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# Achievement Goals, Study Strategies, and Exam Performance: A Mediational Analysis

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Two studies examined achievement goals as predictors of self-reported cognitive/metacognitive and motivational study strategies and tested these study strategies as mediators of the relationship between achievement goals and exam performance in the normatively graded college classroom. The results support hypotheses generated from the trichotomous achievement goal framework. Mastery goals are positive predictors of deep processing, persistence, and effort; performance-approach goals are positive predictors of surface processing, persistence, effort, and exam performance; and performance-avoidance goals are positive predictors of surface processing and disorganization and negative predictors of deep processing and exam performance. Persistence and effort mediate the relationship between performance-approach goals and exam performance, whereas disorganization mediates the relationship between performance-avoidance goals and exam performance.



In the contemporary achievement motivation literature, the achievement goal approach proferred by Dweck (1986), Nicholls (1984), and others (Ames, 1984; Maehr & Nicholls, 1980) has emerged as the most prominent account of individuals' affect, cognition, and behavior in competence-relevant settings. Within this tradition, achievement goals are conceptualized as the purpose (Maehr, 1989) or cognitive-dynamic focus (Elliot, 1997) of task engagement, and the type of goal adopted is presumed to establish the perceptual set for how individuals interpret and experience achievement settings. As such, achievement goals are viewed as important predictors of a host of achievement-relevant processes and outcomes (for reviews, see Ames, 1992; Dweck, 1991; Harackiewicz, Barron, & Elliot, 1998; Urdan, 1997).

Most research in the achievement goal tradition has attended to two types of goals: performance goals (also labeled ego involvement or ability goals), which are focused on the demonstration of competence relative to others, and mastery goals (also labeled task-involvement or learning goals), which are focused on the development of competence and task mastery (Ames & Archer, 1987). Recently, Elliot and his colleagues (Elliot, 1997; Elliot & Church, 1997; Elliot & Harackiewicz, 1996) have proposed a trichotomous achievement goal framework that represents a revision of the performance–mastery dichotomy. In this framework, the performance goal construct is bifurcated into approach and avoidance forms of regulation, and three independent achievement goals are delineated: a performance-approach goal focused on the attainment of competence relative to others, a performance-avoidance goal focused on the avoidance of incompetence relative to others, and a mastery goal focused on the development of competence and task mastery. Each of these goals is hypothesized to lead to a unique pattern of achievement-relevant processes and outcomes.

One important group of achievement-relevant processes that has received significant attention in the achievement goal literature is the cognitive/metacognitive and motivational strategies that students use during studying and exam preparation (Nolen, 1996). The first aim of the present research was to examine university undergraduates' mastery, performance-approach, and performance-avoidance goals as predictors of their strategic approaches to studying. Within the cognitive/metacognitive domain, we focused on three variables validated by Entwistle and his colleagues in their factor-analytic work: *deep processing, surface processing,* and *disorganization* (Entwistle, 1988). Deep processing (also labeled elaboration or critical thinking; e.g., Weinstein & Mayer, 1986) involves challenging the veracity of information encountered and attempting to integrate new information with prior knowledge and experience, whereas surface processing (also labeled rehearsal or memorization; e.g., Zimmerman & Pons, 1986) involves the repetitive rehearsal and rote memorization of information (Entwistle & Ramsden, 1983). The deep–surface processing distinction is widely regarded in study strategy literature as having conceptual and predictive utility. Disorganization refers to the learner's difficulty in establishing or maintaining a structured, organized approach to studying (Entwistle, 1988). This variable has received little attention to date, although several researchers have acknowledged the importance of

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conceptually related constructs (e.g., organizing, Biggs, 1987; time and study environment management, Pintrich, Smith, Garcia, & McKeachie, 1993; planning, Pressley, Borkowski, & Schneider, 1987).

Within the motivational domain, we focused on two variables that represent central constructs in the achievement goal tradition: *persistence* and *effort* (Elliott & Dweck, 1988; Nicholls, 1984). In the context of studying, persistence (also labeled effort management or effort regulation; Pintrich, 1989; Pintrich et al., 1993) refers to a continued investment in learning when obstacles such as comprehension difficulty are encountered, and effort refers to the overall amount of effort expended in the process of studying (Zimmerman & Risemberg, 1997). Several researchers have made use of these or analogous variables in their work on achievement goals and approaches to studying (e.g., Miller, Behrens, Greene, & Newman, 1993; Pintrich, 1989; Wentzel, 1996).

The second aim of our research was to examine these cognitive/metacognitive and motivational study strategies as predictors of exam performance and, importantly, to investigate their potential role as mediational mechanisms. An implicit assumption guiding the work of achievement goal researchers is that study strategies are an important area of inquiry because they account for (i.e., mediate) the relationship between achievement goals and academic performance. This underlying assumption has rarely been examined empirically, and the present research was designed to address this oversight. In the following sections, we delineate our hypotheses regarding the two primary aims of our research and conclude with an overview of the studies that we conducted.

## Achievement Goals as Predictors of Study Strategies

Our hypotheses regarding the relationship between the three achievement goals of the trichotomous framework and the aforementioned study strategies were generated on the basis of the extant literature[1] and consideration of the motivational properties of each goal. Overall, research linking mastery goals to the focal study strategies has produced a relatively clear, consistent set of findings. Numerous studies have demonstrated that mastery goals are positive predictors of deep processing (Anderman, Griesinger, & Westerfield, 1998; Anderman & Young, 1994; Harackiewicz, Barron, Carter, Tauer, & Elliot, 1999; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Nolen, 1988; Nolen & Haladyna, 1990a; Pintrich & Garcia, 1991; Pintrich & Schrauben, 1992; Pintrich et al., 1993; Schraw, Horn, Thorndike-Christ, & Bruning, 1995). Mastery goals have also been shown to be positively related to both persistence (Bouffard, Boisvert, Vezeau, & Larouche, 1995; Miller et al., 1993, 1996; Pintrich, 1989; Pintrich & Schrauben, 1992; Pintrich et al., 1993) and effort (Mac Iver, Stipek, & Daniels, 1991; Meece & Holt, 1993; Miller et al., 1996; Wentzel, 1996). Only the results for surface processing have been mixed, with some studies yielding a positive relationship (Miller et al., 1996; Nolen, 1988; Nolen & Haladyna, 1990a; Pintrich, 1989; Schraw et al., 1995) and some yielding null results (Harackiewicz et al., 1998; Greene & Miller, 1996; Pintrich & Garcia, 1991; Pintrich et al., 1993). Research investigating the relationship between mastery goals and disorganization has yet to be conducted.

We construe mastery goals as fundamentally approach forms of motivation that are grounded in the need for achievement and focused on the possibility of task mastery (Elliot, 1997). As such, it is not surprising that mastery goals have been consistently validated as positive predictors of deep processing, persistence, and effort expenditure during studying, and we anticipated finding this same pattern of relationships in the present work. Generating hypotheses for surface processing and disorganization is not as straightforward. On one hand, mastery goals could be positive predictors of surface processing to the extent that such processing (e.g., memorizing key terms) is viewed as integral to the development of a comprehensive knowledge base. On the other hand, surface processing is often portrayed as a passive, extrinsic form of engagement, suggesting that it may be unrelated to mastery goals (Entwistle, 1990). In a similar fashion, mastery goals could be negative predictors of disorganization, if, as presumed by many theorists, they facilitate an indiscriminately positive, adaptive approach to learning. Alternatively, mastery goals may tend to (mis)lead the learner toward challenging or interesting, but peripheral, material (i.e., material irrelevant to the exam) and thus be positively related to disorganization (Elliot & Church, 1997). Given the equivocal guidelines from both empirical and conceptual considerations, we hypothesized that mastery goals would evidence a null relationship with surface processing and disorganization.

The performance goal measures used in the extant research have varied in composition, with some entirely composed of approach-based items and others composed of a mix of approach- and avoidance-based items. Studies examining the link between performance goals and deep/surface processing have yielded rather clear results, regardless of the type of measure used: Performance goals are consistently unrelated to deep processing but are positively related to surface processing (Greene & Miller, 1996; Harackiewicz et al., 1998; Miller et al., 1996; Nolen, 1988; Nolen & Haladyna, 1990a; Pintrich & Garcia, 1991; Pintrich et al., 1993; Schraw et al., 1995). No clear pattern of results has emerged from studies examining the relationship between performance goals and persistence (Bouffard et al.,

[1] An additional set of studies that were not included in the literature reviews in this section, nor in the section to follow, focus on omnibus indicators of study regulation and strategy use, some of which contain items relevant to the focal study strategies (e.g., Ablard & Lipschultz, 1998; Ames & Archer, 1988; Archer, 1994; Meece, Blumenfeld, & Hoyle, 1988; Meece & Jones, 1996; Nolen & Haladyna, 1990b; Pintrich, Roeser, & De Groot, 1994; Young, 1997; see Zimmerman & Risemberg, 1997). Most pertinent to the present research is a study by Middleton and Midgley (1997), in which they assessed each goal in the trichotomous achievement goal framework and computed concurrent correlations with students' reports of omnibus study strategy use. Results indicated that mastery goals were positively correlated with strategy use, whereas performance-approach and performance-avoidance goals were unrelated.

1995; Miller et al., 1993, 1996; Pintrich et al., 1993) or effort (Mac Iver et al., 1991; Miller et al., 1996; Wentzel, 1996). We believe the reason for this unclear pattern is that performance-approach and performance-avoidance goals are differential predictors of persistence and effort (as delineated below) but that these relationships are difficult to discern given the use of "mixed," omnibus performance goal measures in a large portion of the studies conducted. Data regarding the link between performance goals and disorganization are not yet available.

Conceptually, we view performance-approach goals as similar to mastery goals in that they are grounded in the need for achievement and focused on a positive possibility, but different from mastery goals in that they are focused on an extrinsic achievement outcome and can, at times, be linked to fear of failure (Elliot, 1997). Given their grounding in and focus on positive possibilities, performance-approach goals, like mastery goals, were hypothesized to be positive predictors of persistent and effortful study behavior. The inherently instrumental nature of performance-approach goals led us to anticipate a positive relationship with surface processing and a null relationship with deep processing. As was the case for mastery goals, generating a hypothesis for disorganization is not as straightforward. On one hand, performance-approach goals might impel efforts to devise and maintain a highly structured study regimen channeled toward test-worthy material and thus might be negatively related to disorganization. On the other hand, these goals might simply engender shallow study efforts with little planning or overarching structure and thus might be positively related to disorganization. Given the equivocal guidelines from both empirical and conceptual considerations, we predicted that performance-approach goals would evidence a null relationship with disorganization.

Performance-avoidance goals are construed as fundamentally avoidance forms of motivation that are grounded in fear of failure and focused on the possibility of a negative outcome (Elliot, 1997). In orienting toward and regulating according to negative possibilities, performance-avoidance goals are likely to evoke self-protective concerns that preclude rigorous persistence and full effort expenditure during the study process (Covington, 1984; Jagacinski & Nicholls, 1990). Thus, these goals are posited to be negatively related or, at minimum, unrelated to persistence and effort. Like performance-approach goals, performance-avoidance goals are inherently instrumental in nature, a fact that led us to predict a positive relationship with surface processing and a null relationship with deep processing. Performance-avoidance goals were predicted to be positively related to disorganization, as the threat appraisals and anxiety they engender encourage procrastination and interfere with attempts to engage in structured, focused study behavior (Rothblum, 1990).

## Study Strategies as Predictors of Academic Performance and Testing Mediation

The second aim of the present research was to examine the relationship between the focal study strategies and exam performance and to test whether these variables mediate the direct relationship between achievement goals and performance. The extant data are somewhat mixed for the relationship between deep and surface processing and performance but tend to show a positive relationship for deep processing and null results for surface processing (Entwistle & Ramsden, 1983; Graham & Golan, 1991; Greene & Miller, 1996; Miller et al., 1996; Pintrich & Garcia, 1991; Pintrich, Smith, Garcia, & McKeachie, 1992; Pintrich et al., 1993). The data clearly document persistence and effort as positive predictors of performance outcomes (Bouffard et al., 1995; Meece & Holt, 1993; Miller et al., 1996; Pintrich, 1989; Pintrich et al., 1992, 1993; Pokay & Blumenfeld, 1990; Wentzel, 1996). Disorganization has evidenced a negative relationship with performance in the little research that has been conducted (Entwistle & Ramsden, 1983). In accord with these empirical patterns, we predicted that deep processing, persistence, and effort would be positively related and that disorganization would be negatively related to exam performance, whereas surface processing would be unrelated. An important question, largely overlooked in the extant research (for exceptions, see Pokay & Blumenfeld, 1990; Wentzel, 1996), is the extent to which the empirical patterns observed are independent of objective indicators of ability (e.g., prior grades, standardized test scores). The hypothesized relationships were tested with and without controlling for ability in the present research.

To date, there has been no research in the achievement goal literature that validates a focal study strategy variable as mediator of a direct relationship between achievement goals and academic performance (see Greene & Miller, 1996, and Stipek & Gralinski, 1996, for validation of indirect mediational models). Prior research on the trichotomous framework has revealed that performance-approach goals are positively related and performance-avoidance goals are negatively related to exam performance (Elliot & Church, 1997; Elliot & McGregor, 1999; see also Skaalvik, 1997). We expected this set of findings to be replicated in the present research and sought to test whether the focal study strategies would mediate either or both of these direct relationships. Such mediation would require, at minimum, that an achievement goal variable predict a study strategy variable and that a study strategy variable, in turn, predict exam performance. In light of the hypotheses presented in this and the previous section, the following possibilities were all considered plausible: (a) Persistence, effort, and disorganization (alone or in any combination) would mediate the relationship between performance-approach goals and exam performance, and (b) persistence, effort, disorganization, and deep processing (alone or in any combination) would mediate the relationship between performance-avoidance goals and performance.

## Overview of the Present Studies

We conducted two studies to test the aforementioned hypotheses in the context of the normatively graded college classroom. In Study 1, participants reported their mastery, performance-approach, and performance-avoidance goals

for an upcoming exam, and the influence of these goals (controlling for prior grade point average [GPA]) on students' exam performance, and self-reported deep processing, surface processing, and disorganization was investigated. The impact of the study strategies on exam performance was also examined, and their role as mediators of the direct relationship between achievement goals and exam performance was tested. In Study 2, the three achievement goals in the trichotomous framework were assessed with respect to the class in general, and the influence of these goals on students' exam performance, deep processing, surface processing, disorganization, persistence, and effort was investigated (controlling for scores on the Scholastic Aptitude Test score [SAT]). As in Study 1, the impact of the study strategies on exam performance was also investigated, and their role as mediators of the direct relationship between achievement goals and exam performance was tested. Figure 1 represents a summary of the general mediational model tested in the present research.

## Study 1

### *Method*

### *Participants, Context, and Procedure*

One hundred sixty-four (56 male and 108 female) undergraduates who were enrolled in an introductory level psychology course at a northeastern university participated in the study in return for extra credit. The mean age of participants was 19.96 years old with a range of 17 to 40. The class was conducted entirely in lecture format, and students were informed at the beginning of the course that grades would be assigned on a statistical curve that was based on the overall distribution of scores.

Two weeks before their midterm exam, participants completed an exam-specific achievement goals questionnaire in a group session immediately prior to class. One week before the exam, participants were provided with a questionnaire regarding their approaches to studying and were instructed to complete the questionnaire when they had finished a majority of their preparations for the exam. Participants returned the completed questionnaire on the day of the exam. Students' exam scores were obtained from the professor of the course, and students' GPA information was obtained from the university registrar.

### *Measures*

*Achievement goals.* The achievement goals questionnaire devised by Elliot and Church (1997) was used to assess participants' achievement goals for the exam. This questionnaire is composed of six items for each of the three achievement goals in the trichotomous framework: (a) mastery goals (sample item: "I desire to completely master the material presented in this section of the class"), (b) performance-approach goals (sample item: "I am striving to demonstrate my ability relative to others [on this exam]"), and (c) performance-avoidance goals (sample item: "I just want to avoid doing poorly [on this exam]"). Several studies have provided evidence for the reliability, construct validity, and predictive validity of these measures (Elliot, in press; Elliot & Church, 1997; Elliot & McGregor, 1999). In completing the questionnaire, participants indicated their response to each item on a 1 (*not at all true of me*) to 7 (*very true of me*) scale. Their responses for each goal were averaged to form the mastery, performance-approach, and performance-avoidance goal indexes.

*Cognitive/metacognitive study strategies.* A series of pilot studies was conducted to derive the final measures of deep processing, surface processing, and disorganization. The initial item pool consisted of revised items from existing measures (Entwistle, 1988; Nolen, 1988; Pintrich et al., 1992; Weinstein, Schulte, & Palmer, 1987), as well as novel items generated for the present research. In the final pilot study, five items were used for each variable, and a principal-components factor analysis with varimax rotation yielded a three-factor solution with each item loading on its designated factor. These five-item scales (see Appendix) were used in the present studies. Participants indicated their response to each item on a 1 (*not at all true of me*) to 7 (*very true of me*) scale.

The Study 1 data were submitted to a principal-components factor analysis with varimax rotation. This analysis supported the presence of the three hypothesized factors; each item loaded on its designated factor, with the exception of one surface-processing and one deep-processing item that separated onto their own factor. The three primary factors—disorganization (eigenvalue = 3.31), deep processing (eigenvalue = 2.62), and surface processing (eigenvalue = 2.10)—accounted for 55% of the total variance. The fourth factor essentially had an eigenvalue of unity (1.03) and accounted for 7% of the total variance. (In contrast to the Eigenvalue 1 method of extraction, the scree test indicated three factors, and when the data were reanalyzed on this basis, each of the items indeed loaded on its designated factor.) The Study 1 results for deep and surface processing were the same whether the items from this fourth factor were included or excluded from the indexes; the items were retained in the analyses reported below.

*Exam performance.* Participants were given as much time as they needed to complete the exam. The exam was composed of multiple-choice, short answer, and essay questions worth a total of 100 points. Participants' correct responses were summed to form the exam performance index.

*GPA.* Participants' cumulative GPA (up to the current semester) was used as the indicator of GPA.

### *Results*

### *Direct Relationships*

Two types of multiple regression analysis were used in examining the hypothesized direct relationships. First, we used a basic regression model composed of mastery goals, performance-approach goals, performance-avoidance goals, and GPA to test the three achievement goals as simultaneous predictors of exam performance and study strategies, while controlling for the influence of prior GPA. Second, a stepwise regression procedure was used to test each study

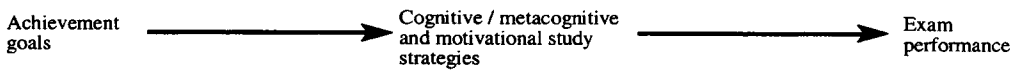


*Figure 1.* The general mediational model examined in the present research.

strategy as a predictor of exam performance, both alone (Step 1, analogous to a zero-order correlation) and controlling for the influence of prior GPA (Step 2). In both types of regression procedures, the main effect of gender was also tested in preliminary analyses and was retained in final analyses when significant. All possible interactions involving the independent measures were also tested in preliminary analyses; given the lack of hypotheses involving interactions, the fact that few interactions attained significance, and the fact that no interactions proved reliable across the two studies, these results are not reported in the text. All of the significant results reported in the text (for Study 1 and Study 2) remained significant when controlling for the interactions that did attain significance. Descriptive statistics, reliabilities, and zero-order correlations for the primary study variables are presented in Table 1.

*Achievement goals to exam performance.* The regression of exam performance on the basic model (adjusted $R^2 = .51$, $p < .0001$) yielded significant relationships for performance-approach and performance-avoidance goals but not for mastery goals. Performance-approach goals were positively related to exam performance, $F(1, 158) = 6.91$, $p < .01$ ($\beta = .15$), whereas performance-avoidance goals were negatively related, $F(1, 158) = 6.20$, $p < .05$ ($\beta = -.15$). GPA was also a significant predictor of exam performance, $F(1, 158) = 122.79$, $p < .0001$ ($\beta = .64$).

*Achievement goals to study strategies.* The regression of deep processing on the basic model (adjusted $R^2 = .23$, $p < .0001$) revealed significant relationships for mastery and performance-avoidance goals. Mastery goals were positively related to deep processing, $F(1, 157) = 23.96$, $p < .0001$ ($\beta = .36$), whereas performance-avoidance goals were negatively related, $F(1, 157) = 11.49$, $p < .001$ ($\beta = -.25$). Performance-approach goals and GPA were not significant predictors. Regressing surface processing on the basic model (adjusted $R^2 = .08$, $p < .005$) yielded a significant positive relationship for performance-avoidance goals, $F(1, 157) = 11.31$, $p < .005$ ($\beta = .27$). Mastery goals, performance-approach goals, and GPA were all unrelated to surface processing. The regression of disorganization on the basic model (adjusted $R^2 = .21$, $p < .0001$) revealed a significant positive relationship for performance-avoidance goals, $F(1, 157) = 6.91$, $p < .01$ ($\beta = .20$). GPA was a significant negative predictor of disorganization, $F(1, 157) = 21.87$, $p < .0001$ ($\beta = -.34$); mastery and performance-approach goals were not significant predictors (see Table 2 for a summary of the above results).

*Study strategies to exam performance.* Regressing exam performance on each of the study strategies (Step 1 of the regression procedure) revealed a significant positive relationship for deep processing, $F(1, 159) = 4.61$, $p < .05$ ($\beta = .17$), and a significant negative relationship for disorganization, $F(1, 159) = 28.29$, $p < .0001$ ($\beta = -.39$). Surface processing was unrelated to exam performance. These relationships remained the same for surface processing and disorganization when GPA was added to the equation (Step 2); the relationship between deep processing and exam performance became nonsignificant ($\beta = .03$).

Table 1
*Study 1: Descriptive Statistics and Intercorrelations Among the Primary Variables*

| Variable | *n* | *M* | *SD* | Observed range | Reliability | Variable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Mastery goals | 164 | 5.14 | 0.85 | 3.00–7.00 | .83 | — | | | | | | | | |
| 2. Performance-approach goals | 164 | 3.98 | 1.59 | 1.00–7.00 | .97 | .26* | — | | | | | | | |
| 3. Performance-avoidance goals | 164 | 3.99 | 1.25 | 1.33–6.33 | .80 | −.14* | .14* | — | | | | | | |
| 4. GPA | 164 | 3.03 | 0.55 | 1.33–3.98 | | .17* | .14* | −.22** | — | | | | | |
| 5. Deep processing | 162 | 4.25 | 1.06 | 1.40–6.80 | .74 | .38** | −.05 | −.34** | .21** | — | | | | |
| 6. Surface processing | 162 | 4.59 | 1.00 | 1.20–6.80 | .66 | .12 | .17* | .24** | .08 | .03 | — | | | |
| 7. Disorganization | 162 | 3.33 | 1.26 | 1.00–7.00 | .84 | −.19** | .05 | .30** | −.39** | −.19** | .00 | — | | |
| 8. Exam performance | 163 | 63.04 | 20.15 | 18.00–100.00 | | .17* | .23** | −.27** | .70** | .17* | .15 | −.39** | — | |
| 9. Gender | | | | | | .05 | −.18** | .05 | .08 | −.08 | .07 | .14* | −.04 | — |

*Note.* GPA = grade point average.
*$p < .05$. **$p < .01$.

Table 2
*Study 1: Achievement Goals and GPA as Predictors of Exam Performance and Study Strategies*

| Achievement goal | Exam performance | Deep processing | Surface processing | Disorganization |
|---|---|---|---|---|
| Mastery | .01 | .36** | .12 | −.14 |
| Performance-approach | .15* | −.13 | .08 | .10 |
| Performance-avoidance | −.15* | −.25** | .27** | .20** |
| GPA | .64** | .12 | .11 | −.34** |

*Note.* Tabled values are standardized regression coefficients from analyses using the basic regression model (comprising mastery goals, performance-approach goals, performance-avoidance goals, and GPA). GPA = grade point average.
*$p < .05$. **$p < .01$.



### *Mediational Analyses*

Three requirements must be satisfied to empirically validate mediation of a direct relationship (see Judd & Kenny, 1981). First, for mediation to be a relevant issue, a relationship between the predictor variable and the outcome measure must be established. Second, to document the first link in the mediational chain, a relationship between the predictor variable and the hypothesized mediator must be established. Third, to document the second link, a relationship between the mediator variable and the outcome measure must be established while controlling for the predictor variable, and the relationship between the predictor variable and the outcome measure should be reduced.

The preceding analyses satisfied the first and second requirements for mediation, because a direct relationship was established between two predictor variables (performance-approach and performance-avoidance goals) and exam performance, and these predictor variables were shown to be related to several potential mediator variables. To test the third requirement for mediation, a series of analyses was conducted in which exam performance was regressed on the basic model with one of the potential mediator variables also in the equation. Whenever mediation was documented in these analyses, a supplementary structural equation modeling (SEM) analysis was also conducted to examine the fit of the mediational model to the observed data. In these analyses, the correlation matrix was used as input, and LISREL 8 (Jöreskog & Sörbom, 1993) generated a solution based on maximum likelihood estimation. Each variable in the equations was represented by a single observed indicator; to account for random measurement error, the unique variance of each indicator was set at one minus its reliability (Bollen, 1989). In models with multiple mediators, the relationships between correlated mediators were allowed to freely vary. In accord with Hoyle and Panter's (1995) recommendation, both absolute fit indexes (chi square, comparative fit index [CFI], incremental fit index [IFI], goodness-of-fit index [GFI], adjusted goodness-of-fit index [AGFI]) and incremental fit indexes were used to evaluate the fit of the model to the data.

When deep processing and surface processing were tested as mediators, neither variable evidenced a significant relationship with exam performance, indicating that neither deep nor surface processing mediated the direct relationships observed. Testing disorganization as a mediator, on the other hand, revealed a significant negative relationship between disorganization and exam performance, $F(1, 155) = 4.67$, $p < .05$ ($\beta = -.14$). GPA was also a significant predictor of performance in this analysis, $F(1, 155) = 88.91$, $p < .0001$ ($\beta = .58$). The direct relationship between performance-avoidance goals and exam performance was no longer significant with disorganization in the equation, and the beta coefficient for this relationship dropped from −.15 to −.11. The direct relationship between performance-approach goals and exam performance, on the other hand, remained significant (the beta moved from .15 to .16). These results indicate that disorganization mediated the relationship between performance-avoidance goals and exam performance but did not mediate the relationship between performance-approach goals and performance (adjusted $R^2 = .50$, $p < .0001$ for the overall model). Furthermore, the SEM analysis demonstrated that the disorganization mediational model provided a satisfactory fit to the data; $\chi^2(4, N = 161) = 8.15$, $p > .05$; GFI = .98; AGFI = .91; CFI = .98; IFI = .98. A summary of the mediational results is presented in Figure 2.

### *Discussion*

The results of this study are highly consistent with our hypotheses. Performance-approach goals were positively related to exam performance, performance-avoidance goals were negatively related to exam performance, and mastery goals were unrelated to exam performance. Mastery goals were positively related to deep processing and unrelated to surface processing and disorganization. Performance-approach goals were not significantly related to any study strategies; the null relationship for surface processing was the only case in which our hypotheses were supported by the data. Performance-avoidance goals were positively related to surface processing and disorganization and unrelated to deep processing. At the zero-order level, deep processing was positively related, disorganization negatively related, and surface processing unrelated to exam performance. For surface processing and disorganization, these relationships remained the same when GPA was controlled; for deep processing, controlling for GPA eliminated its positive relationship with performance. Disorganization was validated as a media-

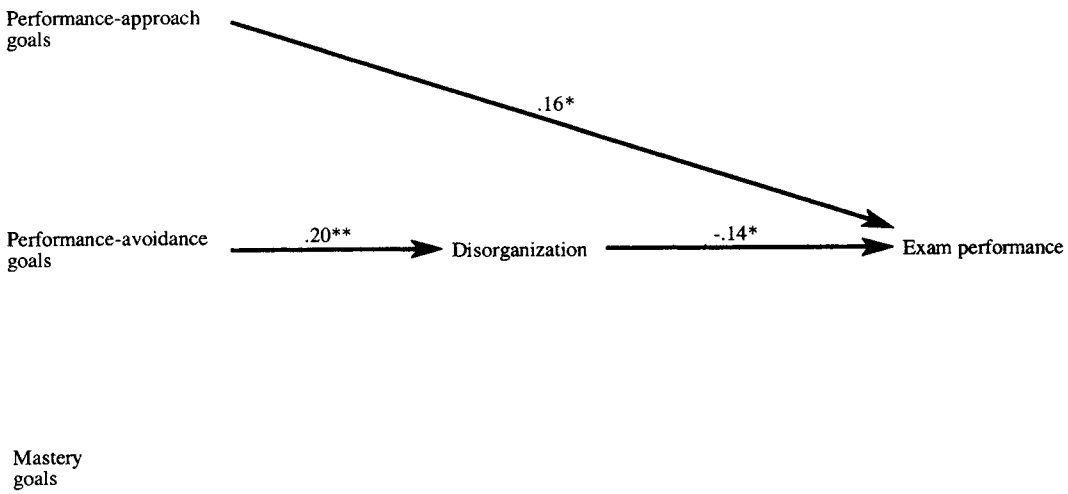


*Figure 2.* The mediational results documented in Study 1. Path values are standardized regression coefficients, and only the theoretically central variables are included in the diagram for presentation clarity. $*p < .05$. $**p < .01$.



tor of the relationship between performance-avoidance goals and exam performance.

Study 2 represents an attempt to conceptually replicate and extend Study 1. The procedure for Study 2 was essentially the same as that used in Study 1 with the exception that participants reported their class-general rather than exam-specific achievement goals, and participants' SAT scores, rather than their prior GPAs, were used as an objective indicator of ability. If the same pattern of results obtained in Study 1 could be obtained in Study 2, it would nicely attest to the robustness of the findings across achievement tasks and control variables. In Study 2, we also investigated self-reported persistence and effort as study strategies, as well as self-reported deep processing, surface processing, and disorganization. The inclusion of effort and persistence broadened our consideration of study strategies to include motivational variables, as well as cognitive/metacognitive variables, and opened new possibilities for documenting mediation. Although mediation of the relationship between performance-avoidance goals and exam performance was demonstrated in Study 1, a parallel mediational process for performance-approach goals was not observed. Many achievement motivation theorists view persistence and effort as important predictors of achievement outcomes (Dweck, 1986; Feather, 1961; Heckhausen, 1991; Lewin, 1935; Weiner, 1965), and we construe these variables as promising candidates for mediation of the relationship between performance-approach goals and exam performance.

## Study 2

### *Method*

#### *Participants, Context, and Procedure*

One hundred seventy-nine (68 male and 111 female) undergraduates who were enrolled in an introductory level psychology course at a northeastern university participated in the study in return for extra credit.[2] The mean age of participants was 19.81 years old with a range of 17 to 35. As in Study 1, the class was conducted entirely in lecture format, and students were informed at the beginning of the course that evaluation would be based on a normative grading structure.

Two weeks before their first exam, participants completed a class-general achievement goals questionnaire in a group session immediately prior to class. One week before the exam, participants were provided with a questionnaire regarding their approaches to studying and were instructed to complete the questionnaire when they had finished a majority of their preparations for the exam. Participants returned the completed questionnaire on the day of the exam. Immediately following the exam, participants completed items regarding their effort in preparing for the exam. Students' exam scores were obtained from the professor of the course, and students' SAT scores were obtained from the university registrar.

#### *Measures*

*Achievement goals.* Elliot's (in press) slightly modified version of Elliot and Church's (1997) achievement goal questionnaire (one item in the Performance-avoidance goal scale has been replaced; see Elliot, in press; Elliot & McGregor, 1999) was used to assess mastery, performance-approach, and performance-avoidance goals; in this study, participants indicated their goals for the course in general.

*Cognitive/metacognitive study strategies.* The same measures used in Study 1 to assess deep processing, surface processing, and disorganization were used in Study 2. A principal-components factor analysis with varimax rotation was performed on the Study 2 data, and this analysis yielded the three hypothesized factors with each item loading on its designated factor. The three factors—

[2] This study was part of a larger investigation of achievement motivation and related processes and outcomes. A very small portion of these data, specifically, the SAT score and exam performance variables, was used in Elliot and McGregor (1999, Study 2).

disorganization (eigenvalue = 4.26), deep processing (eigenvalue = 2.65), and surface processing (eigenvalue = 1.90)—accounted for 59% of the total variance.

*Persistence and effort.* A series of pilot studies was conducted to derive the final measures of persistence and effort. In the final pilot study, four items were used for the persistence variable, and two items were used for the effort variable; a principal-components factor analysis with varimax rotation yielded a two-factor solution with each item loading on its designated factor. These four- and two-item scales (see Appendix) were used in Study 2. Participants indicated their responses on a 1 (*not at all true of me*) to 7 (*very true of me*) scale for the persistence items and a 1 (*strongly disagree*) to 7 (*strongly agree*) scale for the effort items. A principal-components factor analysis with varimax rotation was performed on the Study 2 data, and this analysis yielded the two hypothesized factors with each item loading on its designated factor. The two factors—persistence (eigenvalue = 3.15) and effort (eigenvalue = 1.23)—accounted for 73% of the total variance.

*Exam performance.* Participants were given as much time as they needed to complete the exam, and the same exam performance index used in Study 1 was used in Study 2.

*SAT score.* Participants' scores on the verbal and math components of the SAT were combined to form a total SAT score index.

## Results

### Direct Relationships

The same data-analytic approach used in Study 1 was used to analyze the data from Study 2; the basic model was composed of mastery goals, performance-approach goals, performance-avoidance goals, and SAT scores. Descriptive statistics, reliabilities, and zero-order correlations for the primary study variables are presented in Table 3.

*Achievement goals to exam performance.* The regression of exam performance on the basic model (adjusted $R^2 = .15$, $p < .0001$) yielded significant relationships for performance-approach and performance-avoidance goals but not mastery goals. Performance-approach goals were positively related to exam performance, $F(1, 174) = 5.38$, $p < .05$ ($\beta = .17$), whereas performance-avoidance goals were negatively related, $F(1, 174) = 12.17$, $p < .001$ ($\beta = -.28$). SAT score was also a positive predictor of exam performance, $F(1, 174) = 8.77$, $p < .005$ ($\beta = .22$).

*Achievement goals to study strategies.* The regression of deep processing on the basic model (adjusted $R^2 = .25$, $p < .0001$) revealed significant relationships for mastery and performance-avoidance goals. Mastery goals were positively related to deep processing, $F(1, 168) = 41.85$, $p < .0001$ ($\beta = .45$), whereas performance-avoidance goals were negatively related, $F(1, 168) = 4.68$, $p < .05$ ($\beta = -.17$). Gender was also a significant predictor, $F(1, 168) = 5.90$, $p < .05$ ($\beta = -.17$); men engaged in more deep processing than women. Performance-approach goals and SAT score were unrelated to deep processing. Regressing surface processing on the basic model (adjusted $R^2 = .10$, $p < .0005$) yielded significant relationships for performance-approach and performance-avoidance goals. Performance-approach goals were positively related to surface processing, $F(1, 169) = 6.54$, $p < .05$ ($\beta = .20$), as were performance-avoidance goals, $F(1, 169) = 6.64$, $p < .05$ ($\beta = .21$). Mastery goals and SAT score were unrelated to surface

Table 3
*Study 2: Descriptive Statistics and Intercorrelations Among the Primary Variables*

| Variable | *n* | *M* | *SD* | Observed range | Reliability | Variable 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mastery goals | 179 | 5.64 | 0.87 | 2.50–7.00 | .87 | — | | | | | | | | | | |
| 2. Performance-approach goals | 179 | 4.21 | 1.44 | 1.00–7.00 | .91 | .10 | — | | | | | | | | | |
| 3. Performance-avoidance goals | 179 | 3.66 | 1.23 | 1.00–7.00 | .81 | −.12 | .33** | — | | | | | | | | |
| 4. SAT score | 179 | 1,194.25 | 149.68 | 500.00–1,530.00 | | −.10 | −.04 | −.33** | — | | | | | | | |
| 5. Deep processing | 174 | 4.30 | 1.10 | 1.60–7.00 | .79 | .43** | −.10 | −.28** | .11 | — | | | | | | |
| 6. Surface processing | 174 | 4.69 | 1.03 | 1.60–7.00 | .70 | −.11 | .26** | .29** | −.05 | −.22** | — | | | | | |
| 7. Disorganization | 174 | 3.30 | 1.45 | 1.00–7.00 | .89 | −.09 | .13* | .46** | −.04 | −.29** | .04 | — | | | | |
| 8. Persistence | 174 | 5.15 | 0.98 | 1.75–7.00 | .78 | .29** | .19** | −.07 | −.02 | .28** | .27** | −.35** | — | | | |
| 9. Effort | 178 | 4.65 | 1.46 | 1.00–7.00 | .93 | .28** | .19** | .01 | −.13* | .08 | .15* | −.20** | .45** | — | | |
| 10. Exam performance | 179 | 64.03 | 17.33 | 20.00–95.00 | | .11 | .08 | −.30** | .30** | .17* | .05 | −.36** | .38** | .27** | — | |
| 11. Gender | | | | | | .19** | .05 | .09 | −.16* | −.11 | −.02 | .13* | .05 | .12 | −.06 | — |

*Note.* SAT = Scholastic Aptitude Test.
*$p < .05$. **$p < .01$.

processing. Regressing disorganization on the basic model (adjusted $R^2 = .21$, $p < .0001$) revealed a significant positive relationship for performance-avoidance goals, $F(1, 169) = 43.15$, $p < .0001$ ($\beta = .51$), and null results for mastery goals, performance-approach goals, and SAT score.

The regression of persistence on the basic model (adjusted $R^2 = .11$, $p < .0001$) revealed significant relationships for mastery and performance-approach goals. Mastery goals were positively related to persistence, $F(1, 169) = 12.15$, $p < .001$ ($\beta = .26$), as were performance-approach goals, $F(1, 169) = 7.69$, $p < .01$ ($\beta = .21$). Performance-avoidance goals and SAT score were unrelated to persistence. Regressing effort on the basic model (adjusted $R^2 = .22$, $p < .0001$) also yielded significant relationships for mastery and performance-approach goals. Both mastery goals, $F(1, 173) = 10.93$, $p < .005$ ($\beta = .24$), and performance-approach goals, $F(1, 173) = 5.26$, $p < .05$ ($\beta = .18$), were positively related to effort. Performance-avoidance goals and SAT score were not significant predictors (see Table 4 for a summary of the above results).

*Study strategies to exam performance.* Regressing exam performance on each of the study strategies in Step 1 of the regression procedure revealed significant positive relationships for deep processing, $F(1, 172) = 4.94$, $p < .05$ ($\beta = .17$); persistence, $F(1, 172) = 29.67$, $p < .0001$ ($\beta = .38$); and effort, $F(1, 172) = 14.05$, $p < .0005$ ($\beta = .27$); and revealed a significant negative relationship for disorganization, $F(1, 172) = 25.59$, $p < .0001$ ($\beta = -.36$). Surface processing was unrelated to exam performance. These relationships remained the same for surface processing, persistence, effort, and disorganization when SAT score was added to the equation in Step 2, whereas the relationship between deep processing and exam performance became nonsignificant ($\beta = .14$).

## *Mediational Analyses*

The preceding analyses satisfied the first and second requirements for mediation. Specifically, performance-approach and performance-avoidance goals were shown to be directly related to exam performance, and these variables were shown to predict several of the potential mediational variables. As in Study 1, the third requirement for mediation was tested with a series of analyses in which exam performance was regressed on the basic model with one of the potential mediator variables also in the equation.

Table 5
*Study 2: Goodness-of-Fit Indexes for the Mediational Models*

| Mediational model | $\chi^2$ | *df* | GFI | AGFI | CFI | IFI |
|---|---|---|---|---|---|---|
| Disorganization | 8.66 | 5 | .98 | .93 | .97 | .97 |
| Persistence | 4.48 | 4 | .99 | .93 | 1.00 | 1.00 |
| Effort | 6.10 | 4 | .99 | .94 | .98 | .98 |
| Joint | 13.35 | 10 | .98 | .93 | .99 | .99 |

*Note.* GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; CFI = comparative fit index; IFI = incremental fit index.

When deep processing and surface processing were tested as mediators, neither variable was a significant predictor of exam performance. Therefore, as in Study 1, neither deep processing nor surface processing mediated the direct relationships observed. Also replicating Study 1, testing disorganization as a mediator variable revealed a significant negative relationship between disorganization and exam performance, $F(1, 168) = 15.63$, $p < .0005$ ($\beta = -.30$). SAT score was also a significant predictor of performance in this analysis, $F(1, 168) = 13.05$, $p < .0005$ ($\beta = .26$). The direct relationship between performance-avoidance goals and exam performance was no longer significant with disorganization in the equation, and the beta coefficient for this relationship dropped from $-.28$ to $-.13$. The direct relationship between performance-approach goals and exam performance, on the other hand, remained significant (the beta moved from .17 to .14). These results indicate that disorganization mediated the relationship between performance-avoidance goals and performance but did not mediate the relationship between performance-approach goals and exam performance (adjusted $R^2 = .23$, $p < .0001$ for the overall model). Furthermore, the SEM analysis demonstrated that the disorganization mediational model provided a satisfactory fit to the data (see Table 5 for fit statistics).

Testing persistence as a mediator variable revealed that persistence was a positive predictor of exam performance, $F(1, 168) = 26.77$, $p < .0001$ ($\beta = .36$). SAT score was also a significant predictor of performance in this analysis, $F(1, 168) = 11.49$, $p < .001$ ($\beta = .23$). The direct relationship between performance-approach goals and exam perfor-

Table 4
*Study 2: Achievement Goals and SAT as Predictors of Exam Performance and Study Strategies*

| Achievement goal | Exam performance | Deep processing | Surface processing | Disorganization | Persistence | Effort |
|---|---|---|---|---|---|---|
| Mastery | .08 | .45** | −.09 | −.01 | .26** | .24** |
| Performance-approach | .17* | −.07 | .20* | −.03 | .21** | .18* |
| Performance-avoidance | −.28** | −.17* | .21* | .51** | −.12 | −.07 |
| SAT score | .22** | .06 | .02 | .13 | −.04 | −.12 |

*Note.* Tabled values are standardized regression coefficients from analyses using the basic regression model (comprising mastery goals, performance-approach goals, performance-avoidance goals, and SAT score). SAT = Scholastic Aptitude Test.
*$p < .05$. **$p < .01$.

mance was no longer significant with persistence in the equation, and the beta coefficient for this relationship dropped from .17 to .08. The direct relationship between performance-avoidance goals and exam performance, on the other hand, remained significant (the beta moved from −.28 to −.24). These results indicate that persistence mediated the relationship between performance-approach goals and exam performance but did not mediate the relationship between performance-avoidance goals and performance (adjusted $R^2 = .27, p < .0001$ for the overall model). Furthermore, the SEM analysis demonstrated that the persistence mediational model provided a satisfactory fit to the data (see Table 5 for fit statistics).

The results for effort were similar to those for persistence. The effort mediational model revealed that effort was a positive predictor of exam performance, $F(1, 172) = 15.85$, $p < .0005$ ($\beta = .28$). SAT score was also a significant predictor of performance in this analysis, $F(1, 172) = 12.36$, $p < .001$ ($\beta = .25$). The direct relationship between performance-approach goals and exam performance was no longer significant with effort in the equation, and the beta coefficient for this relationship dropped from .17 to .12. The direct relationship between performance-avoidance goals and exam performance, on the other hand, remained significant (the beta moved from −.28 to −.26). These results indicate that effort mediated the relationship between performance-approach goals and exam performance but did not mediate the relationship between performance-avoidance goals and performance (adjusted $R^2 = .22$, $p < .0001$ for the overall model). The SEM analysis demonstrated that the effort mediational model provided a satisfactory fit to the data (see Table 5 for fit statistics).

In a final mediational analysis, all three of the mediators validated in the preceding analyses were tested simultaneously. Each of the three variables remained significant predictors of exam performance in this analysis. Disorganization was a negative predictor, $F(1, 165) = 5.02$, $p < .05$ ($\beta = -.17$), whereas both persistence, $F(1, 165) = 9.46$, $p < .005$ ($\beta = .24$), and effort, $F(1, 165) = 4.62$, $p < .05$ ($\beta = .16$), were positive predictors. SAT score was also a positive predictor of performance, $F(1, 165) = 15.50$, $p < .0005$ ($\beta = .27$). The direct relationship between performance-approach goals and exam performance was no longer significant in this analysis, and the beta coefficient for this relationship dropped from .17 to .07. Likewise, the direct relationship between performance-avoidance goals and performance was no longer significant, and the beta coefficient for this relationship dropped from −.28 to −.15. These results indicate that disorganization, persistence, and effort served the role of joint mediational variables (adjusted $R^2 = .30$, $p < .0001$ for the overall model). The SEM analysis demonstrated that this joint mediational model provided a satisfactory fit to the data (see Table 5 for fit statistics). A summary of the joint mediational results is presented in Figure 3.

## *Discussion*

The results of Study 2 replicated and extended those of Study 1. Performance-approach goals were positively related and performance-avoidance goals negatively related to exam performance, whereas mastery goals were unrelated. Mastery goals were positively related to deep processing, persistence, and effort and unrelated to surface processing and disorganization. Performance-approach goals were positively related to surface processing, persistence, and effort

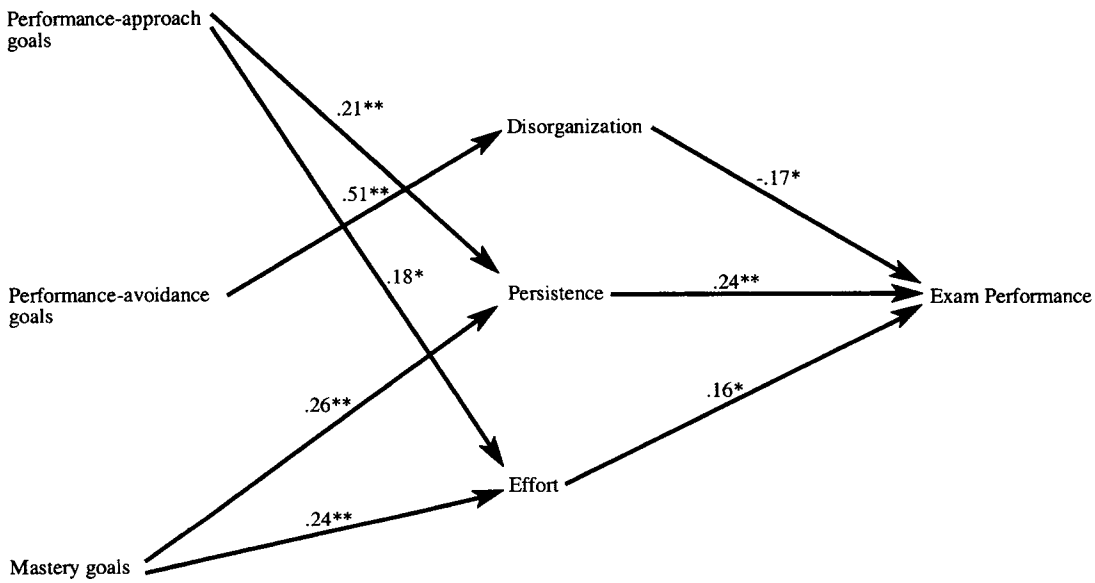


*Figure 3.* The mediational results documented in Study 2. Path values are standardized regression coefficients, and only the theoretically central variables are included in the diagram for presentation clarity. *$p < .05$. **$p < .01$.

and unrelated to deep processing and disorganization. (Although the relationship with surface processing was not significant in Study 1, using the Stouffer method to combine the results across the two studies indeed yielded a significant positive relationship, $z = 2.47$, $p < .015$.) Performance-avoidance goals were positively related to surface processing and disorganization, negatively related to deep processing, and unrelated to persistence and effort. At the zero-order level, deep processing, persistence, and effort were positively related, disorganization was negatively related, and surface processing was unrelated to exam performance. Each of these relationships remained significant when controlling for SAT score with the exception of the deep processing to performance link that became nonsignificant. Disorganization, persistence, and effort were validated as joint mediational variables; persistence and effort mediated the relationship between performance-approach goals and exam performance, whereas disorganization mediated the relationship between performance-avoidance goals and performance.

## General Discussion

In the present research, two studies were conducted to investigate mastery, performance-approach, and performance-avoidance achievement goals as predictors of self-reported cognitive/metacognitive and motivational study strategies and to test these study strategies as mediators of the relationship between achievement goals and exam performance. The results from the two studies were highly consistent with each other and with hypotheses generated from the trichotomous achievement goal framework. Each of the three achievement goals displayed a unique predictive profile. Mastery goals were positive predictors of deep processing, persistence, and effort; performance-approach goals were positive predictors of surface processing, persistence, effort, and exam performance; and performance-avoidance goals were positive predictors of surface processing and disorganization and negative predictors of deep processing and exam performance. Persistence and effort were shown to be positive predictors, and disorganization was shown to be a negative predictor of exam performance. More important, these three variables were validated as joint mediators of the achievement goal to exam performance relationship. Persistence and effort mediated the relationship between performance-approach goals and exam performance, whereas disorganization mediated the relationship between performance-avoidance goals and performance. The above relationships were demonstrated with both exam-specific (Study 1) and class-general (Study 2) achievement goals and controlling for two different objective indicators of ability—prior GPA (Study 1) and SAT score (Study 2).

These results clearly attest to the importance of bifurcating performance goals into approach and avoidance forms of regulation. Performance-approach and performance-avoidance goals yielded differential results on all but one dependent measure (surface processing), and collapsing across the two types of goals (analogous to using a "mixed" performance goal measure) would undoubtedly have produced an ambiguous pattern of results, rather than the informative pattern that we obtained. The literature generated by the dichotomous achievement goal framework indicates that mastery goals are, in general, associated with a clear nomological network, whereas the empirical pattern for performance goals is more difficult to discern. We believe that the trichotomous framework pinpoints an important reason for this differential predictive utility—the confounding of two conceptually distinct types of performance goals.

Just as we think it is important to highlight the divergent results obtained for performance-approach and performance-avoidance goals, we also think it is important to make salient the differential results obtained for mastery and performance-approach goals. These two approach goals evidenced a more similar pattern of results than did the two types of performance goals, but performance-approach and mastery goals still yielded as many divergent results (for deep processing, surface processing, and exam performance) as they did convergent results (for disorganization, persistence, and effort). Thus, collapsing across the two types of approach goals (adopting a strictly approach–avoidance framework), like collapsing across the two types of performance goals, would undoubtedly have produced a less than perspicuous empirical picture. Clearly, both the manner in which competence is defined (the performance–mastery distinction) and the manner in which competence is framed (the approach–avoidance distinction) are important components of achievement goals, and we encourage researchers to attend to both distinctions in their empirical endeavors.

In much of the work on achievement goals and study strategies, researchers have used omnibus indicators of study regulation that aggregate across variables such as deep processing, surface processing, and persistence. Although the use of such indicators has yielded some valuable information, the present work illustrates the need to continue attending to individual components of self-regulated study as well. For example, the pattern of results from both studies indicates that combining deep and surface processing into an omnibus construct would have led to null results for performance-avoidance goals, thereby masking the fact that these goals were negatively related to deep processing and positively related to surface processing. Thus, differentiation appears to be a valued attribute in the study strategy, as well as the achievement goal domain.

It is widely assumed in the study strategy literature that deep processing is positively related and surface processing is unrelated to academic performance. The results of the present research support this assumption with one important exception. Although the bivariate correlations showed a positive relationship between deep processing and exam performance, this relationship was not evident in analyses controlling for ability. Most of the extant research linking deep processing to performance outcomes has neglected to control for ability, and our results highlight the need to examine the extent to which this relationship is indeed confounded. One intriguing possibility is that deep processing does not have a strong influence on immediate performance outcomes (independent of ability) but that it facilitates the long-term retention of material that has been learned. The generalizability of the null relationship between surface processing and exam performance is also in

need of further research attention. Memorization and rote rehearsal seem well suited for some types of material and some types of exam formats (Pintrich & Garcia, 1994), and we would not be surprised if surface processing was a positive predictor of performance in these instances.

A central aspect of the present research, and one that has been overlooked in the literature on achievement goals and study strategies, was the documentation of mediation. In prior work, we have established test anxiety as a mediator of the relationship between performance-avoidance goals and exam performance (Elliot & McGregor, 1999), and in this work we additionally validate disorganization as a variable that can account for the deleterious influence of performance-avoidance goals. Performance-avoidance goals imbue the achievement context with threat and apprehension, which we presume interfere with attempts to establish and maintain a structured, organized approach to exam preparation. Disorganization, in turn, is likely to cause students to be ill prepared come evaluation time, thus leading to anxiety and worry during the examination process. Conceptually, the above account suggests a complex, multi-stage model of mediation: Performance-avoidance goals → threat appraisals → disorganization → test anxiety → poor exam performance. Thus, although we are beginning to comprehend the mechanisms through which performance-avoidance goals exert their inimical impact on performance, there is clearly room for additional work aimed at delineating the precise sequence of processes that are involved over time.

We were also able to document mediation of the relationship between performance-approach goals and exam performance. Performance-approach goals had a positive impact on students' willingness to persist and exert effort during exam preparation, and their persistence and effort had independent, positive influences on exam performance. Thus, it appears that keeping their "eyes on the prize" of normative success impelled students to "put their nose to the grindstone," which paid handsome performance dividends. Achievement goal theorists have long posited a negative relationship between performance goals and persistence, and in this context, our findings appear somewhat contrarian. Our results may simply be attributable to the bifurcation of performance goals into approach and avoidance components, but it is also important to note that in the present work persistence represents perseveration when encountering difficulty during task engagement, whereas in the general literature it typically represents perseveration following repeated failure feedback. The latter form of persistence seems much more difficult to sustain than the former, and the extent to which performance-approach goals are able to foster this more stringent form of persistence remains an open and important question. In addition, it is possible that the benefits of performance-approach goals in general are restricted to certain evaluative contexts (e.g., normatively based), certain achievement tasks (e.g., those with clear-cut right and wrong answers), or certain age groups (e.g., high school and above); the exploration of these issues should be high on the research agenda.

Throughout the present work, we have implicitly assumed that achievement goals exert a causal influence on the focal mediators, which in turn exert a causal influence on performance outcomes. It is important to note, however, that the data in the present studies were correlational and, therefore, definitive conclusions regarding causality cannot be drawn. In addition, the present research was exclusively quantitative in nature, as students' achievement goals and study strategies were assessed by means of predesigned, closed-ended questionnaire items. Other, more open-ended procedures are also available, particularly for assessing study strategies (see Biggs, 1988; Marton, 1976; Van Etten, Freebern, & Pressley, 1997). In future work, supplementing the quantitative approach used in our studies with one or more of these qualitative procedures may yield additional insights into the process of self-regulated study. Finally, it is important to highlight that our findings were obtained in a normative grading context with university undergraduates. Subsequent empirical work is needed to determine the generalizability of these results to other types of achievement settings and other age groups.

A substantial portion of the research conducted on self-regulated study has focused on the issue of intervention. Many researchers have examined the efficacy of various "learning to learn" courses or workshops designed to directly teach students optimal approaches to studying (Schunk & Zimmerman, 1998; Weinstein, 1988). Others have focused on characteristics of the achievement environment that lead students to use particular patterns of study strategies, such as the degree of emphasis on evaluation and the enthusiasm and autonomy supportiveness of the teacher (Dembo & Eaton, 1997; Grolnick & Ryan, 1987; Meece, 1994). The present research, and the work on achievement goals and study strategies more generally, suggests that intervention efforts should also be aimed at encouraging students to adopt particular types of achievement goals. Such efforts would be highly compatible with the aforementioned work linking characteristics of the achievement environment to study strategies, because many of these same characteristics have also been identified as important antecedents of achievement goal adoption (Ames, 1992; Anderman, 1997; Maehr & Midgley, 1996). In fact, we suspect that the influence of the achievement environment on study strategies is actually mediated by achievement goals, such that the achievement environment prompts certain types of achievement goals, which in turn elicit certain types of study strategies.

Nearly all of the intervention work that has been conducted in the achievement goal and study strategy literatures has been designed to foster the pursuit of mastery goals, increase the use of deep processing, or enhance metacognitive awareness. Although we enthusiastically agree that these are important objectives, our trichotomous achievement goal framework and the results of the present research lead us to suggest that there are other achievement goals and study strategies worthy of support. Successful self-regulation in the achievement domain may be conditional and contextual, rather than absolute (Pintrich & Garcia, 1994; Ramsden, 1988), such that in some achievement settings or for some achievement outcomes, mastery goals and deep processing are optimal, whereas in other settings or for other

outcomes, performance-approach goals and their associated processes (e.g., persistence and effort) are more effective. From this perspective, the scope of intervention research should be expanded to not only include a focus on additional goals and strategies but also to include a consideration of when different self-regulatory profiles are to be recommended. Research of this nature should facilitate the ultimate aim of both the achievement goal and study strategy literatures: the promotion of adaptive approaches to self-regulation in achievement settings.

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## Appendix

## Items Used to Assess Students' Study Strategies

### Deep Processing

1. When a theoretical point or conclusion is presented in lecture or in the text, I try to decide if there is good supporting evidence.
2. I treat the course material as a starting point and try to develop my own ideas about it.
3. Whenever I read or hear a theoretical point in this course, I think about possible alternatives.
4. I never question the validity of the theories presented in the text or by the professor. (reversed)
5. I try to think through topics and decide what I'm supposed to learn from them, rather than studying topics by just reading them over.

### Surface Processing

1. When I study for the exam, I try to memorize as many facts as I can.
2. When I study for this course, I go through the text and my lecture notes and try to find the most important ideas to memorize.
3. When studying for this course, I read the text and my notes over and over again to help me remember the material.
4. I study for this course by memorizing the definitions at the end of each chapter of the text.
5. I try to memorize everything that I think will be on the exam.

### Disorganization

1. I'm not sure how to study for this course.
2. I often find that I don't know what to study or where to start.
3. I find it difficult to develop a study plan for this course.
4. I find it difficult to organize my study time effectively.
5. When I study for this course, I have trouble figuring out what to do to learn the material.

### Persistence

1. When I become confused about something I'm reading for this course, I go back and try to figure it out.
2. Regardless of whether or not I like the material, I work my hardest to learn it.
3. When something that I am studying gets difficult, I spend extra time and effort trying to understand it.
4. I try to learn all of the testable material "inside and out," even if it is boring.

### Effort

1. I put a lot of effort into preparing for the exam.
2. I worked very hard to prepare for the exam.

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