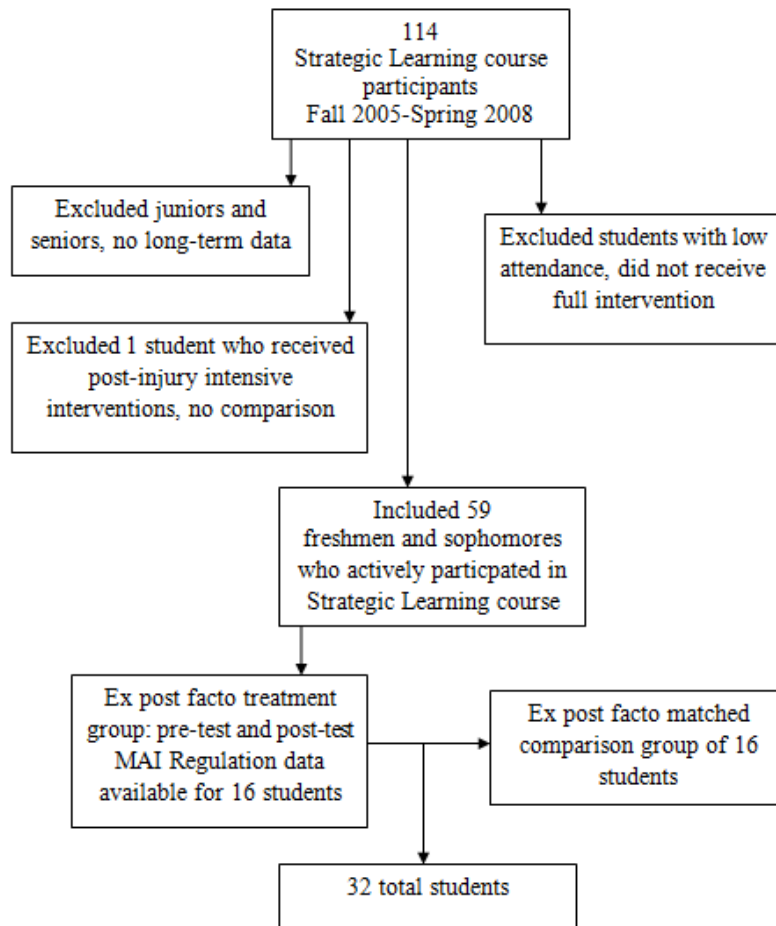
Figure 2: Inclusion and Exclusion of Participants

Though the MAI Regulation scale was used as an assessment tool for large numbers of students at the university, no system existed to match students in their second assessment day with all assessments taken on their first assessment day. Additionally, after the data were received from the university's assessment office, it was discovered that the MAI Regulation scale was not used for any students in fall 2007 or spring 2009. Therefore, the total number of participants in the ex post facto treatment group was 16 students. A matched comparison group included an additional 16 students bringing the total number of participants to 32.

Treatment Group (Ex Post Facto)

There were 16 students in the ex post facto treatment group for whom there were both pre-test and post-test scores on the MAI Regulation scale from assessment data. Of the treatment group participants in this study, seven were freshmen in fall 2005 and nine were freshmen in fall 2006. All students in the study sample participated in fall assessments in the week of freshman orientation prior to starting classes in their fall semester. Five treatment group participants participated in spring assessments in spring 2007 and eleven participated in spring assessments in spring 2008.

Demographic characteristics of ex post facto treatment group. Demographic information characterizing the 16 students in the ex post facto treatment group is shown in Appendix M. Approximately 60% of the student population at this university was female. Of the 16 students in this sample, 14 (87.5%) were female. Approximately 80% of the students at this university were white and approximately 4% were black. In this sample of course participants, one student was black and 15 (93.75%) were white. While

just over 1% of the undergraduates at the university participated in a scholarship program for students in the lowest socio-economic status, none of the students in this study sample were participants in this scholarship program. Though approximately 3% of the total undergraduate population at this university were student athletes, and 21% of participants in the Strategic Learning course were student athletes, none of the students in this final treatment group sample were student athletes. Annually, approximately 3% of this university population is registered with the office serving students with disabilities. During the six semesters, 55% of Strategic Learning course participants disclosed disabilities. In this final treatment group sample, fourteen students (87.5%) registered as having disabilities.

Grades and SAT scores of ex post facto treatment group. Because date of birth was not available on all students in the assessment data, students were matched for the year they entered the university as a freshman. After matching for freshman year, assessment participation dates, gender and race, university assessment staff also matched course participants to a comparison group using high school grade point average (GPA) that was converted to a 4.0 scale, and SAT scores on verbal, math, and writing sections. Such matches controlled for confounding variables of student ability or background to help illuminate differential effects of course participation. Appendix N illustrates mean scores on those measures. For the ex post facto treatment group, the mean converted high school GPA was 3.41 (SD=.28). Treatment group SAT scores were: (a) verbal, 491.43 (SD=65.97), (b) math, 523.57 (SD=78.80), (c) and writing, 510 (SD=60.55).

Mean composite of verbal plus math SAT scores was 1148 for all incoming students to the university and was 1011.43 (SD=133.52) for the treatment group.

Comparison Group (Ex Post Facto)

From the university assessment data, university assessment staff matched a comparison sample of students based upon freshman year, gender, race, high school GPA, and SAT scores on reading, writing, and math. Data for students in a comparison group matched participants on their year of entry into the university and the dates of participation in university assessment days. Seven students in the comparison group were freshmen in fall 2005 and nine were freshmen in fall 2006. Five students in the comparison group participated in spring assessments in spring 2007 and eleven participated in spring assessments in spring 2008.

Demographic characteristics of ex post facto comparison group.   Students in the comparison group also matched participants in demographic factors. Demographic information characterizing students in the comparison group is shown in Appendix M. As in the treatment group, 14 of the 16 were female; one student was black and 15 were white. Status as student athletes, participants in a scholarship for low socio-economic status and disclosure of disability were not available for students in the comparison group.

Grades and SAT scores of ex post facto comparison group.   University assessment staff further matched the comparison group with participants for high school GPA and SAT scores. As illustrated in Appendix N, the mean high school GPA for the comparison group was 3.56 (SD=.24). Mean SAT verbal scores for students in the

comparison group was 495.71(SD=58.93). The mean SAT math score for the comparison group was 526.43 (SD=66.98). The mean writing score for the comparison group was 502.86 (SD=49.91). Mean composite scores of verbal plus math SAT scores were 1014.29 (SD=119.53) for students in the comparison group.

Analysis

The researcher analyzed the data with three between-group research questions and two within-group research questions for course participants only. For between-group questions one, two and three, the researcher compared outcomes between the ex post facto treatment group and the matched comparison group. For within-group questions four and five, the researcher investigated outcomes for course participants only. Some intended analysis deviated from the originally planned analysis due to the small sample size.

Investigation of Pre-Test Differences Between Groups

The data were examined regarding the following research question:

1. Is there any difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen and demographically matched students who do not?

Metacognitive awareness results. The researcher used the MAI Awareness scale as a consistent measure with all course participants. The university used both scales of the MAI, including the Awareness scale for small groups during the assessment period of this study; however, the MAI Awareness scale was not used in the specific assessments administered for any students in this treatment

group or comparison group, so analysis of pre-test differences on this measure could not be conducted.

Metacognitive regulation results. The researcher used *t*-tests to compare the ex post facto treatment group with students in the comparison group on the pre-test scores on the MAI Regulation scale and each of its five subscales: Planning, Information Management, Monitoring, Debugging, and Evaluation. Appendix O displays mean pre-test scores on the MAI Regulation scale. There was no significant difference between students in the treatment group and the matched comparison group in pre-test MAI Regulation scores, $t(30)=-.581$, $p=.57$. There was also no significant difference between course participants and the comparison group in pre-test scores on any of the subscales, for Planning, $t(30)=-.61$, $p=.55$, for Information Management, $t(30)=.08$. $p=.94$, for Monitoring, $t(30)=-1.59$, $p=.12$, for Debugging, $t(30)=1.41$, $p=.17$, or for Evaluation, $t(30)=-1.63$, $p=.11$.

In all, there were no significant differences ($p<.05$) between the ex post facto treatment group and their matched comparison group on the pre-test scores on the MAI Regulation Scale including each of its subscales (Planning, Information Management, Monitoring, Debugging, and Evaluation). The lack of difference between groups in pre-test metacognitive regulation helped to clarify that any long-term difference between groups was the result of participation in the Strategic Learning course.

Investigation of Metacognitive Gains Differences Between Groups

The data were examined regarding the following research question:

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2. Is there any difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course?

Deviation from expected frequencies.   Narrowed to include only students for whom both pre-test and post-test MAI Regulation data existed, the ex post facto treatment group included only 16 students. With a matched comparison group of 16 students, the total number in the study sample was 32 students. Though initial plans were to conduct *t*-tests, because of the extremely small sample size, the researcher employed nonparametric analyses to investigate this question of between group differences in metacognitive gains (AcaStat Software, 1999; NIST/SEMATECH, 2010).

Using Statistical Package for the Social Sciences (SPSS), cross-tabulations of Chi-square showed whether any changes in scores varied significantly from what would be expected. In this computation, the size of the standardized residuals was the residual standard deviation, indicative of the standard deviation from expected frequencies in each cell. Therefore, the standardized residuals helped determine which MAI Regulation gain outcomes were different from expected frequencies for each group. Initial Chi-square with standardized residuals for all changes in scores on the MAI Regulation scale revealed clusters in score changes with a gap between gains of ten and gains of seventeen or more.

Therefore, the researcher grouped changes from pre-test to post-test scores on the MAI Regulation scale into four categories, those students whose scores went down from pre-test to post-test, those students whose scores were unchanged, those students who

gained up to ten points from pre-test to post-test, and those students who gained more than ten points from pre-test to post-test. Crosstabulations of category frequencies with standardized residuals were computed again to assess the likelihood that such categories of scores would occur.

As illustrated in Appendix P, most changes from pre-test to post-test MAI Regulation scores occurred within an expected range of frequency, less than one standard deviation from the expected frequency. In contrast, students in the treatment group made gains of more than ten points significantly more frequently than expected (1.6 SD). Students in the comparison group made gains of more than ten points significantly less frequently than expected (-1.6 SD). As each of these residuals is greater than one standard deviation, the results showed that students who participated in the Strategic Learning course experienced large gains in MAI Regulation with significantly greater frequency than expected. Conversely, students who did not participate in the Strategic Learning course did not make large long-term gains in MAI Regulation.

Chi-square analysis of gains in MAI regulation. As illustrated in Appendix Q, Chi-square analysis of gains in MAI Regulation showed no significant differences at the .05 level in gains in overall MAI Regulation for either group. Nor were there any gains in subscales of the MAI Regulation scale for students in the treatment group; however, there was one significant gain for students in the comparison group. Students in the comparison group made significant gains in Planning, X^2 (8)=17.75, $p<.05$.

Summary. In summary, the investigation of long-term gains in MAI Regulation revealed three significant results. First, results showed that students in the comparison

group made significant gains in Planning. Between the treatment and the comparison

groups, there was a significant difference from expected frequencies for rather large gains

in MAI Regulation. Second, no students in the comparison group made long-term gains

of more than ten points on the MAI Regulation scale, therefore occurring with less

frequency than expected. Finally, five students (31%) in the treatment group made gains

of ten points or more on the MAI Regulation, occurring with significantly greater

frequency than expected.

Investigation of Interrelationships among Variables

The data were examined regarding the following research question:

3.   What are the interrelationships among students' demographic characteristics,

academic goal orientation, awareness of learning and strategy use?

To investigate this research question, the researcher computed multiple regression

analyses of multiple independent variables with two dependent variables. Before

computing linear regression, the researcher first computed Mahalanobis Distances to

remove wide outliers from the dataset. Eleven outliers were removed from this dataset of

thirty-two total students, resulting in a remaining 21 students in the dataset for

computation of multiple regressions. Then, the researcher computed linear regressions

for dependent variable of both gains in MAI Regulation scores and MAI Regulation post-

test scores. Independent variables used for this computation were high school GPA

(converted to a 4.0 scale), SAT factors and pre-test measures of Achievement Goal

Orientation. The measure of Achievement Goal Orientation types were measured by

score on scales of the Attitudes Toward Learning This Semester (ATL) assessment,

Mastery Approach, Performance Approach, Mastery Avoidance, Performance Avoidance, and Work Avoidance.   Initially, SAT factors included Verbal SAT scores, Math SAT scores, Writing SAT Scores, and composite scores of Math plus Verbal SAT scores. Because of the limited number of students for whom the Writing SAT scores were available, multiple regression analysis could not compute when that factor was included. Removal of the SAT Writing scores as a factor allowed computation of multiple regression analysis for the 21 students. Therefore, SAT factors included in the multiple regression analysis included SAT Verbal scores, SAT Math scores, and the composite SAT score of Verbal plus Math scores.

Multiple regression could not be computed for the dependent variable of gains in MAI Regulation due to the small sample size. Multiple regression analysis for the dependent variable of post-test scores in MAI Regulation did demonstrate significant results. The results showed that there was a statistically significant explanation of post-test MAI Regulation scores from variance in SAT Math scores, $F(1,12)=5.389$, $p<.05$. Further, $r^2 = .31$ indicates that variance in SAT Math scores explains 31% of the variance in post-test MAI Regulation scores. This means that scores on the Math SAT can predict a student's metacognitive regulation at the mid-point of their college careers. Further analysis shows that higher SAT Math scores predicted lower post-test MAI Regulation scores, suggesting that students with the lower incoming SAT Math scores reached higher levels of metacognitive regulation by the mid-point of their college experiences.

Investigation of Continuation of Short-term Gains

The data are examined regarding the following research question:

4. Do freshman participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further gains in metacognitive regulation into the sophomore year?

As illustrated in Appendix R, eleven students from this sample of the treatment group made short-term gains from pre-test scores on the MAI Regulation scale to the end-of-course scores on the MAI Regulation scale, $t(10)=3.75$, p<.01. Though these students made pre-test to post-test gains in MAI Regulation that are significant, $t(10)=2.36$, p<.05, they did not make significant continued gains in scores on the MAI Regulation scale from end-of-course scores to post-test scores, $t(10)= -1.88$, $p=.09$. As illustrated in Appendix S, students in this sample initially demonstrated mean short-term gains in MAI Regulation scale scores of 16.64 (SD 14.70); however, from end-of-course to post-test scores these same students demonstrated losses in MAI Regulation of -8.09 (14.25). Therefore, students in the ex post facto treatment group who made short-term gains in metacognitive regulation did not continue to make significant gains in metacognitive regulation into the following academic year, and in fact declined in MAI Regulation scores from the end-of-course scores to the mid-point of their undergraduate careers.

Investigation of Differences in Gains by Disability Status

The data are examined regarding the following research question:

5. For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?

Because of the small sample size, the researcher conducted Chi-square analysis between students with disabilities and students without disabilities to test for differences on disability status in long-term gains on MAI Regulation scores. In Chi-square tests of differences between students with and without disabilities, no results were smaller than the critical values for their respective degrees of freedom. Appendix T illustrates the chi-square results. All results were smaller than the critical values for their degrees of freedom regardless of disability status. These results demonstrate that there was no association between disability status and long-term changes in scores on the MAI Regulation scale or any of its five subscales. Students with and without disabilities experienced similar long-term metacognitive effects from participation in the Strategic Learning course.

Summary

In summary, few findings of this study reached statistical significance. The study was conducted at a university that measures large sample learning outcomes on general education knowledge, motivation, and other constructs of learning behaviors. Assessment data in this study involved pre-test measurements recorded in the orientation week in early fall of the freshman year and post-test measurements recorded in spring of the year a student reaches sophomore status by credit hours. Because the university emphasized large sample measurements and not tracking change over time specific to individual students, the resulting number of students with both pre-test and post-test results on the target outcome was quite small, 16 students in the treatment group and 16

students in the matched comparison group. Such a small sample size affected the power of the results of this study.

Despite the sample size, some research questions yielded significant results. Most significantly, gains from pre-test to long-term post-test of more than 10 points on the MAI Regulation scale occurred with significantly greater than expected frequency for students who participated in the Strategic Learning course. Gains from pre-test to long-term post-test of more than 10 points on the MAI Regulation scale occurred with significantly less than expected frequency for students in the matched comparison group. Students in the comparison group, however, made significant gains from pre-test to post-test on scores on the Planning subscale.

Three other findings were important. Variance in SAT Math Scores explained 31% of the variance in post-test MAI Regulation scores, with higher scores on Math SAT test predicting lower scores on the post-test MAI Regulation scale. This finding suggests that students who scored lower on the Math SAT experienced greater development in metacognitive regulation from their entrance into college to the mid-point of their college experience. Students in the treatment group who made initial short-term gains in metacognition, measured at the end of the course, did not continue to make more gains into the next academic year. This finding suggests that long-term metacognitive benefit fades over time after participation in a course-based intervention. Furthermore, for students in the treatment group, there was no difference between long-term metacognitive gains for students with and without disabilities. This finding suggests that for outcomes of

metacognitive regulation, a course-based Strategic Learning intervention was equally effective for students with disabilities as it was for students without disabilities.

5. Conclusions

The purpose of this study was to examine existing data to ascertain long-term metacognitive effects of a postsecondary learning strategies intervention for students with and without disabilities. Over a period of six semesters, 114 students participated in a Strategic Learning course, a three-credit course focusing on learning theories, promoting self-awareness and explicit teaching of learning strategies appropriate for college success. A previous study demonstrated short-term metacognitive effects of this intervention for participants in the first four semesters of that course (Burchard & Swerdzewski, 2009). This study focused on long-term metacognitive effects of the same intervention. The researcher integrated data from three sources, records on participants in a university Strategic Learning course, confirmation of disclosed disabilities through the office serving students with disabilities, and data from a university student assessment program. The researcher analyzed information including demographic characteristics, disability status, and student scores on self-rated assessment instruments measuring achievement goal orientation, and metacognitive regulation.

Discussion of Results

The participant sample included only students who actively participated in the course, excluding those students with poor attendance, those who withdrew from the university during the course and one student who received additional intense learning strategies intervention following a disabling accident that occurred just after participation

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in the course. The participant sample included only those students who participated in

the course during freshman or sophomore years for whom university post-test assessment

data were recorded in a long-term delay of one full semester or greater following

completion of the course. The participant sample finally included only those students for

whom both pre-test and post-test data were available on the Regulation scale of the

Metacognitive Awareness Inventory (MAI), resulting in a participant sample of only 16

treatment students. From university assessment data, the participant sample was closely

matched with a comparison group of 16 students on factors of freshman year, gender,

race, high school GPA, SAT Verbal scores, SAT Math scores, and SAT Writing scores.

The total sample in this study included 32 undergraduate students.

This study investigated five research questions. Through the first three questions,

the researcher investigated differences between the ex post facto treatment group and the

matched comparison group. The researcher further examined changes within the

treatment group through questions four and five.

No Pre-Test Metacognitive Regulation Differences Between Groups

Research question one focused on pre-test differences between students in the

participant group and students in the comparison group.

1. Is there any difference in metacognitive regulation or awareness pre-test

    scores between students who participate in the Strategic Learning course as

    freshmen or sophomores and demographically matched students who do not?

The specific data set was determined based upon availability of both pre-test and

post-test data for the MAI Regulation scale. Analysis of pre-test data revealed that there

was no difference between the treatment group and the comparison group in pre-test scores on the MAI Regulation scale. Due to the limited number of students to whom the MAI Awareness scale was administered in either university assessment day, pre-test data on metacognitive awareness were not available for any students who met the final inclusion criteria for either the treatment or comparison group. Therefore, the awareness component of this question could not be answered in the current study.

Implications of no differences between groups. The finding of similar pre-test MAI Regulation scores in the current study implies that as incoming freshman, the students who participated in the Strategic Learning course were no different from their matched peers who did not participate in the course in the way they regulated learning and employed learning strategies. This finding was inconsistent with Burchard and Swerdzewski's pilot study (2009) in which students who self-selected the course started with significantly lower scores on the MAI Regulation scale than did the general student population. In that study, there was no matching of treatment group with comparison group for factors such as demographics, high school GPA, and SAT scores. That study included no demographic matching of treatment group with comparison group, but with a significantly larger sample, it would be prudent to examine this relationship further. In fact, Young and Fry (2008) recommended use of the full-scale MAI scores as an efficacious screening tool to identify freshmen in need of explicit training in metacognitive regulation. The finding of no pre-test differences between treatment and comparison groups is important to the further results of the study because any differences

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in post-test scores or gains in metacognitive regulation can be assumed to be the result of participation or non-participation in the Strategic Learning course.

Recommendations about differences between groups. In a setting with a university-wide assessment program and similar learning interventions, a case could be made for the value of metacognitive assessments to be included in university assessments for all students. Importantly, such university-wide assessment programs could be systematically structured to measure long-term growth in individual students in such constructs as metacognitive regulation. Such a structure could match a student with assessments taken in the freshman year when they participate in later assessments. The availability of long-term assessment of metacognitive growth could inform specific practices beyond the implementation of a Strategic Learning course, including, but not limited to, specific services of university writing centers, communication support centers, programs designed to develop critical thinking, and programs specifically targeting students in poor academic standing.

In a setting without university-wide assessments, students who participate in a Strategic Learning course could be assessed prior to the course, immediately after participation in the course, and at a later time to assess long-term metacognitive effects. The same metacognitive assessments could be administered to students who do not participate in the Strategic Learning course but who do participate in other university programs or interventions.

Differences in Metacognitive Gains Between Groups

Research question two focused on gains in metacognitive regulation.

2. Is there any difference in gain scores in strategy use as measured by the
   Metacognitive Awareness Inventory Regulation Scale between participants in
   the Strategic Learning course and demographically matched students who do
   not participate in the course?

For course participants, some long-term changes in MAI Regulation scores were quite large. Students in the treatment group demonstrated gains of 10 points or more on the MAI Regulation with significantly greater frequency than expected while students in the comparison group demonstrated gains of 10 points or more with significantly less frequency than expected.

Implications of long-term gains. The findings mean that most long-term metacognitive changes occurred similarly for those who participated in the Strategic Learning course and for those who did not; however, 31% of students in the treatment group made large gains in MAI Regulation while students who did not take the course did not make any such large gains. Such results were consistent with studies demonstrating that learning interventions made a difference in student learning outcomes (Allsopp et al., 2005; Pascarella & Terenzini, 1991; Vermunt, 1998) and that such learning interventions positively affected long-term outcomes such as grades or retention (Allsopp et al.; Ryan & Glenn, 2004; Pascarella & Terenzini). Though Vermunt demonstrated that improvement in postsecondary learning does not simply occur through maturity, perhaps postsecondary learners can make small but insignificant long-term

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gains in metacognitive regulation with or without explicit interventions. Clearly, though, large gains in metacognitive regulation required explicit training.

Through investigation of this question, the research study also found that students who did not participate in the Strategic Learning course made significant long-term gains in the MAI subscale of Planning. This means that without an intervention, university students made significant gains in the specific skills of metacognitive planning. Though this finding seems inconsistent with Vermunt's (1998) assertion that postsecondary students do not make gains without interventions, previous studies did not examine long-term changes in subscales as specific as planning. Perhaps maturity in planning is natural as students separate from home supports and progress through postsecondary education.

The university at which the current study was conducted emphasizes assessment at the program level, not at the level of courses or students. Mountain Valley University (MVU) administered repeated measures for specific assessments related to general education program priorities, such as a measure of quantitative and scientific reasoning. In fact, students had the option to compare their own scores from freshman year to scores from the mid-college spring assessment on the measure of quantitative and scientific reasoning. In contrast, measures of metacognitive awareness or metacognitive regulation were not repeated measure for all students. If a similar priority were to assess all students in metacognition and students had the same ability to compares their own pre-test and post-test scores, such feedback might connect students with information about campus resources and opportunities for training or support of metacognitive development. Short of such a university-based assessment undertaking, on-line metacognitive assessments

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similar to the learning styles assessment of Soloman and Felder (2009) could provide students with immediate feedback on their areas of metacognitive strength and suggestions about resources and training, which could be accessed to support growth in areas of weakness.

The unique structure of this course leads to an important implication for practice. Unlike most other interventions discussed in the literature, this course was not a course only about learning strategies, but it integrated learning theory, reflection on awareness of learning in the context of learning theories, explicit training in a variety of learning strategies, and reinforcement for application of those learning strategies in other courses. Thus, this course was focused on an outcome of strategic thinking and learning, not simply on acquisition of strategies. Long-term effects for large gains in metacognitive regulation suggest that this instructional approach was a good start toward development of an intervention that can benefit postsecondary student success.

Recommendations about long-term gains. The most essential question for future research remains how universities can best support the postsecondary learner, especially sub-populations of concern. What variations in course design, content, and teaching techniques of a Strategic Learning course might promote even greater likelihood that students would make large long-term gains in metacognitive regulation? For example, the volume of course content should be adjusted to the length of the course. Additionally, this Strategic Learning course was taught by a special educator with expertise in learning strategies, but an educational psychologist may bring more expertise in learning theory or motivation. Could components of this course approach be

embedded consistently throughout specific general education courses toward university-wide metacognitive goals? Writing courses could embed specific writing strategies or critical thinking strategies. A variety of liberal arts general education courses could embed reading or time management strategies.

How might university assessment programs help identify students in need of such interventions? If metacognitive assessments in the freshman year identified students with low metacognitive regulation, those students might be advised to participate in a Strategic Learning course early in their college career. Follow-up monitoring could assess development in metacognitive regulation, and even identify the need for follow-up interventions.

Interrelationships Between Variables

Research question three focused on interrelationships between demographic factors, SAT performance, and Achievement Goal Orientation with outcomes of metacognitive regulation.

3. What are the interrelationships among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use?

Analysis of interrelationships revealed no relationship between participation in the Strategic Learning course and any other factors (demographic characteristics, Achievement Goal Orientation types, high school GPA, and SAT scores) toward the outcome of metacognitive regulation as measured by the MAI Regulation scale. Math SAT scores demonstrated predictive value for long-term MAI Regulation scores.

Implications of interrelationships. Math SAT scores predicted 31% of the variance in post-test MAI Regulation scores. Importantly, students with lower SAT Math scores actually scored higher on the post-test MAI Regulation. Previous research showed that students with higher Math SAT scores were more likely to graduate from college (Chimka, Reed-Rhoads, & Baker, 2007; Livingston, 2008); that metacognitive activity was predictive of grades for postsecondary students (Proctor, Prevatt, Adams, Hurst, and Petscher, 2006; Ruban, 2000); and that students with disabilities were likely to achieve academic success through compensating with strong regulatory strategies (Trainin & Swanson, 2005). As such, the negative relationship between Math SAT scores and scores on MAI Regulation seemed surprising. In fact, given the logical nature of many strategies and the logical performance measured by the Math SAT test, the researcher instead expected an opposite result. Considering the small sample used in the computation of the multiple regression analysis, and the variance from previous research, this finding was likely an anomaly as a large body of research exists on use of SAT scores as positively correlated predictors of student success and performance outcomes.

One relevant finding in studies of SATs suggested that if this finding is not an anomaly, the relationship between Math SAT scores and MAI Regulation scores may have been gender related. As 19 of the 21 students (91%) in this regression analysis were female, gender issues were important to consider. Controlling for math courses taken, males scored higher than females on both the Math PSAT and Math SAT scores (Mollette, 2004). Furthermore, a study by Gallagher and DeLisi (1994) demonstrated that of students with high scores on Math SATs, females were more likely to use

conventional strategies while males were more likely to employ creative problem-solving

strategies. Most learning strategies taught to address metacognitive regulation explicitly

involved specific steps or stages (Minskoff & Allsopp, 2003). The current study did not

measure students' use of specific learning strategies, but instead investigated long-term

metacognitive effects of the specific approach of integrating learning theory with learning

strategies. Perhaps postsecondary females were more traditional in their metacognitive

processes than were male postsecondary students.   Because the MAI Regulation scale

measured how a student intentionally regulates learning, perhaps students who felt more

academically inclined did not feel the need to engage in metacognitive regulation at the

same level. Therefore, if this relationship were to hold true in an extended study with

larger sample size, then admissions data may be useful in advising students to participate

in such learning interventions, recommending course-based strategic learning

interventions for students with the lower SAT Math scores.

Recommendations about interrelationships. The MAI Regulation scale works

effectively for assessment of postsecondary students with no previously demonstrated

gender bias (Schraw & Dennison, 1994; Schraw & Moshman, 1995). No previous

studies of postsecondary learning showed interrelationships among gender, long-term

metacognitive regulation or employment of learning strategies. In light of previous

research, these findings raised the question of whether there is an interaction between

Math SAT scores, gender, and long-term MAI Regulation scores worthy of exploring

further in a larger gender balanced sample. This negative relationship between SAT

Math scores and MAI Regulation scores also suggested that students with lower SAT

Math scores may be more responsive to interventions targeting development in metacognitive regulation. Further examination of such connections is indicated. A replication of this study is indicated to determine if in fact this result is anomalous.

No Continuation of Short-term Gains

Research question four focuses on continued gains in metacognitive regulation by students who made short-term gains.

4. Do participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further long-term gains in metacognitive regulation?

Students in the ex post facto treatment group who did make short-term gains in MAI Regulation did not make continued gains in scores on the MAI Regulation scale from end-of-course scores to post-test scores. Though the change from end-of-course to the post-test measures was not significant, still the mean score change from end-of-course to post-test declined. Without follow-up intervention, students lost some of the regulation strength and learning strategies initially gained. This finding suggested that long-term maintenance of benefit to participation in a Strategic Learning course declines over time.

Implications of declining metacognitive effects. Analysis of which students made the short-term gains reveals that eight of those 11 students (73%) disclosed disabilities. The current study did not code for different disabilities or degree of impact on learning. Though all students who disclosed disabilities did disclose cognitive impact of those disabilities, the disabilities included learning disabilities, ADHD, brain injuries,

and psychological disabilities. With such variance in disability types, the researcher could not discuss relationships between the declining metacognitive effectiveness and characteristics of specific disabilities.

The declining metacognitive benefit over time was consistent with Tuckman's study (2003) of the effect on grades of participation in a learning strategies course. In his study, course participants experienced large effect size grade benefits over a matched comparison group in the semester of the course. When controlling for the grade in the learning strategies course, the effect size benefit to grades was moderate. When comparing effect on grades into the next semester, Tuckman demonstrated a significant effect from participation in the strategies course; however, that effect amounted to only a small effect size advantage over the comparison group. While Tuckman's study demonstrated effectiveness, it also demonstrated a declining benefit for just one semester. The current study examined metacognitive effects well beyond a semester delay from participation in the Strategic Learning course.

Recommendations about declining metacognitive effects. The declining metacognitive benefit raised numerous questions. Would the apparent declining benefit rise to a level of significance in a similar study of a larger sample size? This is an important question as a university should want to support interventions that are effective for both short-term and long-term benefit to students. If declining effects were to be significant, would students' gains completely disappear over a longer period of time? Such findings would be important to timing of interventions and any follow-up services. What types of follow-up interventions might improve maintenance of metacognitive

benefit? For example, some interventions might focus on reviewing specific learning strategies while other interventions might focus instead on conditional awareness of how to transfer previously learned strategies to new situations. Clarity in effective follow-up design could support funding decisions for learning support services or guide development of new supports.

No Differences in Gains by Disability Status

Research question five focused on differences in metacognitive regulation gains relative to disability status for students in the participant group.

5. For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?

Results of the current study indicated that students with and without disabilities experienced no differential effect in long-term metacognitive effect from participation in the Strategic Learning course. This means that students with disabilities benefitted equally well in long-term metacognitive effects of participation in the Strategic Learning course when compared to their non-disabled peers.

Implications of equal effects with and without disabilities. The demonstration of no significant association between disability status and long-term changes in scores on the MAI Regulation scale or any of its five subscales is consistent with some previous findings while inconsistent with others.   This finding was consistent with Hall and Webster's (2008) study that showed no differences between students with and without disabilities in use of metacognitive skills or interrelationships between metacognition and other learning constructs. This finding was also consistent with the earlier study of short-

term metacognitive effects of participation in this same Strategic Learning course, which found no differential effect by disability status (Burchard & Swerdzewski, 2009).

This finding was inconsistent with other studies that showed that students with disabilities were less likely to generalize learning strategies to other courses or contexts (Brinkerhoff et al., 1992; Brinkerhoff, 1996; Minskoff et al., 2003; Swanson, 1989; Weinstein et al., 1986). Investigating postsecondary students' use of learning strategies, Reaser et al. (2007) found different use of learning strategies by students without disabilities, students with learning disabilities and students with ADHD, with varied strengths and weaknesses related to disability type or non-disabled status. Reaser did not investigate the effects of any intervention nor did he assess at more than one time. He demonstrated that specific strategies were more frequently reported to be used by students with learning disabilities than by students without disabilities, but that those same strategies were less often used by students with ADHD than they were for their non-disabled peers. The broad disability status classification of students in the current study prevented investigation of differing effects for students with different types of disabilities.

Importantly, however, with only two students without disabilities in the treatment sample, these results must be interpreted with caution. Because of the overrepresentation of students with disabilities in the treatment group, this aspect of the study should be replicated in order to ascertain if these results are anomalous.

Recommendations about effects with and without disabilities. There is a serious gap in research on differential effects of metacognitive and learning strategy

interventions dependent upon disability status. Given the evidence of the value of such interventions for postsecondary populations, extensions to large sample studies should include investigation of disability-related effects. Are there differential long-term metacognitive effects from participation in Strategic Learning courses for students with specific types of disabilities? Perhaps students with learning disabilities are more responsive to a Strategic Learning course than are students with anxiety disorders. Are there differences in transfer or maintenance of effect dependent upon disability status and/or specific types of disabilities? This is an important question because some disabilities impair memory and require more frequent review of content. Would students with different types of disabilities perform differently on specific subscale components of metacognitive regulation? For example, one might expect a student with ADHD to perform less well on measures of planning or monitoring simply by the nature of their disability. If a Strategic Learning course demonstrates varied effect for students with different types of disabilities, then results may also guide modifications of course content or design to best meet the needs of students in the course.

Any replication of the study should use larger samples of students with disabilities. A larger study similar to the current study has potential to investigate differences not only in overall scores or gains in metacognitive regulation, but also in the specific subscale components of metacognitive regulation, such as planning or monitoring. Additionally, a larger study focused on students with disabilities may allow investigation of differing metacognitive effects for students with different types of disabilities. Such a study would allow for specific inferences regarding differentiation of

techniques for students with and without disabilities or even for students with specific types of disabilities.

Summary

In conclusion, increasingly, universities are focusing on the needs of all learners. To support all learners requires a university investment in student learning supports (Engo & Tinto, 2008; Kuh, 2005). An emphasis must be given not just to admitting more diverse students, but also to supporting student progression through college toward an outcome of graduation (Venezia et al., 2003). Various studies demonstrated that strategy use correlated with higher grades (Proctor, Prevatt, Adams, Hurt, & Petscher, 2006; Young & Fry, 2008). The majority of students with disabilities and disability service providers reported a need for explicit training in learning strategies for postsecondary students with disabilities (McGuire, Hall, & Litt, 1991; Mull, Stillington, & Alper, 2001).

As universities implement assessment programs to monitor student learning outcomes, results from this study suggested the value of tracking student learning over time, including measures of metacognitive development, such as the MAI Regulation scale. In administering different assessment instruments to individual students at their various assessment points, the university missed the opportunity to measure change over time for specific students on valuable constructs, in this case metacognitive regulation. Effort to track the progress of individual students over time in such assessment efforts could yield valuable information about effectiveness of specific interventions and programs.

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Postsecondary students in the current study who actively participated in a

Strategic Learning course demonstrated no differential long-term metacognitive effects

dependent upon disability status. No differential effect based upon disability status

indicated that students with and without disabilities benefitted equally from such a

course-based intervention. Students with disabilities were overrepresented in the

treatment group. Therefore, replication of the study is indicated to determine if research

would find similar results in a larger sample with disability representation more similar to

that in the general student population.

Variance in Math SAT scores explained 31% of the variance in MAI Regulation

scores measured at the mid-point of the college experience. Further, students with lower

SAT Math scores as incoming freshmen scored higher on the MAI Regulation at the mid-

point of their college career. Perhaps this finding was gender-related given the higher

representation of females in the current study sample. Due to the small sample size,

replication of this investigation is indicated to determine if these results are anomalous.

Most significantly, large long-term metacognitive gains, as measured by the MAI

Regulation scale, occurred with significantly greater than expected frequency for those in

the treatment group.   One caution to this result is that long-term maintenance of benefit

to participation in a Strategic Learning course declined from immediate short-term gains

to long-term measures at the mid-point of the academic career. Therefore, replication of

a study on long-term metacognitive effects of a postsecondary course should consider

possible follow-up interventions. The current study showed that students experienced

positive long-term metacognitive effects from participation in the Strategic Learning

course, a course designed to engage students in development of both metacognitive awareness and regulation through teaching about learning theories and training in specific learning strategies. Importantly, the course design emphasized strategic learning, not just accumulation of learning strategies. Findings of this study clearly support development of postsecondary Strategic Learning courses or possible revisions of existing learning strategies courses toward more emphasis on strategic learning.

Appendix A: Advantages and Limitations by each Approach to Teaching Learning
Strategies

Approaches	Advantages	Limitations
Workshops	Facilitates research on effectiveness of specific strategies Minimal time required of students to learn new strategies	Disconnected from actual course requirements Limited evidence of transfer No evidence of maintenance over time
Embedded in Content Courses	Closely connected to content May accomplish specific objectives of courses or programs Facilitates targeting audiences who need field-specific strategies Some evidence of maintenance of learning over time	Content experts may need training in how to teach learning strategies Limited research on varied general learning strategies embedded within content instruction
Learning Strategies Programs	Individualized for specific needs of each learner One-on-one services may facilitate relationships Some evidence of maintenance of learning over time	Evidence of effectiveness typically limited to grades Variance in service details and intensity complicates comparison of results across participants Manpower intensive
Learning Strategies Courses	Facilitates research on effectiveness of package of strategies Facilitates connections of theory with practice	Disconnected from content instruction unless specific assignments require application Limited evidence of maintenance over time
All	May serve needs of at-risk students	Need further evidence of transfer or maintenance

Appendix B: Strategic Learning Syllabus Components

Note: add contact details, policies, campus support information, and grading details.

Purpose and description:
This course is designed to increase application of specific learning theories and active learning strategies. Students will learn about metacognition and learning theories. Students will be introduced to various supports and resources for learning. Through highly structured course activities, the course will teach students to evaluate and apply a variety of learning theories and strategies. In addition, students will use self-assessment information to construct a personal learning plan.

Course Objectives:
1) Each student will comprehend and apply various learning and metacognitive theories.
2) Each student will gain awareness of personal learning preferences, strengths, weaknesses, and strategy use.
3) Each student will learn and implement a variety of specific learning strategies. Strategy areas addressed shall include:
   - Task analysis, time management and organization
   - Note-taking
   - Reading
   - Writing
   - Studying and Memory
   - Test-taking
   - Complex thinking and Reasoning
   - Stress management
   - Research / information literacy
4) Each student will develop a personal learning plan designed to be implemented in future learning.

Suggested readings:
Academic Success Strategies for Adolescents with Learning Disabilities and ADHD by Esther Minskoff and David Allsopp (This book is highly suggested for students who

prefer print material to computer based material as well as for students who plan to become teachers.)

Essential Study Skills, 4th edition by Linda Wong (This book details more learning theories and learning strategies.)

Assignment	Points	Weighted percentage of grade
Participation type grades		
First learning inventories	80	8%
2nd learning inventories	30	3%
In-class activities, participation, and attendance	60	6%
Career Exploration	80	8%
Assignments		
Personal Learning Reflection	100	10%
Brain Function Project	150	15%
Strategy Plan Chart	100	10%
Personal Learning Plan	200	20%
Tests		
Test #1	100	10%
Test #2	100	10%
TOTAL	1,000	100%

Total points obtained ÷ total points possible = grade in course

Assignment Details:
Career Exploration
Students will participate in two choice activities by Career and Academic Planning or department of major. These are scheduled outside of class. Reservations for workshops should be made early in the semester. Points are earned for participation, and this information becomes a key component to the final project.

Strategy Implementation Evidence
Students will show evidence of implementing two strategies in work for another class: note-taking, reading, writing, memory, time management, etc.

Learning Inventories
Students will assess personal learning using various assessment tools. This is an essential component to building awareness of learning and measuring progress. All students must

complete all learning inventories. Grading is not based upon scoring, but upon completion.

Personal Learning Reflection
After completing initial learning inventories, students will evaluate personal learning in a brief paper. Students will evaluate changes in learning in the final project.

Brain Function Project
Students will research one topic related to brain function and/or learning (such as caffeine, sleep, music, etc.) and briefly reflect on the impact on brain function, specifically related to learning, including personal implications. This project is creative, persuasive, and includes implementation of strategies for reading, writing and information literacy.

Learning Goals Chart
Students will address four specific areas of learning challenge with measurable objectives and strategies. This will become a major component in the final project.

In-class Learning Activities/ Discussion Board Activities
Some classes will involve group or individual activities, which may or may not be announced in advance. Watch announcements for what to bring to class. Grades for these activities will be included in class participation grades.

Tests
The tests cover information from class lectures, discussions, specific strategies, and assigned readings. Each test will assess use of test-taking and/or memory strategies. This will be explained in detail.

Personal Learning Plan
This major project substitutes for a final exam. Much of the work this semester builds to this project. Key components of the assignment include personal learning profile, career and academic connections, strategic goals for learning, specific strategies, and helpful resources. Points are also awarded for organization, depth of thought and a brief oral presentation of the project.

Topics in order	*Readings*/ **assignments**
Introductions Syllabus Lessons in course technology	
Personal learning inventories Listening: SLANT, Active Listening Note-taking: Cornell, Margin note-taking	**1st Learning Inventories in class**
Multiple Intelligence Theory Learning Styles	*Multiple Intelligence and Learning Style Readings*

Topics in order	*Readings*/ **assignments**
Achievement Goal Orientation Self-Efficacy	*Motivation Reading*
Metacognition Bloom's Taxonomy and Syllabus Activity	*Metacognition Reading*
Career and Academic Planning presentation What is a Strategy? Note-taking strategies General Study Skills/Strategies	
Task Analysis, Time Management, Organization, *brief panel of presenters from campus learning supports*	
Test-Taking Strategies: RAINS, CRAM	**Personal Learning Reflection**
Brain Function	*Brain Function Readings*
Reading: selecting strategies for different texts, Note-taking: Double entry, CONAIR	
Reading: RAP-Q, BCDE, 5 W's & 1H	
Reading Strategies for research	
Research Strategies Presentation by Librarian	
Stress Management Presentation by Occupational Therapy Professor or Campus Counselor	
Wilson's Model for Critical Thinking Concept Mapping/ Graphic Organizers	
Goal Theories Writing Personal Goals/ ABCD	**Brain Function Project**
Writing Strategies Graphic Organizers, Hamburger	
Writing Strategies Sentence Writing, Personal Lexicons	
Perry's Forms of Intellectual Development Diversity in Learning	**Learning Goals Chart**
Models of Memory	*Memory Reading*
Memory Principles General Memory Strategies: Chunking, others from the readings	**Career Exploration Deadline** and **Strategy Implementation Evidence**
Mnemonics, FIRST Small group creation of personal mnemonics	
Principles of Forgetting	
Mnemonics creations shared, LINCS Vocabulary Strategy	**2nd Learning Inventories in class**
Learning Inventories More Test-taking Strategies: SQUID, essay strategies	
Changes in Learning	
Panel presentation by students who use strategies	**Personal Learning Plans**
Presentation of Personal Learning Plans	

Appendix C: Example Learning Strategies Taught in the Strategic Learning Course

Topic	Strategies and purposes	Sources
Goal setting	GPA Calculator	Bucknell University. (2009)
	ABCD goal writing	Kissel, Miller, & Young. (2003).
Listening and Note-taking	Active listening strategies for improved communication with instructors	Landsberger. (1996)
	CONAIR for taking notes for research or from textbooks with headings and subheadings	Minskoff, & Allsopp. (2003)
	Cornell note-taking to review key words and summarize main ideas from lecture notes	Originally from Cornell University, described in Minskoff, & Allsopp. (2003).
	Double-entry journals to synthesize or reflect	Weiser. (2003)
Memory	LINCS vocabulary strategy for learning new vocabulary	Ellis. (2000)
	FIRST for creating first letter mnemonic devices to remember concepts	Nagel, Schumaker, & Deshler (1986)
	Chunking	Miller. (1956); Wong. (2003).
Reading	BCDE to connect text readings to class lectures	Minskoff, & Allsopp. (2003)
	RAP-Q to comprehend main ideas	Minskoff, & Allsopp. (2003)
	5 W's and 1H to notice details in text	Minskoff, & Allsopp. (2003)
	The Paraphrasing Strategy	Schumaker, Denton, & Deshler. (1984)

Appendix C: Example Learning Strategies Taught in the Strategic Learning Course (continued)

Topic	Strategies and purposes	Sources
Writing	Wilson's model for critical thinking to learn to write about concepts using cases, contrary cases and borderline cases	Wilson (1963)
	Hamburger strategy for organizing expository arguments	Collins (2008)
	Sentence Writing Strategy for increasing complexity in sentence variety	Schmidt (1985)
Test-taking	RAINS for multiple-choice tests requiring selection of *best* answers	Minskoff, & Allsopp (2003)
	CRAM for multiple-choice tests in math, science or for students with test anxiety	Minskoff, & Allsopp (2003)
	SQUID for true/false tests	Minskoff, & Allsopp (2003)
	The Test-Taking Strategy	Hughes, Schumaker, Deshler, & Mercer. (1993)
Time Management	Hours in your schedule to assess use of time	Landsberger (1996)
	Assignment Calculator to plan steps of research papers or projects	University of Minnesota Libraries (2009)
	5-day Test Prep to manage study time before tests	Glickman (2009)

Appendix D: Student-Made Mnemonic Strategy: CAMEL

CAMEL
A strategy for applying key concepts in scenarios on tests.

C Comprehend key concepts

A Assess all questions in word problem

M Make answer which is logical,
(addressing all parts, inserting key terms)

E Evaluate your answer, checking all parts

L Learn from mistakes on past tests
and practice some more.

Written by three Business Majors in the Spring 2008 Strategic Learning course.

Appendix E: Student-Made Mnemonic Strategy: POLARS

POLARS

A strategy for processing dense text reading at higher levels.

P   Pace your reading

O   Order the information

L   Link reading to prior knowledge

A   Actively use what was learned

R   Re-read

S   Summarize

Written by four students in majors with complex dense texts, spring 2008

Appendix F: Example Learning Theories in Strategic Learning Course

Learning Theories or Constructs	Suggested Sources
Achievement Goal Orientation	Dembo (2004), Dweck (2008); Grant & Dweck (2003); Harackiewicz, Barron, Pintrich, Ellit, Thrash (2002); Pintrich (2000); Pintrich (2004).
Bloom's Taxonomy of Learning	Anderson & Krathwol (2001); Bloom (1964).
Brain function	Sousa (2006); Sylwester (2005).
Forms of intellectual development	Perry (1970).
Goal theories and self-determination	Field & Hoffman (1994); Field, Marin, Miller, Ward, & Wehmeyer (1998); Shogren, Wehmeyer, Palmer, Soukup, Little, Garner & Lawrence (2008).
Learning Styles	Soloman & Felder (2009).
Memory and forgetting	Higbe (1996); Miller (1956); Schacter (2002); Wong (2003).
Metacognition	Flavell (1979); Nelson (1999); Pintrich (2002); Schraw & Moshman (1995); Vrugt & Oort (2008).
Multiple Intelligence Theory	Gardner (1983); Guignon (1998).
Self-Efficacy	Bandura (2000); Jakubowski & Dembo (2004); Zimmerman, Bandura, & Martinez-Pons (1992); Zimmerman & Kitsantas (2007).

Appendix G: Student Work Sample of Strategic Goals Chart

General challenges to address	Specific challenges	Goals to address challenges	Prescriptive strategies
Reading Comprehension	Reading comprehension for the big picture. Remembering what I read after I have read the assignment.	During spring semester 2006, I will use note-taking strategies while reading textbooks, which will help me, understand the main ideas and remember what I read. I will measure my success by receiving a B- or better in my classes in which have a large amount of reading required.	Cornell note-taking. Two Column note-taking RAP-Q Review sections I highlighted while reading, after I have finished the reading assignment.
Planning for my slower processing speed.	Generally assignments take me longer to complete, especially ones which involve reading. Finding time to get everything completed when I know that most assignments will take me longer than most students.	During spring semester 2006, I will pick two important assignments to complete each day and plan enough time to complete these assignments in my daily agenda, so that I do not feel rushed or get frustrated with myself when an assignment takes me longer to complete. My success will be measured by seeing if I completed the assignments I planned to complete for that day.	Using a daily planner to allot specific times to work on assignments. Follow the time schedule I set for myself, and if an assignment runs over, determine how much more time I will need to complete it, then decide if I want to finish it at that time or put it aside and start the next assignment I had planned to do. Check off assignments in my planner when they are completed.

General challenges to address	Specific challenges	Goals to address challenges	Prescriptive strategies
Time Management for completing school work and also finding time for myself.	Finding time for myself to relax or exercise on top of all my school work. Sometimes I feel like I am missing out on activities taking place around campus or hanging out with friends because I have too much work to complete.	During spring semester 2006, I will set aside two hours a day to exercise, hang out with friends, relax, or watch TV. My success will be measured by checking off the time I designated for free-time in my agenda planner or writing down the exercise I participated in that day.	Make a daily plan of when to do school work and fit time to either relax or exercise. Recognize exercise can reduce the stress caused by schoolwork.
Not cramming for tests and long term assignments.	I tend to wait to the last minute to study for tests or to start long term assignment because I have other assignments that need to be done before that.	During Spring semester 2005 and throughout college, I will start studying a few days before the test to avoid cramming, and I will also make a schedule for when parts of long term assignments should be done by and strictly follow the schedule to prevent waiting to the last minute to complete the assignment. I will measure my success by receiving a B- or better on tests and assignments.	3Cs TAP-D BREAK Five Day Test Prep Set my own due dates for when parts of a long-term assignment should be completed by. Go over class notes after class that same day to help retain and review information learned.

Appendix H: Research Strategy for College Research or Writing

*Personalize for the specific university using screen shots from university library pages
to illustrate each step, and specific links.

Clarke, K., Burchard, M.S., Hyland, M.G., Wicker, B.M., Andreozzi, S. & Moriarty, A.
(2006). Research strategy for college research or writing projects. As presented in
Learning strategies for effective research, a presentation to the Virginia Council
for Exceptional Children by Burchard and Hyland. (2008).

	The need:	Look here or consider this:	Goals:
Step one	To refine my topic and find background information	Subject specific encyclopedia in Library reference section Opposing viewpoints (link from library page) *Keep an open mind! Choose a topic which interests you!*	Find a topic with sufficient research Narrow a topic that is too big Pick key words for further research Check bibliographies of first sources found
Step two	To find more articles	Search more from specific database: search by subject area—from library page or for a more general search, from library page, click on "research databases and resources"; in middle column select "articles" and then the first database listed *or Ask a librarian to recommend the best database for your topic!*	Beef up research by finding articles from scholarly sources

	The need:	Look here or consider this:	Goals:
Step three	To read the text of the articles I find in step two	Click on PDF or Full Texts when available. or Check for books and journals from Library page If not in your library, click on Interlibrary loan—you'll likely get it within a week—free *Keep a copy of all sources you use!!! This helps in verifying quotes or consulting with questions later.*	Actually reading those articles
Problem solving	To further research if topic is not in journal literature	Look for books in library Or start at step one again to further refine topic	In-depth or comprehensive coverage Possibly narrowing topic
Visual sources	To find a video	Look in library resources—run search in keywords box – then limit results by format of "video/DVD"	Find a DVD or video to check out or streaming video on-line
References	To verify, organize and document sources	Look in style manuals see library page under Quick reference/style manuals Or consult a manual in the library Or click on style format links which you can find at the bottom of the most university library pages Use "find" feature in Word to be sure every citation is covered in your references and every listing in your references is used in your writing. Even cite yourself if you're using words you wrote before.	Insuring references are accurate Checking that bibliography is in good order Avoiding honor code violations

Appendix I: Metacognitive Awareness Inventory (MAI)

Always false	Sometimes false	Neutral	Sometimes true	Always true
1	2	3	4	5

*this is the response option for each of the MAI items.

MAI
Please indicate how true each statement is of you. There is no right or wrong answer.

1. I ask myself periodically if I am meeting my goals.
2. I consider several alternatives to a problem before I answer.
3. I try to use strategies that have worked in the past.
4. I pace myself while learning in order to have enough time.
5. I understand my intellectual strengths and weaknesses
6. I think about what I really need to learn before I begin a task.
7. I know how well I did once I finish a test.
8. I set specific goals before I begin a task.
9. I slow down when I encounter important information.
10. I know what kind of information is most important to learn.
11. I ask myself if I have considered all options when solving a problem.
12. I am good at organizing information.
13. I consciously focus my attention on important information.
14. I have a specific purpose for each strategy I use.
15. I learn best when I know something about the topic.
16. I know what the teacher expects me to learn.
17. I am good at remembering information.
18. I use different learning strategies depending on the situation.
19. I ask myself if there was an easier way to do things after I finish a task.
20. I have control over how well I learn.
21. I periodically review to help me understand important relationships.
22. I ask myself questions about the material before I begin.
23. I think of several ways to solve a problem and choose the best one.
24. I summarize what I've learned after I finish.
25. I ask others for help when I don't understand something.
26. I can motivate myself to learn when I need to.
27. I am aware of what strategies I use when I study.

28. I find myself analyzing the usefulness of strategies while I study.
29. I use my intellectual strengths to compensate for my weaknesses.
30. I focus on the meaning and significance of new information.
31. I create my own examples to make information more meaningful.
32. I am a good judge of how well I understand something.
33. I find myself using helpful learning strategies automatically.
34. I find myself pausing regularly to check my comprehension.
35. I know when each strategy I use will be most effective.
36. I ask myself how well I accomplished my goals once I'm finished.
37. I draw pictures or diagrams to help me understand while learning.
38. I ask myself if I have considered all options after I solve a problem.
39. I try to translate new information into my own words.
40. I change strategies when I fail to understand.
41. I use the organizational structure of the text to help me learn.
42. I read instructions carefully before I begin a task.
43. I ask myself if what I'm reading is related to what I already know.
44. I reevaluate my assumptions when I get confused.
45. I organize my time to best accomplish my goals.
46. I learn more when I am interested in the topic.
47. I try to break studying down into smaller steps.
48. I focus on overall meaning rather than specifics.
49. I ask myself questions about how well I am doing while I am learning something new.
50. I ask myself if I learned as much as I could have once I finish a task.
51. I stop and go back over new information that is not clear.
52. I stop and reread when I get confused.

Appendix J: Attitudes Toward Learning This Semester (ATL)

Not at all true of me						Very true of me
1	2	3	4	5	6	7

*this is the response option for each of the ATL items.

ATL

Please indicate how true each statement is of you. There is no right or wrong answer.

1. My goal this semester is to get better grades than most of the other students.
2. I just want to avoid doing poorly compared to other students this semester.
3. Completely mastering the material in my courses is important to me this semester.
4. I'm afraid that I may not understand the content of my courses as thoroughly as I'd like.
5. It is important for me to do well compared to other students this semester.
6. I want to learn as much as possible this semester.
7. The fear of performing poorly is what motivates me.
8. The most important thing for me this semester is to understand the content in my courses as thoroughly as possible.
9. I worry that I may not learn all that I possibly could this semester.
10. I want to do better than other students this semester.
11. I am definitely concerned that I may not learn all that I can this semester.
12. My goal this semester is to avoid performing poorly compared to other students.

Appendix K: Research Questions and Null Hypotheses

	Questions	Null Hypothesis
1.	Is there any difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen or sophomores and demographically matched students who do not?	There is no difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen or sophomores and demographically matched students who do not.
2.	Is there any difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course?	There will be no difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course.
3.	What are the interrelationships among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use?	There will be no relationship among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use.
4.	Do participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further long-term gains in metacognitive regulation?	Participants in the Strategic Learning course who made short-term gains in metacognitive regulation will not continue to make further long-term gains in metacognitive regulation.
5.	For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?	For course participants, there is no difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status.

Appendix L: Research Questions, Measures, and Analysis

	Questions	Measures	Analysis
1.	Is there any difference in metacognitive regulation or awareness pre-test scores between students who participate in the Strategic Learning course as freshmen or sophomores and demographically matched students who do not?	MAI Regulation and Awareness scales	*t*-test
2.	Is there any difference in gain scores in strategy use as measured by the MAI Regulation Scale between participants in the Strategic Learning course and demographically matched students who do not participate in the course?	MAI Regulation scale	*t*-test and frequency crosstabulations
3.	What are the interrelationships among student's demographic characteristics, freshman achievement measures, achievement goal orientation, awareness of learning and strategy use?	demographic characteristics, high school GPAs, SAT scores, ATL scores, MAI regulation scores	multiple regression
4.	Do participants in the Strategic Learning course who made short-term gains in metacognitive regulation continue to make further long-term gains in metacognitive regulation?	MAI Regulation scale	pair-wise *t*-test
5.	For course participants, is there a difference in metacognitive regulation gain scores as measured by MAI Regulation relative to disability status?	MAI Regulation scale disability status	pair-wise *t*-test

Appendix M: Demographic Characteristics of Participants

	Gender	Race	Disability	Athlete	Low SES
Treatment	Male	White	With	Athlete	Yes
	2	15	14	0	0
	12.5%	93.75%	87.5%	0%	0%
	Female	Black	Without	Non-Athlete	No
	14	1	2	16	16
	87.5%	6.25%	12.5%	100%	100%
Comparison	Male	White	With	Athlete	Yes
	2	15	14	0	0
	12.5%	93.75%	87.5%	0%	0%
	Female	Black	Without	Non-Athlete	No
	14	1	2	16	16
	87.5%	6.25%	12.5%	100%	100%

Appendix N: High School Scores of Participants

	HS GPA	SAT Verbal	SAT Math	SAT Writing	SAT Composite Verbal + Math
Treatment					
Mean	3.41	491.43	523.57	510	1011.43
SD	.28	65.97	78.80	60.55	133.52
Number	16	14	14	7	14
Comparison					
Mean	3.56	495.71	526.43	502.86	1014.29
SD	.24	58.93	66.98	49.91	119.53
Number	16	14	14	7	14

Appendix O: Pre-test MAI Regulation Score Means and Differences

	Treatment *n*=16	Comparison *n*=16	Differences
MAI R	129.12 (12.18)	132.06 (16.17)	$t(30)= -.58, p=.57$
Planning	25.06 (4.68)	25.92 (3.36)	$t(30)= -.61, p=.55$
Info Mgmt	38.06 (4.51)	37.94 (4.43)	$t(30)= .08, p=.94$
Monitoring	24.81 (2.43)	26.56 (3.67)	$t(30)= -1.59, p=.12$
Debugging	22.06 (1.77)	20.69 (3.48)	$t(30)= 1.41, p=.17$
Evaluation	19.13 (3.12)	20.94 (3.17)	$t(30)= -1.63, p=.11$

Appendix P: Crosstabulation of Change Frequencies on MAI Regulation

	Loss	No change	Gains up to 10 pts.	Gains more than 10 pts.
Treatment				
Count	5	1	5	5
Std. Residual	-.6	.7	-.6	1.6[*]
Comparison				
Count	8	0	8	0
Std. Residual	.6	-.7	.6	-1.6[*]

[*] Significant deviation from expected frequency

Appendix Q: Chi-Square Results on Long-Term Change in MAI Regulation Scores

	Treatment Chi-Square	df	Asymp. Sig.	Comparison Chi-Square	df	Asymp. Sig.
MAI-R	1.50	13	1.00	6.00	10	.82
Planning	3.25	10	.98	17.75	8	.02[*]
Info. Mgmt	4.0	9	.91	3.25	6	.78
Monitoring	6.75	6	.35	5.38	8	.78
Debugging	6.00	10	.82	3.25	6	.78
Evaluation	8.75	8	.36	6.50	9	.69

[*]significant at p<.05 level

Appendix R: MAI Regulation Change Significance for Those Who Made Short-Term
Gains

	df	t	p
Short-term change	10	3.75	<.01
End-of-course to post-test change	10	-1.88	=.09
Long-term change	10	2.36	<.05

Appendix S: Mean Changes in MAI Regulation for Those Who Made Short-Term Gains

	N	X	SD
Mean short-term change in MAI R	11	16.64	14.70
Mean end-of-course to post-test change on MAI R	11	-8.09	14.25
Mean long-term change on MAI R	11	8.55	12.01

Appendix T: Chi-Square on Long-Term Change in MAI Regulation by Disability Status

	With disability Chi-Square	df	Asymp. Sig.	No disability Chi-Square	df	Asymp. Sig.
MAI-R	.83	10	1.00	.00	3	1.00
Planning	2.67	7	.91	.00	3	1.00
Info. Mgmt.	1.50	8	.99	.50	2	.78
Monitoring	4.00	5	.55	.50	2	1.00
Debugging	5.33	7	.62	.00	3	1.00
Evaluation	7.83	6	.25	.00	3	1.00

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Curriculum Vitae

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