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ABSTRACT

The effectiveness of training in metacognitive techniques on the academic self-efficacy of students was studied in a population of college students deemed "at risk" because of low scores on the ACT Assessment. Six students completed the 8-week training in metacognitive skills. The study null hypothesis was that knowledge about metacognition would not increase self-efficacy regarding academics. Data indicate that the training did have a significant impact on the self-efficacy of the student participants. The control group (n=25) did not show the same level of improvement in student self-efficacy as the treatment group. Implications for fostering feelings of self-efficacy are discussed. Four appendixes contain the study instruments. (Contains 3 figures and 110 references.) (SLD)

# THE IMPACT OF METACOGNITION TRAINING ON ACADEMIC SELF-EFFICACY OF SELECTED UNDERACHIEVING COLLEGE STUDENTS

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Table of Contents

Chapter One

# THE PROBLEM

## Introduction

Alfred Whitehead in the 1920s declared that the major challenge for education was to find ways and means of keeping information from becoming "inert" (Bereiter & Scardamalia, 1985, p. 65). Inert ideas were defined as knowledge that the student could express, such as on a test, reciting to the class, or in responding to the teacher, but could not be used by the student in the real world. This "parroting" or "mimicking" problem has been recognized in almost every education reform movement since the 1980s. It appears that 'decade of reform' believed focusing attention on the student and initiating learner-centered reform efforts would be the solution to poor student academic performance (Goodlad, 1984).

According to Goodlad not much has changed. Fragmented curriculum, the absence of immediate real world applicability, coupled with the manner in which the academic and secular knowledge/information is organized, presented, and tested, assured that the resulting student learning remains classified as inert knowledge. While it is not within the scope of this research to survey the ills and efforts of school reform (Goodlad, 1984,1990,1994), suffice to say that the school-institutalization processes of school daily routine operations and the occasional school reform initiative knock the pins from under any effort to make 'knowledge' applicable in real world environment (Chipman & Segal, 1985; Covington, 1985; Weinstein & Underwood, 1985).

Since it is proven folly to confront the school as an institution with change and reform, it would be more useful to shift the focus of change downward to the individual student in the school. Can one train the mind? Can one teach thinking and learning? The answer to these

questions are a qualified yes. Once teachers move away from classroom behavior management procedures, such as operant conditioning programs so prevalent in today's classroom, and embrace current research on learning and how the brain works, students can be taught to improve their academic performance (Meichenbaum, 1985).

Information Processing

Intelligent people are thought to use information processing techniques more often and more efficiently than less intelligent people (Baron, 1985). Researchers of intelligence suggest that intelligence is divided into three elements, (1) processing components, (2) strategies, and (3) styles. Neurological processing components (i.e., dendrites, axons, synaptic gaps, neurons) are physiological parameters set by the brain as regards the use of pathways (neurons, axons, dendrites) by which one chemically based mental code activates another (i.e., acetylcholine, dopamine, endorphins, histamine, serotonin) (Baron, 1985; Boyd & Starkey, 1998). These processes are largely automatic and their efficiency is largely based on genes and early environmental stimuli.

For the young adult student, successful school performance components consist largely of speed, accuracy, and comprehension, encoding simple-to-complex and multidimensional external stimuli. This performance requirement also includes retrieval and accommodation of information from long-term memory moved to the sensory register and working memory (Baron, 1985). For the young adult possessing only inert knowledge, the process cycles and re-cycles without making any connections as to applicability to the situation at hand. What the young adult needs are strategies that will interrupt this cycling-re-cycling and position the retrieved knowledge so it can be more easily retrieved and then applied (Baron, 1985; Vermunt, 1995).

Learning Strategies

Learning strategies are plans created by the individual for achieving goals in various mental tasks, such as solving a problem or memorizing information. Thinking strategies are comprised of two major elements, strategy-structure with its learning goals and subgoals, and the control processes. In the former an average person initiates what is called 'selected learning' launching a search of long term memory for similar experiences and information relative to the task at hand. When the desired information is found it is called into the working memory for matching with the information about the task. Relevant information is marked for retention and irrelevant information is returned to memory storage and the process is repeated when new and different associated information is retrieved. This process continues until the bits and pieces of a workable plan to address the task is accomplished. Subgoals of the task help retrieve chunks of data, lists, and rules associated with various elements of the plan to complete the task at hand. This continues until a strategy is formed.

The second element of thinking strategies are the control processes of the memory. These processes are voluntary and their efficiency depend in large part on the experience of the young adult student in making efficient use of the chemical based controls of the flow of data and information (i.e., histamine, neurotransmitters, estrogen) in the accommodation process match long-term memory experiences with the task at hand (Boyd & Starkey, 1998). These processes include such techniques as conducting a relatedness search, stimulus analysis, self-checking, self-talk, rehearsal, mnemonics, and sub-plans for retrieval. More intelligent people tend to use strategies more elaborately and efficiently than less intelligent people. In this regard intelligence is viewed as the environmentally-based capacity to learn and it is not associated with a gene-

based ability to learn. Strategies can be learned thereby improving performance and subsequently increasing self-efficacy. Self-efficacy is a core element of this research study. The research is seeking to link metacognitive training treatment to individual student increase in academic self-efficacy.

Complex, elaborate and efficient strategy use by the youth is called critical thinking. One of the core critical thinking learning strategies is argument counter-argument. Using the strategy techniques identified, discussed ,and summarized herein are what comprises critical thinking (Boyd & Starkey, 1998; Bransford, Arbitman-Smith, Stein, & Vye, 1985; Chipman & Segal, 1985; Dansereau, 1985; Weinstein & Mayer, 1986; Weinstein & Underwood, 1985).

Learning Styles

Learning styles are general behavioral traits that help shape our personality, such as the characteristics of impulsiveness, sensitivity, or premeditation. Strategies and styles are both under our voluntary control and can be shaped and changed over the long term. Styles are the stable conditions of behavior that are predictable in performing mental tasks. For example if one were measuring impulsivity of a student and gave test-clues to the student, the subsequent performance on the test instrument would be distorted. The student incorporated the information given as test-clues into their performance to produce a result on the test they were less impulsive thereby changing the test results.

Styles are situation specific. Thinking and learning styles are modifiable and changeable over the long term. A person can be taught to think and learn more efficiently. According to Baron (1985) "intelligence consists of components, which can be described in terms of human information processing as studied by modern cognitive psychology. The modern theory of

information processing ... promises to remedy the deficiencies of the psychometric approach to the structure of intelligence" (p. 365).

Styles are teachable intelligence. Strategies can be inculcated into a persons' learning style making the learner more efficient in knowledge acquisition, coding, storage, and retrieval of data and information from long term storage memory for use in exploring a problem situation (Baron, 1985).

Cognitive Processes

The teaching-learning act is multidimensional. The effects of the teaching depend, in part, on the learner's prior experience and knowledge. Learning is application of motivation and interest in the topic by the learner, and what the learner thinks about during the processes of learning. This is called active cognitive-processing and occurs during the learning moment (Weinstein & Underwood, 1985). The research of Weinstein and Mayer (1986) found that teachers enter the classroom with either one of two goals: What should the student know or be able to do as a result of this learning this material? Or, How is the best way to present this material so that the student can maximize the learning of this material? The former concerns only the product of the learning such as grades, test results, and the like. The latter focuses on techniques and strategies students can use to accomplish learning. Using the second goal, the teacher concentrates on teaching the student how to learn (pp. 315-316).

Interest in learning strategies evolved from the research of Dewey, Thorndike (Weinstein & Underwood, 1985), Bandura (1986), and more recently Caine and Caine (1994, 1997a, b) as a natural development in the growing sophistication of research shifting away from behaviorist theories (Stimulus-Response; Response-Stimulus Conditioning) to cognitive (self-regulation) and

brain-based learning (holistic; whole brain) (Barker, 1994; Chance, 1994; Caine & Caine, 1994; Kotulak, 1996). Recognizing the existence of the cognitive-brain-based research has changed the perception of teaching-learning in several ways. Learners are now viewed as active in the learning process, no longer passive vessels. Learning is an active process that must engage the learner for effective results. Real learning occurs when the learner is intrinsically motivated to learn. This "intrinsic" motivation is a result of the interaction of several factors like, past success in learning, what the learner already knows {generative learning}(Weinstein & Underwood), what the learner thinks about during learning {cognitive processing}, (Weinstein & Mayer, 1986), and individually based maturity of primary {comprehension and memory} and support learning strategies {concentration, help seeking, focusing} (Dansereau, 1985). The success of learning is determined jointly by how the information is presented and how the information is processed by the brain. On this point, there are two major influences relative to encoding, teaching strategies, and learning strategies. To more effectively gauge the interaction of these three dynamics it is important to know the educational orientation of the teacher as well as the learning orientation of the student. The closer the match of teaching and learning between teacher and learner orientations, the more that the learner can know, acquire, store, and retrieve over a lifetime.

Statement of the Problem

The literature is replete with discussions of why 'Johnnie' is not learning. The 1980s was a decade of studies, reports and reform efforts (Caine & Caine, 1994, 1997a, b; Goodlad, 1984. 1990, 1996) pointing out in explicit detail the problems with teacher education programs, teaching and learning in a place called school. It appears that while these reform efforts are well

intended, not many can report that much success has resulted in a long term benefit when relating the dollars spent to results obtained. While there are many varied factors influencing the success or failure of school reform programs, one perspective of school reform failure to achieve stated reform goals is that there has been too much focus on changing the institution without a concurrent, or superordinate, effort to change the mind set of the organizational members (i.e., teachers, administrators, students, and parents) (Goodlad, 1999; Caine & Caine, 1994).

In this flurry of reform to make schooling effective again, the student as a unique learning individual has been overlooked (Chipman & Segal, 1985). Most educators are familiar with today's student-learning focus regarding school reform being more 'student-learning centered'. This student-learning centered approach of changes trickle down to the school sites. Classroom management and instruction become more individualized and sensitive to the student's learning needs (Darling-Hammond, 1998).

However, students still subsequently arrive at institutions of higher education (i.e., community college, college, vo-tech, regional university) with varying degrees of competency in their basic skills, and a large segment still lack the ability to use their brains effectively (Cohen & Brawer, 1998). These young adults as entering college students do not know how to learn effectively (Caine & Caine, 1994). Many entering Freshmen are allowed to enroll with the condition that they take a developmental course(s) to build up missing or weak academic skills (Cohen & Brawer, 1998). These programs by and large have mixed success because of the mixed academic levels of students comprising that audience. These students by and large have marginal academic histories (Baron, 1985; Carr, Borkowski, & Maxwell, 1991; Dansereau, 1985; Rowe, 1988; Schunk, 1989). Accompanying this poor performance are different levels of understanding

of why they are in college and the social and behavioral expectations placed on them. The crux of the issue is that a large number of entering students drop out by the end of the first year (Cohen & Brawer, 1998). Retention of these students, and their accompanying dollars, has become a significant concern in higher education. Arkansas State University, in particular, is very concerned about the why's of the 40% dropout rate of entering Freshmen (??).

Purpose of the Study

This study intends to address one small part of the bigger issue of students not knowing how to learn effectively in today's schooling system (Caine & Caine, 1994; Goodlad, 1984; Bereiter & Scardamalia, 1985). This research will attempt to address a fundamental element of effective learning; student self-efficacy as regards academic performance. This study will provide an experimental treatment regarding metacognition of selected underachieving students before and after the research treatment. This study will use strategies supporting the current definition of metacognition, which "refers to what a person *knows* about his or her cognitions...and the *ability to control* these cognitions (Meichenbaum, 1985, p. 412). The participating students chosen from a pool of low ACT scores (below 18) suffer from "inert learning" (Bereiter & Scardamalia, 1985).

The experimental treatment will consist of a pre- and post-test using an attitude toward education instrument. The pre-test will be followed by eight out-class sessions of 50 minutes duration teaching specific metacognitive techniques. Specifically, learning styles, note-taking, underlining, summarizing, knowledge acquisition, test taking strategies, problem-solving skills, and critical thinking skills. At the end of the treatment training element the students took the

post-test three weeks later. Comparisons and analyses were made using the t-test family of statistics.

These students need help that is precise and explicit. If these student are ever to have the ability to use the knowledge they seek at college; the help they need must be appropriate. One fertile area to begin a research agenda is to begin at the bottom and look at the "how" of learning.

A significant component of any effort to developing efficient learners from academically challenged students must first reduce or remove the "learned helplessness" habits formed in secondary school (Caine & Caine, 1994; Findley & Cooper, 1983; Karabenick & Knapp, 1991; Newman, 1990). Newman (1990) specifically found that a resolution to learned-helplessness concerned "perceived competence...that children who believe they are competent are likely to seek academic assistance when needed" (p. 77). Competence perceived by the student about a specific area or domain, like academic performance, is called self-efficacy. The target of this research will be to raise individual student participants' academic self-efficacy. The treatments sketched herein are intended to assist individual students gain a feeling of control over their academic learning and thinking {metacognitive} processes. Specifically, the treatments are designed to assist the participating student's understanding of their metacognitive skills. The treatment components use learning strategies currently reported in the literature that have a proven track record. It is hoped these students develop more self-confidence and possess a higher self-efficacy at the end of the treatment. This greater confidence should translate into some measurable level of increased use of more efficient academic learning. Specifically, these participating students should have developed a more positive attitude about academics in general and an higher level of individual personal self-efficacy about their ability to successfully perform

in college. Success in raising academic self-efficacy should reduced individual inert learning. By measuring self-efficacy levels of these voluntary young adult students one should see a significant difference between the before and after attitudes toward academic performance.

This research project will examine one element of the multidimensional teaching-learning problem. One of the foundations of learning, both proximate and distal, is a combination of attitude and motivation as regards to what is to be learned. Perseverance, drive, desire, and need, all combine in each unique individual and therein determine the direction and duration of his/her actions and activities. This motivation is largely innate, determined by environment, temperament, past experiences, and past knowledge about the specific situation at hand. Once motivation is present then successful accomplishment of goals is assured (Wigfield, Eccles, & Rodriquez, 1998).

Part and parcel to motivation is attitude. Attitude as used herein concerns two elements of the individual student psyche, one element is self-esteem, the other element is self-efficacy. Self-esteem is the overall positive or negative feelings, beliefs and behavioral/cognitive engagements that an individual perceives about himself/herself. Self-efficacy is a component of self-esteem. Self-efficacy is a domain-specific internal viewpoint that is unique to each individual and like the stream of consciousness is constantly undergoing evaluation and re-evaluation as the individual moves from experience to experience. These self-evaluations form a self-image of competence or incompetence. Self-esteem is fairly stable and as such difficult to change over the short term. Attempts to change or alter self-esteem can be viewed as tinkering and fraught with failure.

Self-efficacy, on the other hand, is more localized to reflect beliefs, competence, feelings and approaches to specific elements of an individuals life. For example, a person could have a

high positive self-esteem about who s/he is and yet be anxious about higher mathematics tests, learning to drive a car with a manual transmission, or starting a new job based in technology. The individual could be socially popular in and out of school, be held in high regard by peers, teachers, parents, and significant others and be shaped by this reflection on her/his positive self-esteem. But the student may not be a high achiever in school academics. This individual may feel inadequate dealing with either qualitative or quantitative academics. The negative beliefs regarding this may elicit modes of avoidance and thereby block avenues to remedy this negative and anxious feeling about academics. Using a tenant of attribution theory several factors contribute to consistent academic failure,

> ...repeated lack of success is likely to result in attributions of low ability, and stable low ability attributions engender expectations of future failure. Low ability attributions may also be accompanied by negative emotions such as sadness, guilt, embarrassment, hopelessness, and resignation..., and, to the degree that low ability attributions are global, feelings of helplessness. The combination of low expectancies and negative emotions (especially helplessness) would lead to low task persistence and withdrawal, even to the extent that receiving help would be considered irrelevant to achievement and thus unlikely to be sought. Furthermore, help seeking can be especially threatening to such students because continued failure after assistance would constitute additional evidence of low ability and consequently lower self-worth. (Karabenick & Knapp, 1988, p.408)

With a low self-efficacy an overarching anxious feeling or view evolves toward academic work in general. One could ask, why has not this individual dropped out of the system after high school? Individual drive or motivation could be a large degree of the decision to stick it out in school in some unconscious belief that s/he would become better at academics and accomplish the college goal; the degree (Loranger, 1994; Schunk, 1989; Senecal, Koestner, & Vallerand, 1995).

Metacognition is a skill by means of which the learner manages his own thinking behavior. These notions of metacognition are reminiscent of Skinner's *self-management behaviors* and Miller, Galanter, and Pribram's *plans,* Neisser's *executive routines,* and Atkinson and Shiffrin's *control processes* that organize and control the operations of what may be thought of as the more basic on-line learning and memory processes (Meichenbaum, 1985, p.413).

It is important in the maturation process of the young adult college student to skillfully use metacognition in learning (Davies, 1983; El-Hindi, 1996; Redding, 1990) . It is important in this developing process for the student to be willing to seek help from teachers and peers as they strive to be successful in school and then in their life's work. The author believes that there is a direct relationships between seeking help and needing help. While some research show that the relationship is inverse (Karabenick & Knapp, 1988).

Limitations

The limitations of this study were the use of only volunteers enrolled in a mandatory Study Strategy course offered Spring 1999, Arkansas State University. An additional limitation is the assumed cooperation of the voluntary participants in completing the treatment tasks outside the treatment sessions. Collaterally, was the expectation that the student participants had the cognitive abilities to comprehend and perform the tasks assigned.

Definitions

For a better understanding of the implementation and scope of this study, the following terms and their definitions are provided:

Attitude Toward Education. School satisfaction is defined as the measured level of student attitude about the college environment in terms of overall impression, use of college

services, levels of satisfaction in academics, and other areas of the college environment which affects students on a routine basis. Higher levels of satisfaction and reported involvement in college services are reflective of students who are successful and comfortable with the school environment (Ory & Poggio, 1975).

Cognition. Cognition reflects what information is being processed and by what mental operation, in what form, and how successfully these activities work as enabling variables. The issue for cognitive functions are their transferability from the task the function was learned to a task that is similar, but not identical, to create a generalized cognitive function (Rowe, 1988).

Learning Styles. Learning styles are stable individual variations in perceiving, organizing, processing, and remembering information. Styles are types of information processing habits. Styles are inferred from consistent individual differences in organizing and processing information on different tasks. Learning styles are subject to change given training, practice, and motivation (Dunn & Dunn, 1993; Schunk, 1996)

Metacognition. Metacognition refers to the planning, self-regulating, and monitoring of one's own cognitive performance. These behaviors are both affective and cognitive in nature. Cognitive issues include understandings about oneself as a learner and the processes of learning. Affective components deal with one's emotions, feelings, and beliefs involved in the learning process (Schunk, 1996).

Self-Efficacy. Self-efficacy is defined as a personal judgment regarding one's own performance capabilities in a given domain of activity which has diverse effects on activities. As a result, self-efficacy influences such actions as the selection of academic activities, courses, task avoidance, motivation and performance levels, and level-of-effort expended (Bandura, 1986;

Schunk, 1996). Self-efficacy is an accurate predictor of performance and achievement of learners as they input, evaluate, code/decode, and integrate diverse sources of information concerning their own capabilities and then regulate their behaviors and efforts based on this self-evaluation Harrison, Rainer, Hochwarter, & Thompson, 1995; Schunk, 1989, 1996).

Study Strategy. A study strategy is an instructional tool designed to assist students in preparing for content-related learning. Study strategy instruction provides students with a means to foster analysis of each learning situation in terms of self and context and then to modify actions to improve learning (Goetz & Douglas, 1995).

Underachieving Student. Any student enrolled in the developmental courses used in this study. The Study Strategy courses at ASU are designed to improve academic performance to levels appropriate for college level work. These students enroll in these courses through mandatory assessment and placement procedures, counseling, instructor referral, and self-referral. Students in this study all had ACT scores at 18 or below.

Chapter Two

# REVIEW OF RELATED LITERATURE

## Introduction

This study has the purpose of examining one element of individual learning processes, particularly in a college academic environment. Self-efficacy is an affective element of the learning process and is more sensitive to short-term treatments (Bandura, 1986). The literature on metacognition and metacognition training was examined to find appropriate models and techniques for measuring self-efficacy before and after the training treatment. Herein, we will examine successful metacognition programs, the role of the teacher, the role of the student, and current view relevant to metacognition. An overall summary of this literature will conclude this chapter.

Today's scientists have learned more about the human brain in the last ten years than from all previous history. This knowledge about the brain and its functions double every ten years. It is deemed amazing what this three-pound organ can do. While it is not within the scope of this review to outline the amazing detail of how the brain works, it is important that one understands how the brain performs (Kotulak, 1996). What is unique about the brain's performance is "that the brain gets better and better through exercise but 'rusts' with disuse. It is the ultimate use-it-or-lose-it machine, placing the ability to build brain power squarely into the hands of each of us" (p. xiii).

Our brain performs feats of memory that even the most advanced computers cannot do to this day. Consider this, as students, teachers, and academics, the countless times we call upon our memory to identify, locate, retrieve, display, compare, alter [encode], and return to storage,

innumerable discrete facts, concepts, and ideas each and every day of our lives. Only then does one get an inkling of the vastness of the potentiality of our brain and memory (Schacter, 1996). Much of what we know about the functions of brain and memory come from the study of brain injured patients (Abbott, 1997; Yellin, 1983). Although hemispheric specialization (Left Brain/Right Brain) still impacts the teacher's view of how to teach content, the view of the whole brain (holistic brain-based learning) is gaining credence among educators. Research in metacognition suggest, that knowledge of cognitive processes can help students improve their academic performance (1983). However, in many teacher education programs and therein our functioning school systems students still largely parrot their learning, exhibiting fragmented or superficial knowledge indicating that only the most elementary learning is taking place: pedagogical--rote learning (Bereiter & Scardamalia, 1985).

Schools, communities and the society at large needs to develop the capacity in our young to be intelligent (Abbott, 1997). The process of learning as identified by neuroscience and cognitive psychologists is spectacular and messy. Authentic learning does not easily fit within narrowly defined classroom curricula dominated by unrelated content, taught using obsolete pedagogical methods (1997). Understanding 'learning' is the key issue of our time.

Until the 1800s people learned in authentic on-the-job settings; they learned at work the skills they needed to do their work. Industrial Age America required no more from its work force than elementary intellect, like reading, writing, and elementary calculations, to make them fit as cogs in the larger industrial machine. Mass education was primarily elementary school stressing the 'three Rs." Secondary school was later added to teach more advanced knowledge and skills. In the course of time the courses became watered down. For example, written composition all but

disappeared from school curriculums (Frederiksen, 1994). Inclusive-infusion skills that helped students make sense of things were ignored for the more practical 'three Rs.' This error was corrected in the next century through the work of J. H. Flavell (In McIntyre, 1993;) who began reporting important finds regarding metacognition. According to Flavell, metacognition can help people develop skills that are genuinely transferable by using the understanding of how we think, reflect, and remember (Abbott, 1997; Gagne, 1988; Schacter, 1996).

Successful students are believed to use metacognitive processes more often and more efficiently than less successful students. Several components of learning are believed to be affected by application of these processes and thus are potentially modifiable by outside stimuli such as education (Baron, 1985). Additional research adding to this tenant involved cognition, learning styles, and metacognitive elements (Tamaoka, 1985).

Psychology led the way in exploring how a person can be affected by both extrinsic and intrinsic motivational drives influencing learning, performance, and skill acquisition. Prominent among the more contemporary psychologist exploring intrinsic learning was Albert Bandura (1986). Bandura was a psychologist that was influenced by both classical behavioral learning and cognitive learning. This double influence can be seen in the evolution and maturation of his theories of human learning. Early in his career he presented his social learning theory and the influence of observational learning, modeling, and self-regulation. His research guided him away from the extrinsic motivators except for the most elementary tasks. He changed his theory into a social cognitive theory, illustrating his updated beliefs of the importance of intrinsic motivators for learning, particularly for the more complex contextual tasks. It is Bandura and his Social Learning Theory evolved into a more appropriate Social Cognitive Theory that legitimized the

break from solely extrinsic motivators for learning. His social cognitive theory embraced internally dominated drives influencing advanced human learning and intelligence (Boeree, 1998; Scherer, 1998).

Cognitive psychology has blossomed in large part due to the work of such pioneers as Bandura. A closely related area to these studies are metacognition programs, models, and sub-elements indicating a wide diversity of learning like, learning styles, learning strategies, self-assessment. Even sub-sets of these elements link to important processes improving learning. For example, a few of the more prominent are competence, self-regulation, strategic thinking, ability formation, attending, help seeking, learner control, problem solving, awareness {attending}, comprehension, procrastination, note-taking, concept mapping, critical thinking, transfer, infusion, and awareness (Boeree, 1998; Bonds, Bonds, & Peach, 1992; Branford, Stein, Arbitman-Smith, & Vye, 1985; Conway & Ashman, 1989; Dansereau, 1985; Findley & Cooper, 1983; Groller, Kender, & Honeyman, 1991; Harrison, Rainer, Hochwarter, & Thompson, 1997; Hattie, Biggs, & Purdie, 1996; Karabenick & Knapp, 1991; Moran, 1991; Newman, 1990; Nist & Simpson, 1989; Petit & Zawojewsi, 1997; Puntambekar & du Boulay, 1997; Royer, Cisero, & Carlo, 1993; Scherer, 1998; Vermunt, 1995; Weinstein & Underwood, 1985) . One of the more important basic learning influences is self-efficacy. It is self-efficacy that has been found to be primary to real long-term academic learning and enhanced performance (Carns & Carns, 1991; Schunk, 1996). It is a discussion of these elements and related parts that give a holistic view to the concept of metacognition as a useful approach for improving academic performance.

Organization of the Literature Review

Learning, study strategies, and metacognition literature is intertwined across several broad categories. To ensure that the solid theoretical foundation for this study is clearly understood an examination of the literature supporting the many and different facets of metacognition is needed. In this review of metacognition literature several important categories emerged. These categories are, models of metacognition theory, programs dealing with metacognition, metacognition and relevant teacher/teaching issues, conversely, are relevant student issues. Finally, a synthesis of current literature exploring metacognition typology as concept and process is outlined. Although metacognition is a relatively recent evolution, extensive attention has been paid to its potential impact on student learning.

Learning Models

Sternberg and Davidson (1989) conceived a four-prong model for teaching general level intellectual skills. The model specifically outlines the mental processes that are to be taught. Each prong reflects a broad mental process, i.e., familiarization, intra-group problem solving, inter-group problem-solving, and individual problem-solving. In sequential order the specific mental processes are actively working on finding solutions to externally oriented problems. For example, there is recognizing the problem, defining the problem, planning steps to solve the problem, ordering the problem-solving steps, demonstrating the facts, allocate resources (external or internal), monitor solution efforts, and evaluating the solutions (Sternberg & Davidson). This model was one of the first to illustrate the suggested interventions were linked to a larger model of thinking. This model is appropriate in academic settings in sequencing a probable solution from beginning to its end.

Process-Based Instruction (PBI) Model. The importance of students' being aware of his/her own cognitive processes in academic settings, rather than simply being rewarded for correct rote responses has attracted the attention of researchers (Conway & Ashman, 1989). For metacognitive strategy learning to be effectively integrated into every day teaching, its classroom effectiveness must be demonstrated. Supporting the general strategy approach to learning, Conway and Ashman focused on teaching the concepts of plans and planning as a learning strategy. The PBI approach was developed in response to teacher comments about the literature containing little in the way of directions [how to] or procedures [typology] appropriate for classroom use. This model evolved addressing specific learning criteria: 1) Training was to take place in authentic classrooms not in laboratories; 2) it was integrated into the mainstream teaching; 3) application was to current curriculum content rather than on isolated artificial situations; 4) it made students take responsibility for their learning by having students create their own personal learning plans; and, 5) students were encouraged to apply the model elements to different tasks as the way to generalize the learning (1989) .

The PBI model has a five-phase structure: Assessment, Orientation, Strategy Development, Intra-Task Transfer, and Generalization. The model is both phase and time flexible, requiring no set content or time table for classroom use. Many proven metacognitive strategies and techniques can be used during the implementation of the PBI. The PBI aims to permanently incorporate planning as a strategy in the students learning repertoire. It meets the learning needs of mixed ability students and evolves the student as the controller of what is learned. With little modification PBI could be mistaken as the process for using infusion.

Process-Oriented Instruction (POI). The process-oriented instruction is defined as "instruction aimed at teaching thinking strategies and domain-specific knowledge in coherence. It is an instructional model in which learners are taught thinking strategies to construct, modify and use their mental models of the subject domains....because it is focused on learners' processes of knowledge construction and utilization. The thinking activities that students use to learn are the focus of attention" (Vermunt, 1995, p. 326).

The POI as outlined in Table 1 focus the learner on meaning-directed and application-directed learning styles. An important element of this process model is the pre-knowledge both teacher and students have about their own learning styles. Knowing what preferred style students use to acquire, evaluate, and store facts during the learning allows the teacher to identify those learning styles not fully used during the classroom lesson. This model is equally adaptable in the secondary schools as well as in colleges and universities. While additional research is needed to refine some of the more subtle learning influences (how do teacher learning objectives interact with students' own learning objectives) the POI has great potential for classroom utility (Vermunt, 1995).

Information Processing Model (IPM). This model focuses on the proposition that individual differences in the way information is encoded and retained from the world has at its cornerstone learning styles. Learning styles are defined "as people's 'consistent way of responding to and using stimuli in the context of learning' " (Moran, 1991, p. 239). Moran sees a direct link between cognitive psychology and learning styles. He identified over 21 different learning style models. The large number of these models causes difficulty in developing a widely-accepted definition of what is a learning style. The common element among these learning styles is the

Table 1

Design Principles of Process-Oriented Instruction

| Category | Principle |
|---|---|
| I. General | Focus on learning and thinking activities<br>Gradual transfer of control<br>Situated teaching of thinking skills<br>Developing the mental model of learning<br>Taking the learning orientation into account<br>Promoting transfer<br>Presenting the learning content<br>Constructing adjunct instructional means |
| II. Specific<br>First Phase | Diagnosing thinking strategies and domain-specific conceptions<br>Adapting to learning styles and preconditions<br>Creating constructive frictions |
| Second Phase | Teaching cognitive, affective, and regulative activities in coherence<br>Demonstrating usually covert learning and thinking activities overtly and explicitly<br>Activating to use learning and thinking activities<br>Capitalizing on learning and thinking skills |
| Third Phase | Testing of thinking activities and domain-specific conceptions. |

(Vermunt, 1995, p. 327)

'information processing' component found in some manner in them all. Moran, suggest that three elements from cognitive psychology enhance the usability of this information processing model based on learning styles. First, the learning style construct must be rigorously and empirically analyzed to prevent over-extension and weakening of its theoretical foundations. Second, greater emphasis is placed on what people already know [prior-knowledge] in the learning context. Third, the growing importance of metacognition may provide explicit techniques for integrating the information processing model into the classroom.

PLAE. This is a strategy regulation model using the components of Preplan, List, Activate, and Evaluate (PLAE) where the student is solely responsible for her learning. A number of correlation studies were conducted to verify that students improved their test performance through using these specific metacognitive techniques. The premises of PLAE are: students must learn to establish goals, allocate resources, and implement plans of action; students must have a repertoire of strategies for the many tasks they will encounter across their academic careers; students must learn how to select the most appropriate strategies based upon specific content-text needs; students must learn how to activate and monitor their academic plans and make any needed changes in the plan; students must learn how to evaluate their plan's success or failure in terms of leaning goals; and students must develop the ability to replicate this process in planning other academic tasks (transferability) (Nist & Simpson, 1989). This model has been proven to improve student's test performance and metacognitive abilities over time (1989). It was suggested that classroom teachers spend less time on generic skills and time management and more time using PLAE.

Reflective Research Model (RRM). The Reflective Research Model is grounded in prior research on metacognition and learning influences from environmental factors. RRM tries to create interactive learning environments based on three research programs dealing with reading, writing, and mathematics studies by Bereiter and Scardamalia (1985). Its premise was to "shift away from standard teaching methods of direct transmission to methods that actively engage students in their learning, from rote memory of facts to thinking openly via questioning and reflection of ideas" (Asquith, 1996, p. 9). This model integrated the central metacognition activities such as modeling, coaching, scaffolding, and practice with motivation, competence and

reflection. Reflection of what has been learned is the core idea behind RRM. The reflection component is organized around metacognition and metamemory type self-evaluation, self-questioning, and self-talk (1996).

Summary of Models

One can see that the various models, while differing in specifics, appear similar in that the student is held responsible for her own learning as a part of the model's purpose. Learning is an active interchange between what is to be learned and the learner. Learning is more efficient when authentic and infused into the classroom instructional content. All of these theories have elements that can be seen in current curriculum, school, and teaching reform efforts. The models demonstrate that learning is dynamic, can be approached from different perspectives and still be effective if the 'learner knows what he knows and knows what he does not know.' Elements of the information processing models, PBI and IPM were used as a scaffold for the current study. The PBI sees the importance of the student being aware of his/her own cognitive processes. The IPM places an emphasis on further cognitive understanding of the learning style of students. Both are integral to what the current study had as a core assumption. Next, let us look at the learning programs used to disseminate metacognitive techniques and skills in laboratory or authentic settings.

Learning Programs

Using these models as a foundation one can formulate a wide variety of configurations of metacognitive activities into goal-directed programs for enhancing learning. The programs take the approach of teaching specific learning skills, like awareness (El-Hindi, 1996), advanced organizers (Groller, Kender, & Honeyman, 1991), learning and study strategies ( Bransford,

Arbitman-Smith, Stein & Vye, 1985; Dansereau, 1985; Platt, 1991; Weinstein & Underwood, 1985), tutors (Rings & Sheets, 1991), settings (Garner, 1990), or learning styles (Gee, 1990; Gruber & Carriulolo, 1991; Hattie, Biggs, & Purdie, 1996). A number of recent research studies has identified specific techniques and skills that can be used in classroom environments to enhance the metacognitive abilities of students. These programs provide a useful guide to replication of specific skills and metacognitive skills, such as those used in this study.

The study by El-Hindi (1996) was concerned with the lack of independent reading and writing abilities of college freshmen. In this study first-year university students during one summer received metacognitive instruction promoting awareness of their metacognitive processes. El-Hindi assumed for research purposes that reading and writing are interactive processes and developed a six-week training experience that focused on the preparatory activities related to successful reading and writing experiences. These activities were planning (purpose, prior knowledge, review and predicting, and organizing ideas), drafting (self-questioning, monitoring), and responding (evaluating, reacting, relating). Students were trained in the value of using planning, drafting, and responding techniques in their college work. The study showed that direct instruction in these metacognitive techniques increased individual awareness of the value of metacognition in reading and writing at the university level. The point of the article was to show that students do better when trained in metacognitive skills than just using isolated skills instruction without attending to the metacognitive side of learning (El-Hindi, 1996).

Another technique in the metacognitive repertoire is the use of advanced organizers. Groller, Kender, and Honeyman (1991), conducted a study using high school students and sought to find out the specific level of learning increases when advanced organizers were used in

conjunction with metacognitive strategies and where the advanced organizers were used repeatedly in the classroom. Using three treatment groups, one with an advanced organizer coupled with metacognitive strategies, another group using the advanced organizer without metacognitive strategies, and a third group using traditional direct instruction. "It appeared that the use of advance organizers with metacognitive instruction yielded significant gains compared to use of either advance organizer or the historically introductory passage alone on the immediate recall tests" (p.473). The study indicated that using metacognitive instruction in concert with advance organizers did cause significant learning increases among the high school students.

Study strategies are a core component of metacognition and received significant attention from a number of researchers interested in identifying the best approach to the use of these strategies (Bransford, Arbitman-Smith, Stein, & Vye, 1985), the delineation between different types of metacognitive strategies (Dansereau, 1985), and the progress made in the understanding of learning and study strategies (Weinstein & Underwood, 1985). Bransford and associates (1985) examined three specific metacognitive training programs to determine which was overall the best then available. Of the three, the program involving self-evaluation and problem-solving was deemed the more effective. While the other two dealt with metacognitive abilities, the Bransford and associates (1985) believed that they were less effective due to excessive direct instruction and did not provide enough student development of individual self-regulation and self-examination skills as part of the problem-solving program. Dansereau (1985) followed with an examination of training in information processing strategies. This program divided the strategy into a primary active strategy and support strategy. Dansereau examines the strategy development program in great detail stressing using concept-link networks, modeling,

the value of understanding comprehension, recall, review, planning, scheduling, concentration, monitoring, mood setting and coping with distractions. While sufficient resource materials are available for use in training people to use learning strategies, the author cautioned that success in this kind of program lay mostly in the selection of appropriate strategies, the training and the assessment of the training. Their research supported the effective use of content-independent task and text-processing task when used in conjunction with the appropriate application-oriented implementation.

Weinstein and Underwood (1985) supported the findings of Dansereau (1985) and Bransford and associates (1985) but they placed more emphasis on the operational lower-end cognitive skills such as note taking, test preparation, time management, anxiety control, and time-on-task activities. They integrated the tenants of the information processing model into their approach in that they placed emphasis on the diagnosis of how the student learns rather on the conditions under which he or she learns best. For Weinstein and Underwood the ideal program would be heavily influenced by the information processing side of metacognition. Specifically large doses of instruction centered in sentences as elaborators, images as elaborators, forming analogies, drawing implications, creating relationships, and paraphrasing were central to learning using this method. The instructional method varied using mini-lectures, group discussions, role playing, peer tutoring, and practice feed back. All of these methods were used in authentic classroom settings. The authors believed that adequate training in these information processing metacognitive skills enhanced the ability to transfer the technique from one content area to others and aided across domain generalization.

A supporting study to the tutoring element of metacognition training was conducted by Rings and Sheets (1991). Where they contended, "although research in the training and development of tutors is limited, grounding a tutor training program in theoretical models that are researched based can provide a solid foundation for effective tutoring programs" (p.30). Rings and Sheets contend that while many university campuses offer tutors for less successful students, the problem arises that assigning tutors to students where the tutor has not been trained in the best ways to make a student self-directed, self-regulated and responsible for their learning makes for ineffective results for the program and for the student. A basic tutor training program would be metacognitively appropriate and include modeling, coaching, teaching strategies, and teach the tutors to be helpful and non-judgmental. Tutors need to understand the value of learning styles and settings when working with developmental students (Rings & Sheets, 1991).

Garner (1990), in his research, was concerned with the low level of success in dealing with students and their use or non use of learning strategies. For Garner the underlying problem in the failure of the students to effectively use the learning strategies they had been taught related to the absence of consideration of the specific learning setting. He suggested a 'theory of settings' stating that when the context varies, the nature of the learning strategy often varies too. This reinforces the accepted belief that problem solving and application of specific learning strategies are more successful when the specific learning environment is taken into account (Bandura, 1986; Dunn & Dunn, 1993; Schunk, 1996).

In 1996 Hattie, Biggs, and Purdie conducted a meta-analysis on the effects of learning skill interventions. They examined 51 separate studies where specific interventions were used to build effective study strategy skills, focusing on learning on task-related activities, self-

management, motivation and self-concept. They concentrated on research where learning by these interventions was outside the normal teaching context. In other words, they looked at studies where the focus of the research was on the skill technique and not the technique within an academic content-area. They divide the interventions into cognitive interventions (task related skills like note taking, underlining, and the like), metacognitive interventions (planning, implementing, and self-monitoring), and affective interventions (motivation and self-concept). The authors reject the usual 'student to be fixed' approach and encourage the 'student as a unique learner' perspective. In that regard, the metacognitive skills are more effective when used in context (setting), use the same domain as the content, involve a high degree of student engagement in the learning, and view the student not as an object of the teaching. Their piece strongly supports the individuality of the learner and of specific metacognitive practices, or interventions, needed to make long term learning skills a permanent part of one's learning ability (1996).

A major review of assessing cognitive and metacognitive skills was conducted by Royer, Cisero and Cario (1993) where they examined the various procedures used to assess progress in instructional programs described herein as involving metacognition. Royer and associates findings support and reinforce the use of authentic assessment in metacognitive training programs. "Authentic assessment involves performances that have educational value in their own right...{to include} open-ended problems, computer simulations or real world problems, essays, hands-on science problems, and portfolios of student work" (p. 237).

One of the major foundations to effective metacognitive skills acquisition is the understanding of one's own learning style. As mentioned above by Hattie and associates, the

domain must match the content. In other words, the learning style of the student when, matched with the manner in which the content is presented, assures a dramatic increase in the amount learned, increasing the duration and the generalizability of what is learned. Learning style research is broad based (Dunn & Dunn, 1993) containing many unresolved issues as to validity, reliability and individual-domain-context applicability (Westman In Kramer & Conoley, 1992: Schunk, 1996). However, it is well established that learning style does directly influence effective learning. Enough research has been conducted to indicate that it is the wise teacher who takes into account individual learning style preferences in the classroom. Learning styles represent three main domains or 'modalities': visual, auditory, and tactile/kinesthetic. There are many different configurations regarding learning styles from the simple to the complex (Dunn & Dunn, 1993). Learning styles are not stable and can be changed under the right conditions. Metacognitive training represents these change conditions (Gee, 1990; Gruber & Rabianski, 1991; Schunk, 1996). While not a major focus of this paper on metacognition and developmental college students, learning style understanding is a starting point for any effective program where the objective is to enhance the ability of the less successful student learn more efficiently.

Summary of Program Issues

Like with previous contributing model theory, there are many different programs for teaching learning. These programs have overarching similarities. The better, more successful learning programs have components reflecting authentic learning situations. The programs should include a teacher-student understanding of learning style influences, involve student engagement in active learning, and be reinforced by practice. Successful increases in a student's ability to learn can be found to be grounded in solid metacognitive training and practice. We

have seen a small array of the theory and models supporting this study and reviewed a few of the more prominent learning-how-to-learn programs. The missing elements for successful metacognition increases needs the teacher, the student, a firm grasp of infusion, and interaction need among these elements to produce a active, independent, learning student.

Teacher Issues

As seen herein, the context, or setting, of the learning is important to effective content retention. The dominant controller of the context or setting is the classroom teacher. "Asking a group of teachers if thinking skills are important is like asking a group of scientists if the earth is round" (Alvino, 1990, p. 40). Teachers see thinking skills divided into different levels. The basic mental skills and processes of thinking are cognitive: simple recall, analyzing the parts of the whole, recognizing cause and effect, comparing and contrasting, grouping and classifying, conceptualizing, problem solving, and decision making. These basic skills include all the cognitive areas outlined in Bloom's Taxonomy (Linn & Gronlund, 1995). The higher order thinking skills, those learned effectively in metacognitive training, involve planning, monitoring, and assessment of one's own thinking (Alvino, 1990). Alvino suggests that a number of additional dispositions can further increase the learning and thinking abilities of developing students. These include, "tolerance for ambiguity, respect for evidence, willingness to search for reasons and alternatives, willingness to withhold or reverse judgments based on facts, open-mindedness, and sensitivity to others" (p.41).

Teachers enter the classroom with two specific goals; teaching what the student should be able to do at the end of the lesson, and teaching what the student needs to know to accomplish the learning of the lesson (Weinstein & Mayer, 1986). Teachers' interest in learning strategies

(metacognition) is an outgrowth of the change in classroom orientation from behaviorist theories to cognitive theories of learning. Teachers are aware of the two different activities that influence the learning (encoding) process: teaching strategies and learning strategies. For example, teachers employ a number of different devices when teaching complex content. The students, if exposed to metacognitive training, can effectively select the major points to be learned and acquire the facts in various ways moving this knowledge into their working memory and/or long-term memory. This is usually accomplished through rehearsal, underlining, note taking, paired-associate learning (dyads taking turns verbalizing the lesson to each other) and extensive use of elaboration strategies (Weinstein & Mayer).

Teachers using cognitive and metacognitive techniques should be taught to understand the processes of how to teach thinking in their classrooms (Fogarty & Tighe, 1993). Teaching thinking in the classroom is effectively done using a three phase process: thinking skills, critical thinking/creative thinking, and thoughtful schooling. All of these techniques can best be implemented as authentic learning in a classroom. The first phase shows students "classifying, comparing and contrasting, and analyzing for bias" (p. 162). The teacher focus is to develop some level of competency using thinking skills. The second phase "focused on the broad critical and creative macro-processes of thinking necessary for problem solving, decision making, and inventing" (p. 162). The third phase in this thinking skills teacher training builds on the other phases and "is characterized by metacognitive reflection about learning" (p. 162). This phase places emphasis on the ability to transfer the learning skills from one content area to another and to appropriately apply solutions to classroom problems to the real world. According to Fogarty and Tighe, the teacher is an architect building a student's intellect in the classroom.

Some researchers are concerned with the gap between research-derived knowledge and authentic pedagogical practice. Clift, Ghatala, Naus, and Poole (1990) explored this neglected area of teacher's knowledge about the learning process. Clift and associates wanted to determine a teacher's perceptions of what constitutes task-appropriate study strategies and to account for how these strategies are taught, either as integrated into the content [infusion] or as separate units. It was found that strategies were either student-controlled or teacher-controlled and while the training was efficient, the outcome was that students learned to execute a particular strategy but only used it when cued by the teacher or the task. The study showed that the teachers were good at showing "how to" learn strategies, but did not do well in relaying to the student the 'where, when, why' (p.262) of strategy information. Clift and associates reported that the teacher's were interested in student metacognitive skills acquisition, but they just needed to 'fine tune' their own teaching metacognition abilities to include more self-initiation of these strategy methods.

Another study by Calfee (1994) examined teacher-classroom issues of "authentic rather than superficial evaluation of student achievement,...high-level learning rather than low-level training for students, and...professional teachers rather than civil service managers of instruction" (p. 340). Behavioral teaching methods became dated with the advent of cognitive psychology in the 1970s. By the 1990s cognitive psychology came to emphasize the structure of knowledge as more than simply the processing of information. Reflection came to be the core issue as regards cognition and metacognition. The problem with these advances was that: "The tasks require technical expertise that goes beyond the capabilities of many of today's teachers. The conceptual base is complex, requiring appreciation of cognitive strategies for curriculum and instruction, as

well as assessment strategies....most of today's teachers received their preservice training a decade ago or more, and the evidence suggest that this preparation was often brief and unrelated to...instructional practice" (p. 347). Calfee says that with the explosion of knowledge, a new kind of teacher needs to evolve, one that "requires the transformation of today's teaching force from behaviorism to metacognition, from workers who do as they are told to professionals capable of reflective and collegial problem solving" (p. 349).

It follows then that there is a concern over the issue of teacher competence. Leat (1993) believes that in teacher education programs competence must be linked to thinking, particularly the higher order thinking skills. The numerous examples used by local authorities to describe the performance of teachers in the classroom is observed and the behaviors marked on a checklist as 'exemplary' or 'blameworthy.' This behaviorist construct of competence is obsolete. Teacher education programs must become as sophisticated as the society within which they exist; "Sternberg's (1977) triachic theory of intelligence seeks to 'understand intelligence in terms of three distinct but related aspects: the internal world of the individual, the external work of the individual, and the experience of the individual" (In Leat, 1993, p.502). According to Leat, competence is here to stay for the immediate future. Teachers need to review their instructional methods and work to promote a closer connection between their current teaching and existing methods and techniques of cognition and metacognition in the classroom. The way to remain competent is to be current.

This belief is in line with Payne and Manning (1991) research on teaching cognitive self-direction. In brief the methodology is four steps; first, lectures and discussions emphasizing self-statements regarding emotions and behaviors. Second, a number of modeling videos

demonstrating through self-talk planning, teaching and classroom management issues are examined. Third, additional self-talk demonstrates goal-setting, guiding, coping, and reinforcing. Both appropriate and inappropriate behaviors were shown to the preservice teachers. The third step involved the preservice teacher modeling what was demonstrated using self-talk. Fourth, fading and covert self-talk are practiced to fluency. These are practiced until the preservice teachers become proficient in the methodology. The final step encourages the preservice teachers to be positive and to continue practicing the self-talk methodology. The authors state that soon the self-talk becomes automatic and soon transfers the process to other equally complex tasks. Incorporation of self-direction via self-talk could be a means to reduce stress among preservice teachers and evolve a more pliable teacher, one who is more reflective, proactive, and professional.

Teachers' classes can be multigrade or multi-age, a situation that could hamper cognitive development of students and create additional barriers for any planned metacognitive training. Veenman (1995) completed an exhaustive review of the literature as regards student grouping and found that several factors explain why student learning in these situations does not differ from the student learning in single-grade or single-age classes. One factor is that learning is more influenced by instructional quality than by organizational configurations. The student selection for these classes often have a curious bias; those students selected by the administration tend to have more independent work habits, are more cooperative, exhibit little or no behavioral/emotional problems and generally contain the more autonomous students. The inherent bias about the concept held by the teachers, administration, and concomitant lack of appropriate classroom materials all contribute, essentially keeping the grouped class in essence as

a single-age or single-grade class. In other words, the class is still treated like a single-grade/age class. A final factor that prevent differences in learning between grouped classes and non-grouped classes is that teachers are so overwhelmed by the increased work load that teachers do not use more effective grouping approaches. With no opportunity to take advantage of techniques for maximizing learning in grouped settings, the teacher is lessening the learning of their charges. Veenman believes that teacher education programs should adjust their programs and acknowledge that the multigrade/multiage class is here to stay.

Summary of Teacher Issues

Teachers appear to be as ignorant of metacognition as the students. There are many barriers to effective use of metacognitive strategies. Some of the more entrenched are the continued use of obsolete pedagogical teaching education programs (Veenman, 1995). The lack of more authentic teaching of these metacognition skills. There is an absence of aggressive student-centered/teaching-learning in the public school classroom orientation. Teacher competence as regards knowing about metacognition is nil. And, last but not least is the archaic classroom organization. Teachers, according to the literature, are overburdened with ways and means of teaching that do not work with contemporary students. A summary composite of feasible solutions suggested in the literature are for the teachers to be more sensitive to what metacognitive training can do in improving learning in the classroom (Alvino, 1990; Calfee, 1994; Leat, 1993; Payne & Manning, 1991).

Student Issues

At many colleges and universities students become possessed to successfully progress toward their goal: a degree. This progress is often shaky and in some cases students are stopped

in their tracks finding the college experience unrewarding. Successful students overcome three learning problems; weak writing skills, poor problem solving abilities, and the inability to learn how to learn (Davies, 1983). Basically students do not live up to their potential because of these three basic problems. They are academic underachievers. Their potential does not compare well with their school performance (Carr, Borkowski, & Maxwell, 1991). These underachievers are less successful in achieving their college goals without significant struggle. Research has shown that these types of students do not even see themselves as unsuccessful, in fact quite the opposite, they perceive themselves as successful learners (Loranger, 1994). Part of this mis-perception is based on academic course selection. Courses are selected that maintain a positive self-concept. Students weave their way though general education, the major and minor requirements, toward a degree by carefully selecting only those courses that can be successfully completed (Marsh & Yeung, 1997). In accomplishing this feat, one has to reflect that these underachieving students are not dumb. It would take a master advisor to develop such a similar selection of course work.

What we have here is the outline of a student who attends college with a self-perception that he/she has average or better academic abilities, when in reality the student is really poorly equipped to make it a successful academic experience. Through perseverence, focused motivation, and careful navigation of available curricula, large numbers of these students do graduate (Marsh & Yeung, 1997). They may spend five years in a four year program, drop out then drop back in, or they may expend tremendous, but inefficient effort, to learn specific course material, passing one course at a time; learning little along the way. It is here that the education becomes a process to be accomplished. Learning is left by the wayside because the student had never been taught to learn in the first place (Carr, Borkowski, & Maxwell, 1991; Loranger, 1994;

Marsh & Yeung, 1997). This dismal picture could be avoided by attending to the techniques, skills, and solutions offered from the research in learning and metacognition. It would be appropriate at this juncture for the reader to experience some of the research findings in the general area of learning (Archambeault, 1992; Biggs, 1988; Chipman & Segal, 1985; Covington, 1985; Goetz & Douglas, 1991; Rowe, 1988; Sternberg & Grigorenko, 1993). Student academic performance and metacognition are well researched areas. But, alas, while there are numerous studies reporting success for students exposed to and trained in metacognitive elements, teachers, administrators, and schools, in general, appear not to be reading what the research has found that could make today's student a more efficient reader, writer, problem-solver (Anderson, 1982; Baum, Owen, & Oreck, 1997; Braten, 1991; Carns & Carns, 1991; Findley & Cooper, 1983; Harrison, Rainer, Hochwarter, & Thompson, 1995; Heldenbrand & Hixon, 1991; Karabenick & Knapp, 1991; Knapp & Karabenick, 1988; Liddell & Baumgarten, 1995; Newman, 1990; Rowe, 1988; Puntambekar, 1995; Puntambekar & du Boulay, 1997; Reynolds, Shepard, Kreek, Lapan, & Goetz, 1990; Rosenholtz & Simpson, 1984; Schunk, 1989, 1996; Steinberg, 1989; Young, 1997). It would be appropriate at this point to discuss what research has discovered about student learning in various academic environments. Large segments of the research literature focuses on specific aspects of the student's academic abilities, i.e., reading, writing, problem solving. Additional segments of the literature focus on what the student must know and control (Kim, 1992) in order to be successful in college. Some of the findings are presented here.

What the future holds in terms of knowledge needed by college students is difficult to predict, who is to say what abilities they should possess and what problems they will have solve in the next 20 years (Chipman & Segal, 1985). Chipman and Segal reported their concern about

the deteriorating student abilities to deal with complex skills, not the basic skills. Research focusing on reading and writing of college students has garnered interesting results. Goetz and Douglas (1991) found that when college students read an expository passage and then reported on the strategies they used to understand and summarize what they had read, a surprising number reported up to eight different strategies to accomplish the task. A subsequent study of college students and their ability to read textbooks efficiently reported that those student who were aware of their personal study style were better able to control the conditions affecting their study, i.e., teaching style, texts, purpose of the learning, content, and environment or setting. (Archambeault, 1992). Thinking style was identified as a possible contributor to this enhanced student performance. A report by Sternberg and Grigorenko (1993) examined thinking styles of the gifted and reported that style is different than ability and the gifted tended to use more appropriate 'styles' when solving academic problems. To Sternberg and Grigorenko a major difference between a gifted and non-gifted student was the variety of thinking styles they controlled. The operative word here is 'control.' The control of selection, application, and self-evaluation as regard to the successful use of a thinking style was one of the key factors separating successful from unsuccessful students (Sternberg & Grigorenko, 1993).

Lack of control produces fear and helplessness for many students. Fear of failure has a direct impact on student performance. The problem 'fear of failure' generates is that students become more motivated by a desire to avoid failure than the desire to be successful. Think about it, how many times have you made decisions based on the need not to fail, rather than the desire to succeed. What can be done to change this fear of failure syndrome in academic settings was examined by Covington (1985). Covington suggested classroom reward systems must be

changed to allow greater variety of means to accomplish course objectives; thereby allowing the student to receive more rewards for success causing them not make choices to avoid failure. Instruction in strategic thinking styles such as those outlined by Sternberg and Gregorenko (1993) could help the student evolve a repertoire of problem-solving styles to diminish the fear of failure syndrome. Biggs (1988) found control over learning by the student involves three levels, surface, deep, and achieving type learning. Enhanced learning occurs when the student is aware of the learning strategies used to remember and know (Schacter, 1996) and their developing ability to control how they learn best. Biggs took the student's perspective in identifying the three learning approaches. To Biggs the surface approach is motivated by meeting minimal institutional requirements; doing only enough to get by and nothing more. The deep approach is an intrinsic interest in the content causing extra effort and attention as a means to master the task at hand. The achieving approach is driven by the related ego concern over grades to a point that the decisions about accomplishing the task involves efficient time management, attending to the content, and adequate practice to be successful. Coupling the three approaches (surface, deep, achieving) with metacognitive training demonstrated changes in student achievement behaviors. Biggs emphasized that while his study reported significant changes in student approaches to learning, care should be taken in using the terms cognitive and metacognitive. Specifically, Biggs encouraged that 'cognitive' abilities should be taught 'metacognitively.' Metacognition is not an end, but a process (Biggs, 1988).

Self-Efficacy is a major element of Bandura's social cognitive theory and is the human self-referent thought used to mediate knowledge and behavior. According to Bandura (1986), "peoples judgments of their capabilities to reorganize and execute courses of action required to

attain designated types of performance" (p. 391). The self-efficacy differences between individuals helps to explain why people's behaviors differ widely even when they have similar knowledge and skills. To successfully understand self-efficacy in context one cannot divorce it from outcome expectations and self-regulation (Baum, Owen, & Oreck, 1997). Too often researchers only concentrate on self-efficacy alone to explain performance phenomena (Bandura, 1986; Harrison, Rainer, Hochwarter, & Thompson, 1997; Schunk, 1989, 1996). Students with high self-efficacy are more likely to undertake challenging tasks, persist longer, and be more successful than those with lower self-efficacy (Harrison et al., 1997). It would follow that if one were to raise an individual student's self-efficacy about academics, there should follow a higher level of performance as measured by higher grades, more risk-taking in course selection and real increases in knowledge. The models, programs and teacher issues discussed above tend to support this view of self-efficacy improving academic performance when appropriately taught as a process for empowerment.

For the student there are number of ways and means to increase personal self-efficacy. We can examine research which has identified a number of discrete attributes enhancing learning processes and performance potential. These attributes include, advance organizers, ability formation, attending, help seeking, learner control/locus of control, and higher order thinking. Each of these elements has proven to be linked to overall strategy development of any student wanting to enhance academic performance. It would be informative here to examine a few of the more prominent studies of these attribute-based phenomena.

One of the earliest techniques for helping one to learn, in this case to read and comprehend better, is the use of the advance organizer. Ausubel (In Anderson, 1982) reported

that for the advance organizer to work effectively it must be written at a higher level of abstraction than the material to be learned. Advance organizers for improving learning (reading comprehension) are the most studied of the attribution oriented techniques, and yet their instructive value is still in question. The advance organizer can focus the student on the overall picture of what is being learned. "So why not provide the scaffold (of ideas) at the beginning (of the course)? Let the student in on the secret of the structure, including an understanding of how it continually emerges through further inquiry, so that the mind can be active as the course progresses" (Joyce & Weil, 1996, p. 265).

When trying to understand content, it is important to understand the process of ability formation. A youth's ability formation relates to a person's conceptions of their own and others' abilities and tend evolve and mature in academic settings. As one matures this estimate of ability (self-efficacy {intrinsic} or self-regulation {extrinsic}) becomes more realistic and precise. Research confirm, that a student's expectations regarding novel and unspecified tasks is highly correlated with grade point averages and general overall academic performance (Rosenholtz & Simpson, 1984). Rosenholtz and Simpson offer ability formation as regards academics as cooperatively formed as a series of interactions caused by the influences of classroom organization (grouping), teacher perceptions and expectations and students' own behaviors in school. Developmental psychology based in behavioral research taught in teacher education helped formalize these beliefs and caused them to be perpetrated in school (Schunk, 1996).

Another attribute that developmentally evolves is 'attention' (Wade & Reynolds, 1989). Attending to material increases long-term learning, but attention itself is different for successful and less successful students. Reynolds, Shepard, Kreek, Lapan, and Goetz (1990) undertook a

study of selective attention strategy (SAS) to explain why some readers learn and recall more important information than less successful students. The research showed that for the less successful readers importance of the material was related to learning, as was attention , but that attention was not related casually to learning. For the more successful readers importance was related to attention, attention was related to learning and there was a casual relationship between attention and importance. The findings indicate that there are different competence levels in using selective attention strategies. SAS skills can be practiced and mastered thereby adding SAS to the tool box of metacognition.

A learner can control anxiety, evolve ability formation estimates, and learn selective attention strategies, but only successful students as active learners overcome their hesitation in reaching out for help from others to solve academic problems. Therefore help seeking is an important learning strategy. Help-seeking can be viewed as both a learning strategy and a social-interactional process (Karabenick & Knapp, 1991; Knapp & Karabenick, 1988; Newman, 1990). A learner can use help seeking as a strategy in her repertoire and at the same time view help seeking as a social interaction process occurring in the classroom. Much of the ability and motivation of the learner to use help seeking depends on individual personal characteristics and if this student view his academic performance as inadequate. If a learner hesitates or even refuses to seek help when faced with complex academic task he becomes vulnerable to a variety of problems possibly leading to dropping out of school. Even when adequate support services are available, some students prefer to seek help from those least able to provide the help sought: friends, parents, family (Knapp & Karabenick, 1988). An added ingredient to the mix is whether the learner is an active learner or passive learner. Previous research presented herein has

indicated that less successful students are unlikely to have the self-efficacy to seek appropriate help, while the successful (active learners) students link effort with performance and attend to need for outside help to selectively address academic problems (Karabenick & Knapp, 1991).

Another element of active learning is the concept of learner control (Steinberg, 1989) and locus of control. While similar, the two concepts are different. As regards learner control, it has been shown that while student control of instruction is basically appealing, research has proven that students learn less when given control over the instructional sequence. Better students tended to be skilled managers of the instruction. Conversely, less able learners have difficulty selecting exercises at appropriate difficulty levels (Findley & Cooper, 1983; Steinberg, 1989). There was shown a relationship among control, information processing skills, and other learning strategies; in other words maximum learning was situational. An earlier study by Findley and Cooper (1983) in talking about learner control, locus of control specifically, found that active learners responded to intrinsic motivators more often than passive learners who were more sensitive to external motivators. 'Internals' were more willing to delay gratification in order to maximize achievement. An overarching contributor was maturation, the older the learner got the more internally motivated in terms of locus of control. This was more so for males than females (Findley & Cooper, 1983).

Summary of Student Issues

Students, in order to be successful, must overcome any weaknesses in writing skill, problem solving, and become proficient in 'learning-how-to-learn.' The literature has illustrated how students do not live up to their full potential because of these three problems. It has been shown that there are greater similarities between gifted students and underachievers than

differences. They both have similar thinking styles, but place emphasis on different cognitive processes related to their individual thinking thereby making some students gifted and others not gifted (Sternberg & Grigorenko, 1993). For the not gifted are the additional problems of poor cognitive control spawning issues of fear of failure and learned helplessness. Looking at self-efficacy and self-regulation as an avenue for laying a foundation for academic success has been fruitful for a number of cognitive psychologists (Bandura, 1986; Baum, Owen, & Oreck, 1997; Biggs, 1988; Harrison, Rainer, Hochwarter, & Thompson, 1997; Rowe, 1988; Schunk, 1989, 1996; Stewart & Landine, 1995). These research findings are the underpinning of this current study. Based on these varied findings, it would follow that if one were to raise the self-efficacy of an underachiever by training in metacognition skills and techniques, then this student should exhibit some level of positive increases as regards academic achievement. Self-efficacy is an individual oriented predilection, is more sensitive to experimental treatment, and could be focused on a more narrow component of self-worth, like academic attitude, than trying to use self-esteem or self-regulation. The author takes this basic and guarded step into the world of underachievers and what it takes to make them successful students.

Metacognition

One of the most important aspects of learning is possessing a clear understanding of metacognition (Rowe, 1988). As we have seen in this review of relevant literature, the critical issue for the individual learner is the being aware of how one learns and, concurrently or subsequently, the ability to control the processes of this learning as pivotal to individual school success. Successful students have full control of their learning and use it as a purposive and planned activity (Rowe, 1988; Puntambekar, 1995; Puntambekar & du Boulay, 1997).

Metacognitive information processing strategies support the executive functions of cognition and allow the learner to accomplish higher order learning, such as problem solving, monitoring understanding and comprehension, evaluation of goal attainment, and selection and modifying situational learning behaviors (Heldenbrand & Hixon, 1991; Rowe, 1988; Young, 1997). Training in metacognitive techniques related to learning to learn, mold students into lifelong learners, and give them a set of skills that can be generalized among domains, styles and environments (Leddell & Baumgarten, 1995).

Metacognition developed out of the teachings of L. S. Vygotsky (In Braten, 1991). Vygotsky influenced the evolution of metacognition in his belief in self-regulation, cognitive self-control, and is the cornerstone of Vygotsky's theories stating that "the increasing ability of children to control and direct their own behavior, a mastery made possible by the development {of the child}....biologically determined" (p. 306). From Vygotsky's theories have evolved an in-depth nomenclature of metacognition and its elements. We have reviewed metacognition from the point of view of theoretic models, training programs, viewpoint of the teacher, and how the student understands and uses metacognition in their own academic pursuits. This category of the literature review concentrates on metacognitive components: what comprises the processes and goals of good metacognition.

One of the greatest barriers to learning has been the inability of the student to put their knowledge to work problem solving (Redding, 1990). Self-regulation is one of the more important components of metacognition involving an interaction of cognitive, metacognitive, and affective learning elements (Gourgey, 1998). Training in self-regulation reduces the number of false starts and setbacks. Winne (1997) suggest that learners adopt learning 'tactics' to solve

complex learning problems. He posits a three-prong approach to developing a problem-solving tactic; initiate cognitive operations, understand the desired product of the operations, and possess beliefs about the conditions under which a product can be seen as useful to the learner. By using these elements self-regulated learning can bootstrap itself to higher order learning through observational learning via the problem solving experience (1997).

One of the negative tactics impacting self-regulation is academic procrastination. Procrastination is comprised of motivational attributes of anxiety, self-esteem, and depression and is closely related to the students fear of failure. It involves more than poor self-regulation, poor time management or trait laziness (Senecal, Koestner, & Vallerand, 1995). Achievement motivation counters much of the negative aspects of procrastination attributes associated with self-regulation. Achievement motivation focuses more on higher order reasoning, inferences about rules (typologies from one domain that are modified and generalized to other domains), and problem solving strategies that learners actually use.

Metacognition is more than broad strategies such as problem solving, achievement motivation, and tactics. At the operation level are a number of basic techniques used daily by both good and poor students. As we have seen the good students are more effective in their learning. There are some elemental reasons for this academic skill. It would be appropriate to outline some of the more common techniques that underpin metacognitive training. Note taking, concept mapping, acquisition procedures, modeling, executive skills, transfer, and awareness or attending all are among a wide assortment of learning tools available to both poor and good students (Schraw & Dennison, 1994).

Problem solving is one of the more complicated tasks of higher order thinking skills, sometimes called critical thinking, for the academic learner. Good problem solving involves first understanding the problem, then the ability to plan and implement possible solutions, and self-regulation in the form of assessment so as to learn from the experience in a way that is generalizable across domains (Kersh & McDonald, 1991; Petit & Zawojewski, 1997). Another view of this problem solving approach is comprehension monitoring (Bonds, Bonds, & Peach, 1992) through asking assessment like questions like, "Does it make sense?" Better students make sense from individual words in understanding complex material, while poorer students rely on the context from which the words come to make sense of the problem.

Note taking has received a renewed interest and been studied in authentic classroom environments. It was found by David and Hult (1997) that note taking is actually two separate functions: processing (encoding or actual writing of the notes) and the review. They encourage training that includes a close look at the interaction between encoding and reviewing as complimentary learning strategies acting as an "orchestrating" element in learning. Another study tool is concept mapping. Concept mapping is where instructors model cognitive and metacognitive strategies emphasizing key ideas and supporting points combined into a meaningful classroom structure (Mikulecky, Clark, & Adams, 1989). Note taking implements the concept mapping used in the classroom, possibly as part of an advance organizer.

Age level and maturity come into play across these different metacognitive techniques. Some younger adult learners are less skilled and may need to mature more before they can fully appreciate or incorporate some of the higher order skills into their repertoire of learning methods (Short, Schatschneider, & Friebert, 1993). Specifically the learning readiness of a learner must be

considered, particularly when teaching self-regulation, problem solving, or critical thinking methods. These developmental younger learners recall less information, underuse existing organizational strategies, and understand less about the way their memory works (metacognition). The research done by Short and associates clearly showed that while task specific methods of learning can be taught (note taking, underlining, summarization, active learning), the higher order learning skills (problem solving, transfer, critical thinking) would not be effectively incorporated into the learners repertoire until developmental ready. Short (1993) and associates did not tie any year- spans to these findings.

A current trend for teaching higher order metacognitive skills is the use of infusion. Infusion is the teaching of thinking skills in the context of instructional subject matter. The typology for infusion is simple but effective, the teacher explains the metacognitive skill to be taught in the lesson, then it is modeled by the teacher, then modeled by the learner and then the learner reviews and evaluates their particular success with the metacognitive skills. It is within this process of explaining, modeling, and self-assessment that the learner evolves a critical thinking ability: all within the context of the classroom instructional content (Wilen & Phillips, 1995). The self-assessment often includes a thinking-out-loud (Meichenbaum, 1985) phase early on in the infusion process. Talking-out-loud usually takes the form of "OK, where am I now" "Good, then this is next" and the like. Learners are thereby encouraged to recognize when they encounter a problem, identifying it as such, and motivated to find solutions to resolve the problem. In this manner learners exhibit their skills in the context of the content. More importantly the learners using metacognitively based infusion to add 'transfer' to their repertoire of learning skills. Transfer is "the use of previous learning in a situation somewhat different from

the situation in which learning took place" (McKeachie, 1987, p. 707). Transfer is involved in all learning, it is part and parcel to learning itself. It is the essence of "learning to learn" for through the use of transfer learning from observation, modeling, or direct experience occurs.

Summary of Metacognition

The basic issue needed to be addressed in order to resolve a student's poor academic performance is to ensure the student understands the basic premises of metacognition and that s/he be aware of how one learns and thereupon work to acquire the ability to control these proceses (Braten, 1991; Heldenbrand & Hixon, 1991; Leddell & Baumgarten, 1995; Puntambekar, 1995; Puntambekar & du Boulay, 1997; Schunk, 1989, 1996; Young, 1997). Metacognition, once understood can be taught holistically or through its components, i.e., problem solving, self-regulation, note taking, developmental readiness, and concept mapping, to name a few. There is no need to repeat the above reports as regards metacognition techniques, suffice to say, these learning techniques act as sort of an abstract conceptual framework for academic success. Metacognition is more easily understood when viewed as an advance organizer for attacking an academic problem(s). This study uses several metacognitive techniques in the treatment phase.

Summary of the Related Literature

It is important to the understanding of the current study that the reader grasp the unfolding of the literature based research into the framework of this small study. The author begins with an assumption that if a student in not physically hurt as regards being brain damaged, then why does not this otherwise healthy student not learn (Schacter, 1996). In some respects the answer came from the literature, but only a partial answer. The students today are more

sophisticated, well informed, and technology savvy, but they have proven to be poor students (Guffey & Rampp, 1998; Guffey, Rampp, & Masters, 1998; Rampp & Guffey, 1998). Armed with this conundrum, the author sought a path to an answer to the concern about "why can't Johnnie learn?" If the Alvino dispositions can further increase the learning and thinking abilities of developing students. They must include for teacher and student alike, "tolerance for ambiguity, respect for evidence, willingness to search for reasons and alternatives, willingness to withhold or reverse judgments based on facts, open-mindedness, and sensitivity to others" (Alvino, 1990, p. 41). Yes we have been exposed to thinking and learning methods, usually in informal settings more than formal training, but alas, many students appear to have to wait until the post-graduate level to understand the true worth in maturing one's thinking ability.

Instrumentation

Self-efficacy will be measured using the Attitudes Toward Education instrument (Appendix A) developed by John Ory and John Poggio in 1975. This instrument will be reconfigured as two separate test instruments. Using the equivalent forms methodology the Ory and Poggio (1975) instrument that had been originally constructed of 100 items in 14 domains will be revised into two equivalent forms.

A second instrument will be a learning style inventory. This learning style instrument was based on the Dunn & Dunn (1993) Learning Style Inventory comprised of 24 items and can be manually scored. This quick instrument will be given to the student volunteers at the beginning of the metacognition study treatment (Appendix B)

Chapter Three

# METHODS AND PROCEDURES

## Design of the Study

This study will be conducted using a randomized control-group, pre-test post test design. The design is intended to investigate self-efficacy as it applies to academic achievement. The design will be carried out around single research question.

Research Question: Does having knowledge about metacognition techniques improve self-efficacy regarding academic course work? Statistical hypothesis to be tested:

$H_0$: Knowledge about metacognition does NOT increase self-efficacy regarding academics.

$H_1$: Knowledge about metacognition does increase self-efficacy regarding academics.

## Target Population

The target population to investigated is "at-risk' college freshman with ACT composite 18 or below. The subject population are students attending Arkansas State University, University College, enrolled in Freshmen Studies Study Strategies course(s). Their ages are between 18 and 24 years. All are classified as freshmen college students.

## Sampling Procedures

A purposive sample was obtained from this populations by asking for volunteers for the study treatment. Each of the 80 potential subjects who completed the pre-test regarding attitude (Attitude Toward Education, Form A) were offered an opportunity to volunteer for an 8-week

metacognition training series (experimental treatment). Six volunteers of the 80 potential subjects did volunteer and subsequently completed the eight-week treatment sessions.

Instrumentation

Self-efficacy will be measured using the Attitudes Toward Education instrument (Appendix A) developed by John Ory and John Poggio in 1975. This instrument will be reconfigured as two separate test instruments. Using the equivalent forms methodology the Ory and Poggio (1975) instrument that had been originally constructed of 100 items in 14 domains will be revised into two equivalent forms. The instrument used in this study will be two forms with each form equivalent in number of questions (50 each) and equally representative of the original domains. Six items that did not have any statistical significance will dropped from the revised instrument. These forms will have about half of each of the factor-specific items randomly placed on these two forms. Duplication will be avoided. Each form of the divided instrument shall be composed of 50 items evenly representing the original 13 categories. These two forms will be designated Form A and Form B (Appendix A). Form A will be administered to all study participants within two class meetings and serve as a pre-test of attitude toward school. This same instrument, as Form B, will be administered within two class meetings of the end of the semester and serve as a post-test. This revised instrument will be administered in class by the instructor. The survey should take not more than 30 minutes to complete in each cased, pre/post.

A second instrument will be a learning style inventory. This learning style instrument was based on the Dunn & Dunn (1993) Learning Style Inventory comprised of 24 items and can

be manually scored. This quick instrument will be given to the student volunteers at the beginning of the metacognition study treatment (Appendix B)

Each instrument, Attitudes Toward Education (Form A and B) and the Learning Style Inventory reflects current educational measurement methods. The Attitudes Toward Education is written in a force-choice format following the pattern of a Likert-type scale. For example: Attitude Toward Education;

I seldom ask for someone's advice while I am working on a problem.

1. strongly agree
2. agree
3. disagree
4. strongly disagree

Time spent in college is worthwhile.

1. strongly agree
2. agree
3. disagree
4. strongly disagree

The Learning Style Inventory (LSI) used in this study was originally developed in 1974 by Dunn and Dunn (1993). It is very popular among teachers and academics for its ease to administer, interpret and one that students can quickly understand. It's validity and reliability are not great. The Dunn and Dunn LSI has been criticized by some measurement evaluators as being too broad. The validity is based on a factor analysis and Alida Westman found the factors logical. The reliability coefficients cited are low to moderate, covering a range of .40 to .84, representing grades 5 to 12. The author elected to use this particular learning style inventory because there was a only one grade difference between the suggested grade range, 5 to 12. These subjects were all college freshmen, grade 13. Westman concludes that, "The LSI provides some good indices

on aspects of learning style" (In Kramer & Conoley, 1992, p. 462). Since the LSI had a limited function of diagnosing the participants basic learning style, which was used as a starting point for the treatment techniques these limitations did not affect the integrity of the study results. A standardized answer sheet (bubble sheet) will used in scoring both of these instruments so as to facilitate marking by machine.

Statistical Techniques

All classes were determined to be intact groups for this study. Since direct pairing of the participants, treated and nontreated students, would introduce the possibility of regression to the mean effects, it was necessary to employ a statistical method which would employ a method of indirect control to decrease within-group variability. The statistical method chosen for this purpose was a t-test statistic. The sample was determined by volunteers who self-selected themselves for the treatment. Each member of the population had an equal chance to participate in the treatment. Pre/post test means will be calculated, as will the means of the volunteers who also took the pre/post test as well as experiencing the treatment. The pre/post scores of the treatment sample subjects will be pair matched and their means compared with the pre/post test means of the population to identify any significant difference as regards attitude as identified from the Attitude Toward School instrument (Enger, 1992).

Data Collection and Recording Procedures

Treatment: Sequence of the treatment will be chronologically sequenced over one semester and involve formal and informal sessions and include both training and education. The specific treatment protocol is as follows:

**Step One:** The first class meeting of the University College, Freshmen Studies, Study Strategies course will be used to administer the Attitude Toward School instrument (Form A). This is the pre-test.

**Step Two:** Within two or three class meetings a presentation about Metacognition will be presented for 30 minutes. At the end of the presentation volunteers will be solicited to participate in an eight week series of informational and practice sessions held once a week for fifty minutes on Metacognition skills.

**Step Three:** Post test was administered to study population. At eight weeks the treatment ends. Before dead week and within two sessions at the end of the semester the Attitude Toward School (Form B) will be administered

**Step Four:** The sessions will end by the eight week mark. This ends the treatment phase of the study.

Each of the sessions is well-planned and had a pre-determined mix of information presentation, discussion, student engagement, and student self-appraisal. The sessions and content are outlined below:

Informal Session One: Metacognition-defined and explained with examples. Learning Style Inventory (LSI) administered. Neurological processes outlined of how the brain learns (sensory-register, working memory, long-term memory).

Informal Session Two: LSI handed back and discussed. Individuals understand and internalize their learning style. Discussion related to specific course work and individual style. Test taking strategies outlined as regards learning style/Metacognition skills. (student-talk)

Informal Session Three: Discuss specific courses, Metacognition techniques and learning style influence on their learning. (Responsibility on the learner) Participants explain or relate efforts to use Metacognition techniques.

Informal Session Four: self-regulation, elaboration, rehearsal techniques, and thinking out loud.

Informal Session Five: affective and motivation in effective learning.

Informal Session Six: paraphrasing, summarizing, creating analogies, generative note taking, outlining, and question-answering,

Informal Session Seven: networking in learning, knowledge-telling strategy,

Final Informal Session: An exit interview will be administered.

Data Processing and Analysis Procedures

The processing of the data took four steps. First, the Attitude Toward Education bubble sheets were assembled and marked. These had to be marked manually because the electronic scorer could not produce score results as were needed by the researcher. The mechanical score reader could only give frequen cies an item was marked and could build an accumulative score. It was essential that an accumulative score was calculated for each individual instrument. Additionally, the standardized bubble sheets provided by the ASU Testing Center had five distractors available when only four were needed.

Second, each bubble sheet was manually scored and then an accumulative score was calculated for each completed instrument. Third, these cumulative scores for each subject was entered into SPSS. Fourth, using the t-test family and descriptive statistics calculations and analyses were performed on the resulting numbers produced by the SPSS calculations.

The SPSS produced three figures to be used in determining the study results. Calculations were made to produce a t-test dependent experimental group showing pre- and post-metacognitive skill training (n=6). This was labeled Figure 1. Next, calculations were made to produce a t-test dependent control group pre- and post- no metacognitive training (n-19). A third set of calculations were made to produce a t-test independent mean change experiment versus control group (n=25). These three figures provided sufficient numerical calculations to allow the researcher to develop findings that offer suggestions and made observations as to the results of this study in raising underachieving student academic self-efficacy through structured training in metacognition techniques.

Chapter Four

RESULTS

Introduction

The purpose of this study was to address one small part of the bigger issue of students not knowing how to learn effectively in today's schooling system (Caine & Caine, 1994; Goodlad, 1984; Bereiter & Schardamalia, 1985). The research attempted to address the fundamental element of effective learning; student self-efficacy as regards academic achievement. An experimental treatment was designed regarding metacognition of selected underachieving Arkansas State University freshmen. This chapter will explain the data presentation and analysis divided into four elements; data presentation, data analysis, interpretation of figures, and a chapter summary.

The study used a randomized experimental group-control group, pre-test posttest design. The main research tools were Attitude Toward Education (Ory & Pioggo, 1975) and Learning Styles Inventory (Dunn & Dunn, 1993). A experimental treatment was designed and implemented that was comprised of eight 50-minute metacognition training sessions that included:

Informal Session One: Metacognition-defined and explained with examples. Learning Style Inventory (LSI) administered. Neurological processes outlined of how the brain learns (sensory-register, working memory, long-term memory).

Informal Session Two: LSI handed back and discussed. Individuals understand and internalize their learning style. Discussion related to specific course work and individual style. Test taking strategies outlined as regards learning style/Metacognition skills. (student-talk)

Informal Session Three: Discuss specific courses, Metacognition techniques and learning style influence on their learning. (Responsibility on the learner) Participants explain or relate efforts to use Metacognition techniques.

Informal Session Four: self-regulation, elaboration, rehearsal techniques, and thinking out loud.

Informal Session Five: affective and motivation in effective learning.

Informal Session Six: paraphrasing, summarizing, creating analogies, generative note taking, outlining, and question-answering,

Informal Session Seven: networking in learning, knowledge-telling strategy,

Final Informal Session: An exit interview will be administered.

Data presentation

This study examined the effect that metacognition training had on the self-efficacy of at-risk college freshmen attending Arkansas State University, Spring 1999. The target population was at-risk underachieving college students taking a study strategies course required because these at-risk students had scored 18 or below on the ACT composite.

A research question and a statistical hypotheses were developed to reflect the objectives of the study. This research question and statistical hypotheses are presented below:

Research Question:

Does having knowledge about metacognition techniques improve self-efficacy regarding academic course work?

Statistical hypothesis:

$H_o$: Knowledge about metacognition does NOT increase self-efficacy regarding academics.

$H_1$: Knowledge about metacognition does increase self-efficacy regarding academics.

The statistical analysis was conducted by first reducing the data using descriptive statistics such as mean and standard deviation. The t-test was determined to be the most appropriate for this study. In particular, the need to compare dependent matched scores for the experimental subjects on the pre- and post-test necessitated a dependent t. The dependent t-test was performed on both the control and experimental groups to determine whether significant change in self-efficacy existed pre to post treatment. There was also a need to do an independent t-test to compare the change in self-efficacy (if one existed) for the control group compared to any change in self-efficacy in the experimental group.

Three figures are provided below to illustrate the results of the analysis. Calculations were made to produce a dependent t-test for the experimental group showing pre- and post-metacognitive skill training (n=6). This was labeled Figure 1.

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Place Figure 1 here

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Next, calculations were made to produce a dependent t-test for the control group pre- and post-no metacognitive training (n-19). This was called Figure 2.

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Place Figure 2 here

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# T-Test (Dependent) Control Group
# Pre - Post No Training
# Figure 2
# n = 19

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | PRE | 125.3684 | 19 | 12.0932 | 2.7744 |
| | POST | 127.1579 | 19 | 12.2350 | 2.8069 |

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | PRE & POST | 19 | .948 | .000 |

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | PRE - POST | -1.7895 | 3.9240 | .9002 | -3.6808 | .1018 | -1.988 | 18 | .062 |

A third set of calculations were made to produce an independent t-test for mean change experiment versus control group (n=25). This was called Figure 3.

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Place Figure 3 here

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This analysis provided sufficient numerical calculations to allow the researcher to develop findings that offer suggestions and make observations as to the results of this study in raising underachieving student academic self-efficacy through structured training in metacognition techniques.

Data analysis

Figure 1, illustrated above, compared the two matched samples (n=6) performance on the pre-test and post-test study instrument, Attitude Toward Education (Ory & Pioggo, 1976). The descriptive statistics of mean and standard deviation were calculated for the sample on the pre-test and on the post-test. The pre-test mean for the paired matched sample was 110.0 and the standard deviation was 7.483 with a standard error mean of 3.055. The post-test mean for the paired matched sample was 98.33 and the standard deviation was 4.321 with a standard error mean of 1.764.

The alpha for these t-tests was set at .05. The descriptive statistics for the paired sample dependent tests (n=6) were: the mean change was 11.667; the standard deviation was 4.551; 'dependent-t' was 2.564, degrees of freedom was 5, and two-tailed test produced a significance of .050, indicating a significant improvement in self-efficacy following the experimental treatment.

# T-Test (Independent) Mean Change
# Experimental vs Control
# Figure 3
# n = 25

**Group Statistics**

| | Group | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| CHANGE | Experimental | 6 | 11.6667 | 11.1475 | 4.5509 |
| | Control | 19 | -1.7895 | 3.9240 | .9002 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| CHANGE | Equal variances assumed | 5.958 | .023 | 4.597 | 23 | .000 | 13.4561 | 2.9269 | 7.4013 | 19.5109 |
| | Equal variances not assumed | | | 2.901 | 5.397 | .031 | 13.4561 | 4.6391 | 1.7898 | 25.1225 |

Figure 2, illustrated above compared the two matched control groups (n=19) performance on the pre-test and post-test study instrument, Attitude Toward Education (Ory & Pioggo, 1976).

The descriptive statistics of mean and standard deviation was calculated for the sample on the pre-test and on the post-test. The pre-test mean for the paired matched control group sample was 125.37 and the standard deviation was 12.09 with a standard error mean of 2.77. The post-test mean for the paired matched control group sample was 127.16 and the standard deviation was 12.24 with a standard error mean of 2.81.

The alpha for this dependent t-test was also set at .05. The descriptive statistics for the paired sample control group (n=19) were: the mean change was -1.7895; the standard deviation was 3.924; 'dependent-t' was -1.988, degrees of freedom was 18, and two-tailed test produced a significance of .062, indicating no significant change in self-efficacy during the training period.

Figure 3, illustrated above compared the experimental group (n=6) against the control group (n=19) using an independent t-test to compare mean change in self-efficacy between the control and experimental groups. The performance data on the pre-test and post-test study instrument came from the Attitude Toward Education (Ory & Pioggo, 1976).

The descriptive statistics of mean and standard deviation was calculated for both control and experimental groups. The alpha of these t-tests was also set at .05. The mean change for the two samples was: 11.667 for the experimental group and -1.7895 for the control group. The standard deviation was 11.1475 for the experimental group and 3.9240 for the control group. The standard error mean of 4.55 for the experimental group and .9002 for the control group.

In comparing the level of change between the experimental group and the control group an independent t-test was used. As can be seen from Figure 3, there was a significant difference in mean change for academic sel-efficacy between the groups. More precisely, the academic self-efficacy was significantly more improved with the eight-week metacognition training that the experimental group received than was the self-efficacy of the control group that received no training in metacognition.

Data interpretation

The analysis was grouped into three elements. The researcher wanted to examine the attitude improvement (self-efficacy) as shown by the scores recorded on the pre- and post-Attitude Toward Education instrument of the experimental group (n=6). Next the researcher wanted to examine the same pre- and post- scores of the control group (n=19). A third element of the analysis was to compare the degree of change between the experimental group and the control group. In other words, did the metacognitive training experienced by the experimental group over eight weeks improve individual self-efficacy as demonstrated by changed scores from the Attitude Toward Education instrument.

The null hypothesis was "Knowledge about metacognition does NOT increase self-efficacy regarding academics." The null hypothesis was rejected. The alternative hypothesis was accepted: "Knowledge about metacognition does increase self-efficacy regarding academics." The data analysis supports this decision. When comparing pre- and post- experimental group training the t-test calculated a significant difference ($p < .05$).

These calculations using the t-test (dependent and independent forms) suggest that the metacognitive training did make a difference in the academic self-efficacy between the treatment volunteers and the control group participants. The treatment or experimental group participants did demonstrate greater increases in self-efficacy related to college academics than the control group participants at the conclusion of the eight-week metacognition training. This would suggest that metacognitive training improve academic self-efficacy of at-risk underachieving college freshmen enrolled in the Spring 1999 at Arkansas State University in the Freshmen Studies study strategy course.

Summary

This study examined whether metacognitive training could raise individual academic self-efficacy in freshmen college students who had been labeled at-risk. The data analysis and interpretation appear to support the alternative hypothesis that knowing about metacognition learning techniques can improve locus of control over academic life and specifically raise feeling of self-worth regarding academics. In other words, for these students, regardless of the overall feeling about their self-esteem in general, they specifically had increased their positive feelings about themselves and their ability to do well in academics.

Chapter Five

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Introduction

This study examined the impact of metacognition training on the academic self-efficacy of at-risk college freshmen enrolled in Freshman Studies Course on study strategies at Arkansas State University during the Spring 1999. The study null hypothesis was that "knowledge about metacognition does NOT increase self-efficacy regarding academics." The data and its subsequent interpretation required that the alternate hypothesis be accepted. The alternative hypothesis was "knowledge about metacognition does increase self-efficacy regarding academics.

Metacognition is a complex area of study. There are several important elements that directly impacted the results of this small study. When considering the use of metacognition training in college development courses various critical aspects of metacognitive techniques must figure centrally in the planning. For example, information processing (Baron, 1985, Boyd & Starkey, 1998; Vermunt, 1995), learning strategies (Bandura, 1986; Bransford, Arbitman-Smith, Stein, & Vye, 1985; Caine & Caine, 1994; Chipman & Segal, 1985; Dansereau, 1985; Dunn & Dunn, 1993; Weinstein & Mayer, 1986; Weinstein & Underwood, 1985), metacognitive skills and techniques (Braten, 1991; Heldenbrand & Hixon, 1991; Leddell & Baumgarten, 1995; Puntambekar, 1995; Puntambekar & du Boulay, 1997; Rowe, 1988; Schunk, 1989, 1996; Young, 1997), and, of course, self-efficacy (Anderson, 1982; Bandura, 1986; Baum, Owen, & Oreck, 1997; Harrison, Rainer, Hochwarter, & Thompson, 1997; Schunk, 1989, 1996). The literature is

replete with relevant research illustrating the techniques, ways, means, modes, and manners of implementing a successful metacognitive training program at the college level.

Summary of study

The researcher used the research to block out a model metacognitive training programs designed on the research of Sternberg and Davidson (1989), Conway and Ashman (1989), Vermunt (1995), and Moran (1991). Their findings and suggested approaches are threaded throughout this study. The outstanding contribution was made by the research of Nist and Simpson (1989) and Asquith (1996). These two pieces of research provided the operational training elements and provide strategies and classroom instructional suggestions that have proven successful for Nist and Simpson and Asquith. Their research can be readily recognized in the way the study was structured and implemented.

The findings are supported in other literature as regards uses of the specific training elements integrated into the classroom activities for the students to use as focus for their practice. The data indicated that this study did make a significant impact on the self-efficacy of the student participants. The students showed a higher level of academic self-efficacy at the end of the treatment. The control group did not show this same level of improvement of student self-efficacy. The analysis and interpretation of the data can be reviewed in the preceding chapter.

Conclusions.

From the data analysis it can be seen that in the three ways that the data was analyzed there was a significant difference between the pre-test and post-test scores on the attitude instruments used in this research for the experimental group. The result that a significant difference in self-efficacy improvement existed between the group receiving metacognitive

training and the group not receiving metacognitive training implicates the importance of metacognition training. Greater academic self-efficacy can potentially be facilitated when underachieving students are given training in metacognition skills in addition to their customary study skills courses.

Recommendations.

One of the major limitations of this study was the small sample (n=25). A larger sample of at-risk underachievers needs to be studied using the same metacognitive training protocol as used here. Replications of this study in varied college settings would enhance the findings and possibly suggest a method that could be used that is not generalizable but transferable from learning setting to learning setting. For example, this study needs to be replicated at community colleges, vocational and technical colleges, and other regional universities. If this if done the findings from such efforts would make a major contribution to resolving freshmen retention problems faced by Arkansas State University and it's sister institutions of higher learning.

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# APPENDIX A

Attitude Toward Education Instrument [Form A]

## Attitudes Toward Education

Form A

Last 4 digits of ID#

____

**Directions:**
This tool is designed to evaluated what student's believe about the various aspects of learning in an educational environment. Completion of this tool will assist in gaining a better understanding related to individual attitudes about learning. This survey is expected to be anonymous and personal identification is limited to the last four digits of your social security number. These numbers will be used exclusively to measure change in attitude during the course of learning. Please complete the following self assessment by writing the appropriate number from the scale below in the space provided next to each question. It should take about 15 minutes to complete the entire survey

**Please use the following scale when answering the questions about yourself:**

**1 = always**
**2 = often**
**3 = seldom**
**4 = never**

1 ____ I often choose moderately difficult tasks rather than very difficult ones.
2 ____ I have found myself short of time on a test because I spent too much time on one or two problems.
3 ____ I would rather work on a commission basis with a chance for a large income than work on a fixed salary with a lower, but steady income.
4 ____ I often feel at peace with myself.
5 ____ If I were a teacher, I would rather have good students, than freedom and flexibility in the job.
6 ____ My parents (guardian) seldom discouraged me from doing new things as I grew up.
7 ____ I prefer games of skill to games of chance.
8 ____ Getting an "A" in a course is always possible for me.
9 ____ I can accomplish simple manual tasks faster than most people.
10 ___ I become frustrated easily.
11 ___ I prefer to watch sports on television, rather than participate myself.
12 ___ My parents (guardians) allowed me to make my own friends.
13 ___ I prefer to work on difficult projects with someone, rather than trying them alone.
14 ___ I am (was) frequently the first person done with a test.
15 ___ Being popular is more important than just being successful.
16 ___ I am not as much concerned about the present as I am about the future.
17 ___ I have courage.
18 ___ I have often followed my parents' (guardians') advice even whin I disagreed with it.
19 ___ I feel as though I can take short breaks after successfully completing one stage of a large project.
20 ___ While working on a project, I often get side-tracked by new ideas.
21 ___ I like to live by the saying, "Never give up."

22 ___ I always lacked closeness with my parents (guardians).
23 ___ Often I am disappointed in my ability to interact with others.
24 ___ I consider myself open to new ideas or beliefs.
25 ___ In school, I am (was) active in extra-curricular activities.
26 ___ I would rather change my opinion than disagree with the consensus of a group.
27 ___ It is more important to have friendly co-workers than flexibility in the job.
28 ___ If I cannot solve a particular problem, I would rather try an easier one than keep working on the harder task.
29 ___ I frequently find myself doing something now, in preparation for the future.
30 ___ My parents (guardians) expected a lot from me when I was young.
31 ___ I seldom ask for someone's help while I am working on a problem.
32 ___ I would often work very hard at something just for my parents' (guardians') approval.
33 ___ One cannot be truly successful if s/he is not also popular.
34 ___ I will frequently make a very easy task more difficult to make it more interesting.
35 ___ Very difficult problems are more motivating than moderately difficult problems.
36 ___ Generally, I feel compelled to know the exact time.
37 ___ I prefer a well written book to a good movie.
38 ___ Social acceptance is more important than personal success.
39 ___ I will often do my best in order to avoid the embarrassment of failure.
40 ___ I enjoy competing against the clock.
41 ___ After participating in athletics, I find it much easier to accept defeat if I have played well.
42 ___ My parents (guardians) rewarded me with a hug or a similar show of affection for doing something well.
43 ___ I often pack my suitcase days before I am ready to leave.
44 ___ I feel that I can succeed at almost anything I try.
45 ___ It is important to finish something once it is started.
46 ___ After successfully completing a task, I like to relax for a short period before attempting something new.
47 ___ I consider myself an independent thinker.
48 ___ I will often attempt a difficult problem after failing at an easier one.
49 ___ I realize the limits of my own ability and knowledge.
50 ___ I enjoy solving problems that some people would consider impossible.

Thank you for taking the time to complete this survey. Your help is greatly appreciated. You are free to receive an analysis of your individual responses after the completion of both the pre and post survey. Please contact the investigators of this study and furnish them with the last four digits of your social security number. Individual analysis of the results will only be performed by specific request. For the purpose of this investigation, a collective analysis is being performed.

# APPENDIX B

Attitude Toward Education [Form B]

## Attitudes Toward Education

Form B

Last 4 digits of ID#

____

**Directions:**
This tool is designed to evaluated what student's believe about the various aspects of learning in an educational environment. Completion of this tool will assist in gaining a better understanding related to individual attitudes about learning. This survey is expected to be anonymous and personal identification is limited to the last four digits of your social security number. These numbers will be used exclusively to measure change in attitude during the course of learning. Please complete the following self assessment by writing the appropriate number from the scale below in the space provided next to each question. It should take about 15 minutes to complete the entire survey

**Please use the following scale when answering the questions about yourself:**

**1 = always**
**2 = often**
**3 = seldom**
**4 = never**

1 ____ I am highly motivated when I know that a task is difficult.
2 ____ I am physically more active than most people.
3 ____ I prefer to work alone.
4 ____ I often find myself speaking in the future tense.
5 ____ Successful completion is the primary goal of any undertaking.
6 ____ I will often keep working at something even if it seems hopeless.
7 ____ I am motivated more by social pressures than by personal needs.
8 ____ I find it easier to make decisions after getting someone's advice.
9 ____ I would rather take a multiple-choice test than an essay exam.
10 ___ My parents (guardians) were seldom affectionate with me.
11 ___ I believe that I succeed at tasks more times than if fail.
12 ___ I would rather have the teacher set the deadlines than set them myself.
13 ___ I view my parent's (guardians') lives as unproductive.
14 ___ I would rather work for a company that pays well, than work for a company that pays less but affords job flexibility.
15 ___ I feel my parents (guardians) were very restrictive in raising me.
16 ___ I am often the last person to finish a test.
17 ___ I am usually realistic about my goals and aspirations
18 ___ I feel that I am more likely to succeed at any given task than are most people.
19 ___ After a considerable amount of time on a problem, I prefer to move on to an easier one.
20 ___ I prefer web based or self paced academic courses to traditional lecture classes.
21 ___ I feel that I am being very realistic with my career choice in relation to my ability.
22 ___ My parents (guardians) are (were) friendly.
23 ___ I dislike giving up on a task.
24 ___ When the odds are against me in games of skill, I am highly motivated to do my best.

25 ___ A true challenge is one that is practically impossible to accomplish.
26 ___ I enjoy(ed) classes in school with a mixture of students with varying abilities.
27 ___ Unfinished tasks bother me until I get a chance to finish them.
28 ___ I consider myself very conscious to time.
29 ___ My father (male guardian) is (was) very dominating and strict.
30 ___ I will often spend days just thinking and organizing before beginning the work of a project.
31 ___ Other people influence my opinions more than I would like them to.
32 ___ I enjoy completing many easy tasks rather than just a few difficult ones.
33 ___ My parents (guardians) never seemed very confident of their own abilities.
34 ___ It is important to have long range goals clearly in mind.
35 ___ Monetary rewards are the best way to motivate me to do my best.
36 ___ I do not mind putting in extra hours and work if it helps me finish a task.
37 ___ In school, I have usually taken advantage of self paced course options.
38 ___ I generally aim my activities toward a future goal.
39 ___ When younger, I felt very guilty when I disobeyed my parents (guardians).
40 ___ I will work longer on problems I believe I can solve, than on those I consider close to impossible.
41 ___ I will often do things for the present enjoyment and not be concerned with future consequences.
42 ___ Tasks are performed best through group efforts rather than through individual effort.
43 ___ Games are not much fun if the competition is too strong.
44 ___ It is often too much trouble to disagree with a group opinion.
45 ___ I would rather fail at a difficult task than succeed at an almost effortless task.
46 ___ Success encourages me to attempt even more difficult problems.
47 ___ I enjoy being in groups with people of equal ability.
48 ___ I would rather be unpopular with my own opinions than be popular with someone else's opinions.
49 ___ I enjoy trying to solve problems some people would consider impossible.
50 ___ My parents (guardians) gave me considerable independence early in life.

Thank you for taking the time to complete this survey. Your help is greatly appreciated. You are free to receive an analysis of your individual responses after the completion of both the pre and post survey. Please contact the investigators of this study and furnish them with the last four digits of your social security number. Individual analysis of the results will only be performed by specific request. For the purpose of this investigation, a collective analysis is being performed.

# APPENDIX C

Learning Style Inventory Instrument

## Learning Styles Inventory

***Directions:***

To gain a better understanding of yourself as a learner, you need to evaluate the way you prefer to learn or process information. By doing so, you will be able to develop strategies which will enhance your learning potential. The following evaluation is a short, quick way of assessing you learning style.

This 24-item survey in NOT timed. Answer each question as honestly as you can.

***Fill in the (0) bubble on the accompanying answer sheet, where 1=often, 2=sometimes, and 3=seldom.***

1. Can remember more about a subject through the lecture method with information, explanations, and discussion.
2. Prefer information to be written on the chalkboard, with the use of visual aids and assigned readings.
3. Like to write things down or to take notes for visual review.
4. Prefer to use posters, models, or actual practice and some activities in class.
5. Require explanations of diagrams, graphs, or visual directions.
6. Enjoy working with my hands or making things.
7. Am skillful with and enjoy developing and making graphs and charts.
8. Can tell if sounds match when presented with pairs of sounds.
9. Remember best by writing things down several times.
10. Can understand and follow directions on maps.
11. Do better at academic subjects by listening to lectures and tapes.
12. Play with coins or keys in pockets.
13. Learn to spell better by repeating the words out loud than by listening to the radio.
14. Can better understand a news article by reading about it in the paper than by listening to the radio.
15. Chew gum, smoke, or snack during studies.
16. Feel the best way to remember is to picture it in your head.
17. Learn spelling by "finger spelling" words.
18. Would rather listen to a good lecture or speech than read about the same material in a textbook.
19. Am good at working and solving jigsaw puzzles and mazes.
20. Grip objects in hands during learning period.
21. Prefer listening to the news on the radio rather than reading about it in the newspaper.
22. Obtain information on an interesting subject by reading relevant material.
23. Feel very comfortable touching others, hugging, handshaking, etc.
24. Follow oral directions better than written ones.

# APPENDIX D

Learning Style Inventory Scoring Instrument

## Scoring Procedures

***Directions:***

Place the point value on the line next to the corresponding itme. Add the points of each column to obtain the preference scores under each heading.

**OFTEN** = 5 points
**SOMETIMES** = 3 points
**SELDOM** = 1 point

| Visual No. | Points | Auditory No. | Points | Tactile No. | Points |
|---|---|---|---|---|---|
| 2 | _____ | 1 | _____ | 4 | _____ |
| 3 | _____ | 5 | _____ | 6 | _____ |
| 7 | _____ | 8 | _____ | 9 | _____ |
| 10 | _____ | 11 | _____ | 12 | _____ |
| 14 | _____ | 13 | _____ | 15 | _____ |
| 16 | _____ | 18 | _____ | 17 | _____ |
| 19 | _____ | 21 | _____ | 20 | _____ |
| 22 | _____ | 24 | _____ | 23 | _____ |
| VPS= | | APS= | | TPS= | |

VPS/visual preference score
APS/auditory preference score
TPS/tactile preference score

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