

# Goals, Efficacy and Metacognitive Self-Regulation

## A Path Analysis

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### Abstract

The purpose of this study was to illustrate the relationship between self-efficacy, task value, goal orientations, metacognitive self-regulation, self-regulation and learning strategies and to investigate the unique contribution of each on the variability in students' total scores of 12 exams. Our study revealed that students' self-efficacy, task-value, self-regulation, and elaboration are significantly positively correlated with total scores. Path analysis demonstrated that self-efficacy was the strongest predictor of total score and positively predicted mastery goals, but negatively predicted avoidant goals. The study reveals positive direct effect of mastery goals on metacognitive self-regulation. In addition, positive direct effects of metacognitive self-regulation on deep learning strategies and on self-regulatory strategies are found. However, some expected direct effects were not represented with significant parameters in the model. Performance-approach goals were not a significant predictor of other variables in the model. Also, there were no significant direct effects of mastery goals nor metacognitive self-regulation and deep learning strategies on total scores which were discussed here.

**Keywords:** Self-efficacy, Task value, Achievement goal orientation, Metacognitive self-regulation, Self-regulation, Learning strategies

## 1. Introduction

Metacognition and self-regulation have unique roots within the psychological literature (Dinsmore, Alexander, & Loughlin, 2008; Fox & Riconscente, 2008). Researchers must examine these roots not only to avoid overlapping the constructs of metacognition and self-regulation, but also to operationally define the variables of interest. Importantly, metacognition has been approached from a variety of perspectives in the educational psychology literature. For example, metacognition has been divided into two distinct aspects: knowledge about cognition, and the regulation of cognition (Brown, 1987; Flavell, 1979; Veenman, Van Hout, & Afflerbach, 2006). In addition, Pintrich, Woters, and Baxter (2000, as cited in Tobias, 2006) divided metacognition processes into three components; knowledge about cognition, monitoring of learning processes, and control of the processes. Tobias (2006) considers the control of the processing components as self-regulation. Dinsmore et al., (2008) provided an analysis of 255 studies to explore the theoretical and empirical boundaries between metacognition, self-regulation, and self regulated learning. They concluded that the difference between metacognition and self-regulation is that metacognition involves cognitive orientation while self-regulation is more concerned with human action. Furthermore, Pintrich (1995) claimed that students may demonstrate different aspects or dimensions of self-regulation of learning. These dimensions are behavior, motivation and cognition. Cognition as a third component of self-regulation involves the control of various cognitive strategies for learning, such as the use of deep processing strategies (Pintrich, 1995; Vrugt & Oort, 2008) and these cognitive processes are required for successful academic performance and learning (Bembenutty, 2007; Lan, 1996; Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990; Vrugt & Oort, 2008). One example of these processes is when a student adjusts her/his learning strategy so that s/he stays in sequence with task demands. In our study, we refer to this component as metacognitive self-regulation, whereas self-regulatory strategies refer to regulation of effort, time and environment.

Regulation of cognition refers to a set of activities that help students control their learning (Vrugt & Oort, 2008). Although metacognition is operationalized in many distinct ways in the research literature, three essential skills are included in all accounts: planning, monitoring and evaluation (Jacobs & Paris 1987; Veenman et al. 2006; Winne 1996). Planning involves the selection of appropriate learning strategies and the allocation of resources that improve academic performance. Monitoring refers to one's awareness of comprehension and task performance. Evaluation refers to personal judgments of the products and efficiency of one's learning, such as evaluating one's goals and conclusions.

Few data are available concerning the relationships between motivational variables and the use of metacognition, specifically, metacognitive self-regulation (Bembenutty, 2007; Ford, Smith, Weissbein, Gully, & Salas, 1998; Lan, 1996; Schraw, Horn, Thorndike-Christ, & Bruning, 1995; Schunk & Ertmer, 2000; Vrugt & Oort, 2008). One motivational variable that may impact metacognitive self-regulation is achievement goal orientation (see Elliot, 2005; Was, 2006 for a review). In achievement goal orientation theory, mastery goals focus on the development of competence, task mastery, self-referential standards, and on learning and development of skills, whereas performance-approach goals are directed toward attaining

favorable judgments of competence and oriented to demonstrate that one is more capable than his or her peers. In addition, theorists have also identified performance-avoid goals, which focus on effort minimization to protect self-worth. Schraw et al. (1995) found that students who adopt mastery achievement goals reported more metacognitive knowledge than students with less strong mastery goals. Similarly, Ford et al. (1998) reported that students with learning goal orientation were more likely to be metacognitively self-regulated. In contrast, Sperling, Howard, Staley, and DuBois, (2004) reported that intrinsic motivation was not related to the engagement in metacognitive activities. We argue that understanding students' learning probably requires consideration of the effects of students' metacognitive self-regulation skills, in addition to the motivational variables.

The importance of self-regulatory strategies to successful academic performance has been well established and has been modeled by a number of theories (Pintrich, 1995; Pintrich & De Groot, 1990; Schunk, 1989; Zimmerman, 1989). As discussed above, behavior and motivation are dimensions of self-regulation of learning (Pintrich, 1995). Specifically, self-regulation of behavior involves the active control or use of various resources that the students have available to them, such as time, environment, and effort, whereas self-regulation of motivation involves controlling and changing motivational beliefs, such as efficacy and goal orientation.

The impact of self-regulation on academic achievement has been investigated in conjunction with motivational variables, such as self-efficacy, achievement goal orientation, and learning strategies (Bartels & Jackson, 2009; Bouffard-Bouchard, Parent, & Larivee, 1991; Dembo, 2000; Middleton & Midgley, 1997; Paulsen & Gentry, 1995; Pintrich & Schunk, 2002; Schunk & Ertmer, 2000; Schunk, 1990, 1994, 2001; Zimmerman, 2000; Wolters, Yu, & Pintrich, 1996). For example, a study done by Paulsen and Gentry (1995) examined the relationships among motivational variables (intrinsic and extrinsic goal orientation, task value, control of learning, test anxiety, and self-efficacy), cognitive learning-strategy variables (rehearsal, elaboration, and organization), self-regulation variables (time, study, and effort), and students' academic performance (final grade) in an Introduction to Financial Management course. A total of 353 undergraduate students were asked to complete the Motivation Strategies for Learning Questionnaire (MSLQ), and then exploratory factor analysis was used to develop scales that measure the motivational and learning strategy variables. Paulsen and Gentry found that all motivational variables were significantly related to the academic performance (final grade in the course). More interestingly, path analysis demonstrated that the strongest predictor of performance was self-efficacy. In Paulsen and Gentry's study, self-efficacy mediated the impact on performance of all motivational variables and partially mediated the effects of time, study, and effort regulation. Although their study showed some generality in students' goals, Paulsen and Gentry's distinction between students' goals is nonetheless too broad because goal orientation was divided into intrinsic and extrinsic goals. The intrinsic goal items assessed how much students perceive themselves as doing academic tasks to gain internal rewards, such as feeling challenged. The extrinsic goal items assessed how much students perceive themselves as doing academic tasks for external rewards, such as grades. Consequently, the results did not provide detailed

information regarding the associations of achievement goals across self-efficacy, self-regulation, and academic achievement.

Zimmerman (2000) argued that “self-efficacy beliefs provide students with a sense of agency to motivate their learning through use of such self-regulatory processes as goal setting, self-monitoring, self-evaluation, and strategy use” (p.87). Evidence was provided by a study that tested the productiveness of several self-motivational factors of students’ academic achievement in the naturalistic context of a high school studies class (Zimmerman, Bandura, & Martinez-Pons, 1992). Zimmerman et al., (1992) found that the more capable students judge themselves to be, the more challenging the goals they set. A study done by Bouffard-Bouchard et al., (1991) investigated the influence of self-efficacy on self-regulation during a verbal concept formation task of 45 junior high-school and 44 seniors known to be of average or above average cognitive ability. Self-efficacy was measured by asking the participants to state whether or not they believed they would be able to solve four problems. If the student responded “Yes”, they also had to indicate the corresponding level of difficulty for each problem. After that, participants were observed while they attempted to solve four problems of varying difficulty. While students worked on the problems, certain criteria (overview, monitoring of time, persistence, rejection of a correct hypothesis, self-evaluation, performance-correct responses) were observed to operationalize self-regulation and performance. The researchers concluded that self-efficacy had a significant influence on the occurrence of various aspects of self-regulation. For example, their study demonstrated that students with high self-efficacy were better at monitoring their working time, more persistent, less likely to reject correct hypotheses, and better at solving conceptual problems than inefficacious students of equal ability.

Middleton and Midgley (1997) examined the relationship between 703 sixth-graders’ self-efficacy, self-regulation, academic goals, and academic achievement in mathematics. They found that mastery goal orientation positively predicted academic self-efficacy and reports of the use of self-regulated learning strategies. Surprisingly, performance-approach goals did not significantly predict self-efficacy or self-regulated learning. This contradicts other investigations in which the relationship between self-efficacy and performance-approach goals was found to be positive (Midgley & Urdan, 1995; Wolters et al., 1996).

Earlier research has indicated that self-efficacy has a stronger effect on academic performance than other motivational variables, such as self-regulation (Kitsantas & Zimmerman, 2009; Pintrich & De Groot, 1990; Pintrich & Schunk, 1996, 2002). Research has also indicated that self-efficacy has significant influence on self management behaviors and self-regulated learning processes, such as self-observation, self-judgment and self-reaction (Dembo, 2000; Pintrich & Schunk, 2002; Schunk, 1990, 1994, 2001). Furthermore, research also suggests that effective self-regulation is based on students’ sense of self-efficacy for self-regulating their learning and performing well (Pintrich & Schunk 2002; Schunk 1994). One might question how the effect of self-efficacy on self-regulatory strategies (effort, time, and environment) is mediated by achievement goal orientation. To investigate, subscales from MSLQ (Pintrich, Smith, Garcia, & McKeachie, 1991) were used

to measure students' self-efficacy and self-regulatory strategies. Students' goal orientation was measured by using Elliot's (1999) measure. These variables were then included in a model predicting academic achievement as measured by the students' total scores in an educational psychology course.

An important part of this investigation tested in the present study concerned metacognitive self-regulation. Specifically, the relationship of metacognition to other motivational variables has been addressed by little research (Bembenutty, 2007; Ford et al, 1998; Lan, 1996; Schraw et al, 1995; Schunk & Ertmer, 2000; Vrugt & Oort, 2008). However, these previous studies did not adequately test whether metacognitive self-regulation mediates the relationship among motivational variables. In the present study, we specifically address this question.

In recent years, we have seen a convergence of theory and research around the constructs of mastery and performance goals and their relations to learning strategies and self-regulatory skills (see Elliot 2005 for a review). One purpose of the current study was to determine if there are specific types of achievement goals metacognitive self-regulated learners set and how metacognitive self-regulation may direct students with different achievement goals to deep or surface learning and self-regulatory strategies. In the current study, learning strategies are defined as specific processes which students may use alone or in combination to learn content of the curriculum (Graham & Robinson, 1987), and a subscale from MSLQ (Pintrich et al., 1991) was adopted to measure each of four components of learning strategies: rehearsal, elaboration, organization, critical thinking. Rehearsal, the reciting or repeating of information, is a low-level strategy used for simple tasks and is thought to be helpful for encoding new information. Elaboration strategies (e.g., paraphrasing, summarizing, and note taking) are higher-level and active strategies that help students to make internal connections among the new information and their prior knowledge. Organization strategies (e.g., out-lining and concept mapping) are also higher-level strategies and likewise help to build connections among ideas. Finally, critical thinking involves students applying prior knowledge to solve or understand new problems and is a strategy that requires higher-level manipulation of information, both new and old.

We proposed that goal-orientations students adopt for their learning predicts the use of metacognitive self-regulation skills. More specifically, the goal orientations students adopt for their learning provide the students a standard by which they can monitor and judge their performance and then make the appropriate adjustments, if needed. We argue that these standards (provided by goals) are important for metacognitive self-regulated learner to make judgments about their learning. Dunlosky and Metcalfe (2009) claimed that a judgment of learning is an essential component in metacognition because it provides students with assessments regarding their performance. We argue that in order for this component to work and provide students with assessments about their learning, it requires standards (provided by goals) to base the judgments on.

Moreover, it has been found that self-regulated learners tend to demonstrate a high level of self-efficacy, intrinsic motivation and achievement mastery goal orientation (Bouffard-Bouchard, Parent, & Larivce, 1991; Pintrich & De Groot, 1990; Wolters et al.,

1996; Zimmerman, 2000). We proposed that students who are mastery oriented will have high metacognitive-self-regulation skills because these skills are involved in controlling of various cognitive strategies for learning. Previous research has demonstrated that deep processing learning strategies (organization, elaboration, and critical thinking) were found to be positively correlated to achievement mastery goals (Elliot & McGregor, 1999; Liem, Lau, & Nie, 2008; Wolters et al., 1996). In addition, although contrary results were found in the literature regarding the relationship of performance-approach goals to learning strategies and self-regulatory strategies (Liem et al., 2008; Wolters et al., 1996), we hypothesized that these goals predict the use of metacognitive self-regulation skills. Our rationale behind this assumption is that performance-approach oriented students care about the final grade and want to achieve better than others, they need to have high metacognitive self-regulation skills to direct them to particular learning strategies to achieve their goals. On the other hand, the main goal for performance-avoidant students is to protect their self-worth. In order to do so, these students use a surface learning strategy like rehearsal, produce less effort, and do not manage their time and environment, which is likely to result in lower learning and performance. These students lack the awareness of and control over their cognitive processes.

## **2. Methods**

### *2.1 Participants*

Two hundred sixty-five undergraduates enrolled in an educational psychology course at a Midwestern state university received course credit for their participation in this study. Data was collected from students in several sections of this course beginning in the Fall semester of 2003 and ending in the Spring semester of 2006. Over this time frame approximately 400 students were enrolled in this course, however, only data from those students who provided consent to use final grade in the course were included in the study. Females represented 74% of the participants.

### *2.2 Measures*

#### *2.2.1 Motivated Strategies for Learning Questionnaire*

The MSLQ consists of 81, self-report items into two broad categories: (1) a motivation section and (2) a learning strategies section. The MSLQ is completely modular, and thus the scales can be used together or individually, depending on the needs of the researcher.

#### *2.2.2 Self-efficacy*

The participants of this study answered questions aimed to measure students' self-efficacy for learning and performance. This sub-scale was adopted from Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). It contains a total of 8 items. Sample questions include "I believe I will receive an excellent grade in this class" and "I am confident I can learn the basic concepts taught in this course."

#### *2.2.3 Task Value*

A single sub-scale adopted from the MSLQ was designed to measure how important,

interesting, or useful the course is seen by the student. A total of six items were used to measure task value, sample items include “I think I will be able to use what I learn in this course in other courses” and “it is important for me to learn the course material in this class.”

#### 2.2.4 Metacognitive Self-regulation

A sub-scale was adopted from Motivated Strategies for Learning MSLQ to measure students’ metacognitive self-regulation. This sub-scale contains a total of 12 items, sample items include “When reading for this course, I make up questions to help focus my reading” and “If course readings are difficult to understand, I change the way I read the material.”

#### 2.2.5 Learning Strategies

Four sub-scales were adopted from MSLQ to measure students’ rehearsal, elaboration, organization, and critical thinking, sample items include (rehearsal) “When I study for this class, I practice saying the material to myself over and over”, (elaboration) “When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions”, (organization) “When I study the readings for this class, I outline the material to help me organize my thoughts,” and (critical thinking) “I often find myself questioning things I hear or read in this course to decide if I find them convincing.” The learning strategies were conceptualized as deep processing (organization, critical thinking, and elaboration) and surface processing (rehearsal).

#### 2.2.6 Resource Management Strategies

In the current study, the MSLQ subscales of time and study environment, and effort regulation were used to operationalize resource management. This sub-scale contains four items measuring effort regulation. Sample items include “I work hard to do well in this class even if I don’t like what we are doing” and “Even when course materials are dull and uninteresting, I manage to keep working until I finish.” The sub-scale also contains eight items measuring time and study environment management. Sample items include “I usually study in a place where I can concentrate on my course work” and “I make good use of my study time for this course.”

#### 2.2.7 Achievement Goal Orientation

Goal orientations of Mastery, Performance-Approach, and Performance-Avoidant were measured using Elliot’s (1999) measure. Elliot adapted this measure from the previous measure published by Elliot and Church (1997). The achievement goal questionnaire is comprised of 18 items, six representing each of the achievement goal outlined in the trichotomous goal framework Elliot (1999).

#### 2.2.8 Course Total Score

Educational psychology grades were calculated as the sum of 12 exams worth 100 points each and 12 quizzes worth 25 points each, for a total of 1500 points, that were administered throughout the semester for students participating in the study.

### 2.3 Procedures

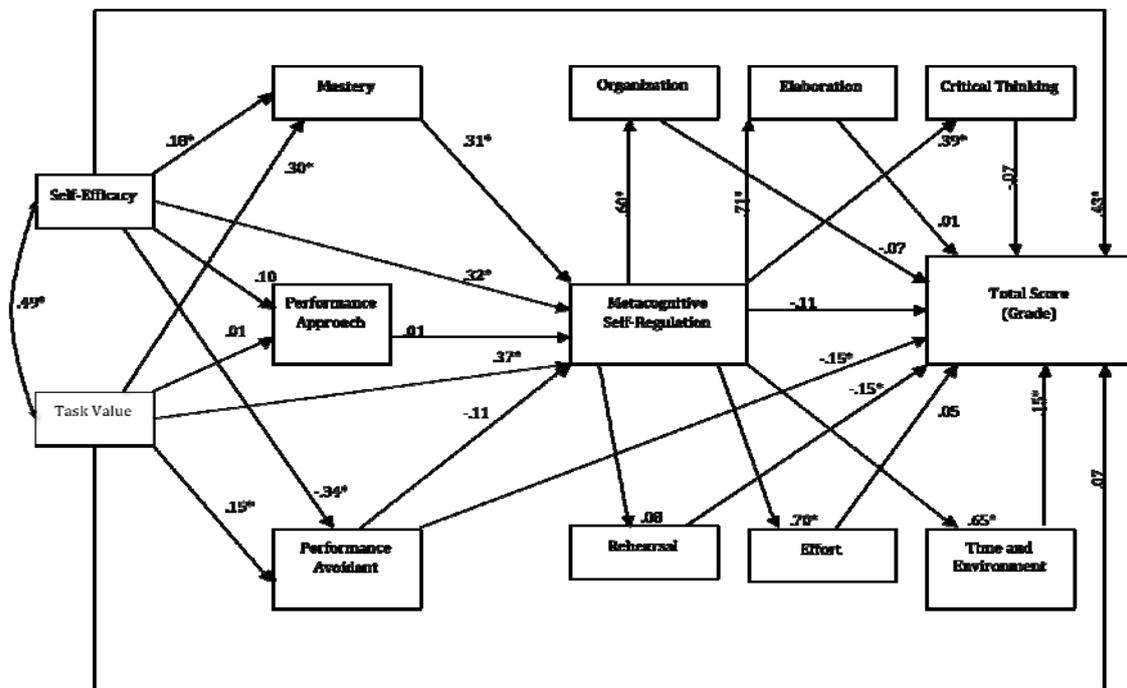
All self-report measures were completed online by participants with an imposed deadline to complete the questionnaire by a specific date as defined by the course syllabus.

### 2.4 Analysis

Correlation and path analyses were used to investigate the relationship between all variables as well as to assess the unique contribution of each predictor on the variability in students' total scores. Figure 1 presents the full path model tested.

### 3. Results

Table 1 presents the means and standard deviations for all variables in the study. Relations between the variables in our conceptual model were first examined with Pearson product-moment correlations between variables. The correlation analysis was completed in order to examine the relational patterns of the variables of interest. Table 2 presents the correlations between all variables in the study. Of particular interest among the correlations is that between self-efficacy for learning and total score ( $r = .45$ ). This correlation is the largest correlation of all variables with total score. A composite score of the learning strategy subscales (the sum of scores for rehearsal, elaboration, organization and critical thinking) did not correlate with total score in the course ( $r = .03$ ). However, a composite score of the resource management subscales (the sum of the scores for time and study environment, and effort regulation) did correlate with total course score ( $r = .14, p < .05$ ).



\*  $p < .05$

Figure 1. Full Path Model Tested with Standardized Path Coefficients.

Table 1. Means and Standard Deviations of Measured Variables.

<i>Variable</i>	Mean	Standard Deviation
Self-efficacy	70.83	6.51
Task-Value	55.78	3.91
Meta-Cognitive Self-Regulation	98.37	9.40
Rehearsal	31.33	3.74
Elaboration	50.57	4.44
Organization	32.30	4.37
Critical Thinking	38.91	5.10
Time and Study Environment	67.62	8.25
Effort	34.72	3.93
Mastery	25.79	2.65
Performance-Approach	17.50	5.20
Performance-Avoidant	18.81	4.70
Total Score (Grade)	1269.78	150.54

Table 2. Correlations Among Measured Variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>MSLQ</i>													
1. Self-efficacy for Learning	.93	.45	.50	-.05	.40	.22	.35	.40	.50	.30	.06	-.32	.45
2.Task-Value		.83	.55	.14	.51	.40	.30	.43	.53	.35	.02	-.03	.22
3. Metacognitive Self-Regulation			.69	.17	.73	.61	.48	.65	.66	.32	.01	-.10	.22
4. Rehearsal				.69	.17	.37	.06	.13	.11	.05	.10	.32	-.19
5. Elaboration					.75	.56	.56	.48	.51	.30	-.01	-.07	.14
6. Organization						.64	.32	.46	.40	.28	-.02	.05	.02
7. Critical Thinking							.80	.25	.22	.20	-.03	-.09	.07
8. Time and Study Environment								.76	.75	.15	.01	-.01	.26
9. Effort									.77	.30	.05	-.16	.29
<i>Achievement Goal Orientation</i>													
10. Mastery										.78	.11	-.11	.09
11. Performance-Approach											.88	.15	.04
12. Performance-Avoidant												.83	-.26
<i>Grade</i>													
13. Total Score													--

$r > .11$ ,  $p < .05$ ;  $r > .15$ ,  $p < .01$ ; Values on the diagonal represent Cronbach's alpha reliability estimates.

*Path analysis.* The analysis was conducted using Amos 5 software (Arbuckle, 2005) employing maximum likelihood path analysis (Bentler, 1995). Maximum likelihood allows for the estimation of means and intercepts for missing data. The estimated standardized path coefficients are presented in Figure 1.

As expected, Metacognitive Self-Regulation was also correlated to total score ( $r = .22$ ) as was Task-Value ( $r = .22$ ). Several other variables are significantly correlated to total score. Variables that we identified as effort regulation, Time and study environment, as well as Effort, were moderately correlated with total score ( $r = .26$  and  $r = .29$  respectively). Interestingly, the variables that we identified as deep processing strategies we not correlated with total score in the course ( $r$  values ranging from  $.02$  to  $.07$ ) with the exception of Elaboration, which produced a small correlation with total score ( $r = .14$ ). Rehearsal, identified as a surface processing strategy was negatively correlated with total score ( $r = -.19$ ).

Of the goal orientations, only Performance-Avoidance was correlated with total score ( $r = -.26$ ). There are several other correlations of interest among the predictor variables, however, the path analysis provides more insight to the relationships in the model. For ease of understanding, Figure 2 presents the path model with only statistically significant parameters. Table 3 presents the direct, indirect, and total effects of all predictor variables on total score.

Three predictors had significant direct effects on total score, Self-efficacy ( $\beta = .42$ ), Performance-Avoidance ( $\beta = -.13$ ), and Rehearsal ( $\beta = -.16$ ). Self-efficacy had a significant direct effect on Mastery goal orientation ( $\beta = .18$ ) and Performance-Approach goal orientation ( $\beta = -.34$ ), as well as a moderate correlation to task value ( $r = .49$ ). Task value also had significant direct effects on Mastery goal orientation ( $\beta = .30$ ) and Performance-Approach goal orientation ( $\beta = -.15$ ).

Metacognitive Self-Regulation had a significant direct effect on all deep-processing strategies, but not on rehearsal (see table 3). An interesting outcome of the path analysis was the negative parameter between Metacognitive Self-Regulation and TotalScore. Sobel tests of mediation determined that the variables Time and Study

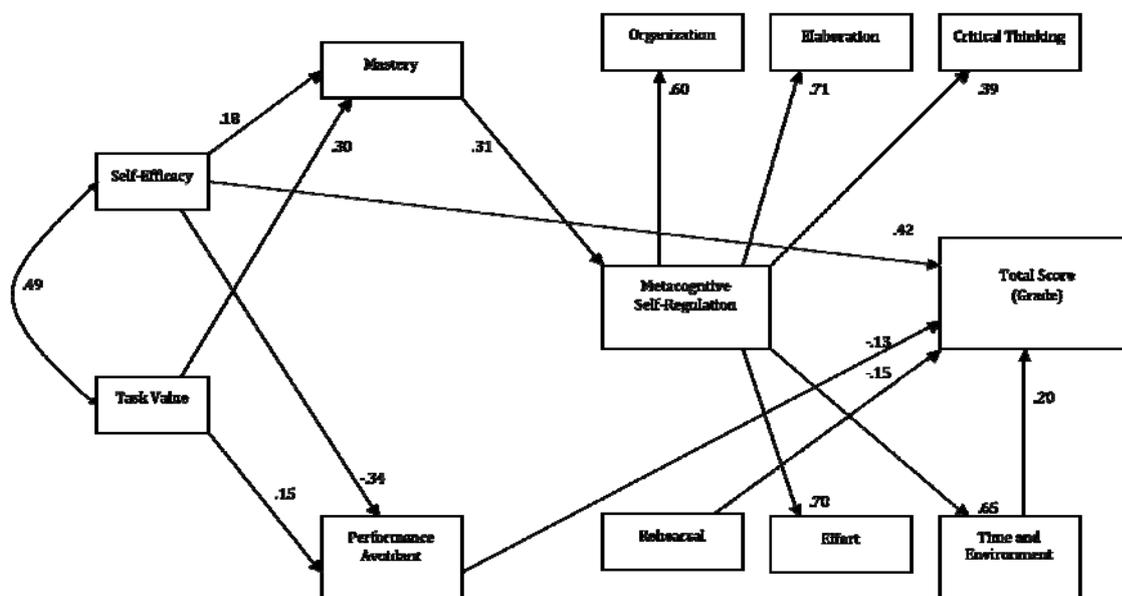


Figure 2. Path Model with Significant Path Coefficients

Table 3. Standardized Effects of Predictor Variables on Total Score (Grade).

Variable	Direct Effects	Indirect Effects	Total effects
Task Value	.070	-.047	.023
Self-Efficacy	.420	.046	.466
Performance-Approach	.044	-.004	.041
Performance-Avoidant	-.127	-.038	-.165
Mastery	-.061	-.016	-.077
Metacognitive Self-Regulation	-.109	-.057	-.051
Rehearsal	-.153	.000	-.153

Environment and Effort Regulation fully mediated the effects of metacognition on grade ( $t = 2.42, p < .05$ , and  $t = 2.94, p < .01$  respectively).

#### 4. Discussion

In the present study we sought to investigate the relationships between self-efficacy, task value, achievement goal orientations, metacognitive self-regulation, learning strategies and self-regulatory strategies. We were also interested in the relationships between these variables and academic achievement as reflected in examination grades. The expected relationships between self-efficacy, task value, achievement goal orientations (mastery and performance-avoid), and students' achievement were generally represented in the path model,

with positive direct effect of achievement mastery goal on metacognitive self-regulation and metacognitive self-regulation on deep learning strategies and on self-regulatory strategies. However, some expected direct effects were not represented with significant parameters in the model. More specifically, performance-approach goals were not a significant predictor of other variables in the model. Also, there were no significant direct effects of mastery goals nor metacognitive self-regulation and deep learning strategies on total scores.

One primary objective of this research was to examine the effect of self-efficacy on students' academic achievement in relationship to the other factors in the model. As predicted, the direct and indirect effects of self-efficacy demonstrated a relationship to academic achievement. The parameter between self-efficacy and total score is a strong positive parameter in the model. Data modeling demonstrated that self-efficacy accounted for the most variance in total score. A possible interpretation is that students' beliefs about their efficacy to manage academic task demands can influence them emotionally by decreasing their stress and anxiety. Students who believe they can perform certain task usually do not experience negative thoughts about their ability to perform a task successfully (Bandura, 1993, 1997; Chemers, Hu, & Garcia, 2001). Alternatively, Bandura (1993) indicated that a low sense of efficacy produces depression and anxiety. Our finding is consistent with other previous research findings demonstrated that self-efficacy is a powerful variable in predicting students' achievement (Andrew, 1998; Bandura, 1993; Barkly, 2006; Paulsen & Gentry, 1995; Schunk, 1981, 1989; Zimmerman, 2000).

In addition to the direct effects of self-efficacy on total score, the indirect paths are also informative. The correlation between self-efficacy and task value is another strong positive parameter in the model. When student encounters an academic task, two questions are raised "Can I do this task?" (self-efficacy) and "Why am I doing it?" (task value). If the answer for the first question is yes, then the student starts searching for the value in the task or in its outcomes. Our model provided empirical results supporting the idea that the answers for both questions directly and indirectly affect students' achievement goals and academic achievement. More specifically, we found that self-efficacy and task value directly predict specific achievement goal orientations (mastery and performance-avoid). Our model demonstrated that students with a high sense of self-efficacy and task value adopted mastery goals for their learning. In other words, self-efficacy and the value assigned to a task function direct the students to pursue a specific goal-orientation. For example, a math major with high self-efficacy, who values the understanding of a complicated equation rather than memorizing it for the test, will adopt mastery goals because regardless of their effects on performance, mastery goals will facilitate other desirable outcomes in achievement settings, such as understanding the complicated equation. In essence, this pattern of relationship suggests that the self-efficacy beliefs affect students' thoughts and behaviors before and while they work on tasks. Students who are not confident that they can complete a task often become anxious and preoccupied with concerns about failing, especially when they are being evaluated. These students adopt performance-avoid goals as we see later in this discussion. In contrast, students who are convinced of their competence are task-oriented and concentrate on the task at hand instead of worrying about whether they will be able to solve the task.

As we hypothesized, the parameter between self-efficacy and performance-avoid goal orientation was negative. This is an indication that students low in self-efficacy adopt performance-avoid goals for their leaning perhaps because they have negative beliefs concerning the degree to which they are capable of accomplishing academic tasks (Elliot, 1999). These students focus on avoiding demonstrations of incompetence and view achievement settings as threatening. They may therefore try to escape the situation if such an option is available. As predicted, the achievement performance-avoid goal orientation was negatively related to total score. Performance-avoid goals are debilitating in that withdrawing efforts or not seeking help when it is needed may lead to lower performance (Liem et al., 2008). One implication of this finding is the need for educators to be cognizant of classroom factors that may lead students to avoid the demonstrating a perceived lack of ability. Our findings add to a growing body of empirical work attesting to the negative and widespread influence of achievement performance-avoid goal in achievement settings.

Unexpectedly, our model indicated that task value positively predicts performance-avoid goal orientation. Although this parameter was small, it is important to attempt to reconcile this finding. Our interpretation of this parameter is that some performance-avoid students may value the task or the outcomes, but on the other hand, they doubt their capabilities of successfully accomplishing the task because of low self-efficacy. As discussed in the introduction, the main goal of these students is to protect their self-worth by adopting failure-avoiding strategies regardless the manifest value they observe in the task. These strategies include avoiding academic tasks and setting unrealistically high or low goals. One suggestion for the future research is to further investigate the relationship between task value and performance-avoid goal orientation in real classroom settings.

As discussed in the introduction a substantial amount of research has shown the positive relationship between mastery goals and the use of effective learning strategies (Ames & Archer, 1988; Anderman & Young, 1994; Nolen, 1988; Sankaran & Bui, 2001; Somuncuoglu & Yildirim, 1999). In our model, we proposed that the various achievement goal orientations predict the use of leaning strategies and eventually affect the students' performance through the use of metacognitive self-regulation skills. It is clear from path analysis that only mastery goal orientation has an indirect effect on learning strategies via metacognitive self-regulation. Generally, the metacognitive self-regulation component refers to the awareness of and control over the cognitive processes. The explanation of this predicted finding is that the metacognitive self-regulation component operates to direct the individuals to the appropriate ways of processing the materials to be learned. Therefore, students use metacognitive self-regulation skills in relation to mastery goal orientation when they ask "What is the best learning strategy to achieve my goal?" or "How can I study this task?" For example, a mastery oriented student who sets a goal such as understanding the topic will end up using deep level learning strategies, such as organization, elaboration, and critical thinking and persist when they are faced with difficult tasks. This is in line with previous findings suggesting that achievement mastery goal oriented students are more inclined to persistently engage in their learning although the tasks may be perceived as difficult (Elliot, 1999; Kaplan & Maehr, 2002; Pintrich, Smith, Garcia, & McKeachie, 1993). Contrary to this, the path

analysis showed that there were no direct or indirect effects of performance-approach and performance-avoid goals on metacognitive self-regulation. Our interpretation of this result is that the metacognitive self-regulation involves some complex ideas and cognitive processes. Many of these ideas and processes are not specifically taught in the classroom. Students typically develop metacognitive knowledge and skills slowly and only after many challenging learning experiences, thus, it is not surprising that performance-approach and performance-avoid goals develop few if any effective learning strategies. Students who are performance-avoidant do not prefer to be challenged and they quit when they are encountered with challenging academic task (Elliot, 1999; Pintrich et al., 1993).

Surprisingly, the results of the path analysis (Figure 2) revealed no direct effect of achievement mastery goals on total score and no significant exogenous parameters from performance-approach in the model. These surprising findings are in line with and can be explained through a limited amount of research that raised major concern about self-reports measures of achievement goal orientations in academic contexts (Brophy, 2005; Jan & Hall, 2005; Pintrich, Conley, & Kempler, 2003). For example, Jan and Hall (2005) examined the social desirability effects on Vande Walle's Learning Goal Orientation scale (LGO) and Midgley et al.'s Task Goal Orientation scale (TGO). Social desirability is defined as students' tendency to present themselves in a favorable light. Jan and Hall argued that this tendency can be a source of method bias in self-report questionnaire research. The results demonstrated that social desirability affects the goal orientation measures. More specifically, their results suggested that mastery oriented students may be less self-conscious about academic situations where failure may occur. Instead, they place precedence on improving their skills and competence. In contrast, for both measures (LGO and TGO), Jan and Hall found positive secondary loadings for performance-approach goal on the social desirability construct.

Furthermore, Pintrich et al., (2003), have shed light on another issue concerning the definition of achievement goal orientations. They questioned whether a student can set a goal of understanding the material, but then judge success relative to others, or if the student who sets demonstrating a competence goal, might use personal improvement as a measure of progress toward the goal. Pintrich et al., (2003) argued that success may be defined in one way, but a student may use both improvement and outperforming others as an indication of progress toward that goal. Alternatively, students may set goals of developing and demonstrating competence in the classroom, but focus only on evidence of relative ability when making competence judgments.

In addition, Brophy (2005) noted some general concerns about achievement goal orientations and its assessment, though his critique focused largely on performance goals. He claimed that there is weak to nonexistent evidence for a causal link between performance goal adoption and subsequent performance. He continued to argue that students' history of past achievement affects their current willingness to endorse optimistic goals when completing measures of achievement goals. These proposed effects are perhaps reflected in the correlation between achievement goal measures and measures of students' achievement.

A relationship between learning strategies and academic performance has been found in several studies (Busato, Prins, Elshout, & Harnamaker, 1998; Entwitle, 1988; Pintrich & Schrauben, 1992; Weinstein & Mayer, 1986; Vermunt, 1998). Typically, high achievement has been positively related to deep learning strategies and negatively related to surface learning strategies. However, our missing direct effect between the deep learning strategies and total score is in line with limited research findings and can be attributed to the subjects' lack of effort, interest, and motivation to use deep learning strategies in this particular class. For example, Kember, Jamieson, Pomfret, and Wong, (1995) investigated the learning strategies of first year students. They used an hourly recording approach by asking the subjects to keep an hour-by-hour study diary for a period of one week. In addition, open-ended questions were asked to collect more information about learning strategies the subjects used. The subjects were also required to complete the Bigg's (1987) Study Process Questionnaire to measure surface, deep, and achieving approaches. One result of this study demonstrated that adopting deep learning strategies does not guarantee success or high performance; hard work is still necessary. Furthermore, another possible reason for the lack of a direct effect between deep learning strategies and total score was that students who adopted deep learning strategies did not achieve a high score because of a lack of interest in the subject. Without interest, students do not usually produce the effort necessary to perform well. To support this conclusion, Biggs (1970, 1976, 1979, 1987, as cited in Wilding & Andrews, 2006) investigated the relationship between study approach and academic performance. One interesting finding was that deep study approach correlated positively with performance only in the students' favorite subjects. In addition, a third possible reason for the lack of a direct effect of deep learning strategies on total score might be that the participants were not motivated enough to use these strategies. Students need to be rewarded to adopt deep learning strategies because if they believe that the test's materials could be studied sufficiently through surface learning strategies, there is no reason to use deep learning strategies. A study completed by Diseth and Martinsen (2003) investigated the relationship between approaches to learning, cognitive style, motives, and academic achievement. 192 undergraduate psychology students completed Approaches and Study Skills Inventory for Students (ASSIST) and students' examination grades were used as the measure of academic achievement. One relevant finding of this study was that the deep approach of learning did not predict achievement. Diseth and Martinsen interpreted this finding by arguing that the academic course used in the study did not invite or reward subjects to explore the learning materials (also see Sankaran & Bui, 2001).

The absence of a significant direct effect of metacognitive self-regulation on total score in the final model was likely due to the distribution of shared variance among the other variables involved in the analysis, particularly, the effects of metacognitive self-regulation on deep learning strategies (organization, elaboration, critical thinking) and on self-regulatory skills (effort, time and environment).

The present study demonstrated that self-efficacy, task value, and achievement goal orientation (mastery and performance-avoid) are linked in important ways to the use of learning and self-regulatory strategies through the use of metacognitive self-regulation. The

model provide evidence that students who have high self-efficacy for learning beliefs are likely to be mastery oriented, value the task at hand, and are more likely to be cognitively engaged in learning (using deep learning strategies: organization, elaboration, critical thinking) through the use of metacognitive self-regulation. More importantly, the results of our study are consistent with our theoretical predictions in that metacognitive self-regulation mediated the effects of achievement mastery goal on deep learning strategies and self-regulatory skills. Our model supports the conclusion that the metacognitive component of self-regulation impacts what learning strategies are adopted for a given task, how much effort is employed, and how best to use time and environment available for the learning tasks. Students who are mastery oriented use their metacognitive knowledge to plan ahead with regard to a learning task and use their time effectively to accomplish their goals. However, researchers need to rely on other measures (e.g., performance measures) rather than self-report measures to study specific attitudes and behaviors of achievement goal orientations and how these might mediate the effects on metacognitive self-regulation skills. Some of these attitudes and behaviors are students' persistence, choice of activity, anxiety, and expectations. The results of the present research give us confidence that such research is likely to yield important, meaningful, and useful information.

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