

Exploring the Relationships between Goal Orientations, Knowledge Monitoring and Academic Achievement

Christopher A. Was¹ & Tara L. R. Beziat²

Abstract

Although achievement goal orientation research has been a focus of educational psychology for more than 30 years, there is still a great deal of variance unaccounted for in the relationship between goal orientations and academic success. The current investigation was conducted to examine the influence of achievement goals on knowledge monitoring accuracy and academic performance. A total of 120 undergraduate educational psychology students (80 female, 40 male) participated in the current study. Knowledge monitoring and goal orientations were assessed via questionnaires and final exam scores were used to operationalize academic achievement. To test the causal effects among the previous variables, a path analysis was conducted. Correlational and path analyses indicated that the relationship between goal orientations and academic outcomes is perhaps mediated by the ability to accurately assess one's existing knowledge but not, as previously believed, accurately assessing what one does not know. The metacognitive knowledge of knowing whether one knows, or sensitivity, appears to be a greater predictor of success than specificity, or knowing whether one does not know. Also, performance approach goal orientated individuals are more likely to succeed on a final exam than performance avoidant individuals. Further research should examine the relationship between sensitivity and mastery learning orientation for long-term learning outcomes.

Keywords: knowledge monitoring; metacognition; goal orientations; metacognitive knowledge monitoring

1. Introduction

The goal of the current investigation was to examine the relationships between achievement goal orientations, metacognition and academic achievement. Specifically, the aim of this investigation was to explore the impact of goal orientations and knowledge monitoring accuracy of post-secondary students on academic performance. Abundant research exists that examined the impact of goal orientations on academic outcomes. A similarly large literature regarding the impact of metacognition on academic outcomes also exists. However, the influence of goal orientations and metacognition on academic performance has not been explored in combination to the same extent. The current investigation was conducted to begin to explore these relationships. Achievement goal theory has been a major focus of the field of educational psychology for the past 35 years. Indeed, a simple search of the term –achievement goals– in the Journal of Educational Psychology returns 52 published articles since 2009. Include the databases ERIC, SCOPUS, JSTOR and Web of Science in the search and the number of published articles since 2009 increases to over 900. This focus on achievement goals and goal orientations is a result of the potential impact goals have on student performance. An exhaustive review of the goal orientation and achievement orientation literature is beyond the scope of this manuscript; however, we do present the most consistent finding in the literature. Goal theorists have spent great efforts to examine and determine the influence that different goal orientations have on student self-regulation (Wotlers, Yu, & Pintrich, 1996), learning strategies (Somuncuoglu & Yildirim, 1999), and to a lesser degree metacognition (Vrugt & Oort, 2008).

¹ 405 White Hall, Kent State University, Kent, Oh 44242, USA. Email: cwas@kent.edu

² Alabama University at Montgomery

The type of goals one sets also determines the personal experience one has following success or failure of the task in which one engages. Goal theorists have made great progress in determining what types of goals are productive for students and what types of goals result in cognitive strategies, affective responses and behaviors that lead to student success (Pintrich, 2000). The dominant theoretical approach in achievement goal theory has been to distinguish between performance and mastery goals. This simple bifurcation describes students setting mastery goals as focused on learning the material and mastering the tasks in which they are engaged. Students setting performance goals are concerned with demonstrating ability and comparing their performance to others' achievements. This binary distinction was a focus of the early research regarding achievement motivation (e.g. Ames, 1992; Ames & Archer, 1988; Maehr, 1984; Nicholls, 1983).

1.1 Mastery Goals

Mastery goals have been consistently described as the appropriate approach for enhancing learning, increasing self-efficacy, persistence, as well as effective cognitive and metacognitive strategies. When a student is mastery goal oriented effort is seen as contributing to success and not as an indication of ability (Middleton & Midgley, 1997). The mastery oriented student also views achievement (success) as learning something new or mastering the task at hand. Other terms have appeared in the literature to identify these goals. Dweck (1986) referred to these types of goals as learning goals, but they have also been identified as task-involved goals (Nicholls, 1984) and Nicholls and Miller (1984) referred to task-involved learners as students whose focus is mastering the task at hand. Students setting mastery goals persist longer on difficult tasks, are likely to attribute success and failure to internal and controllable causes, are more likely to prefer challenging tasks and more likely to take academic risks (Ames, 1992). These findings are not limited to research involving k-12 students, but are also true for college students and adult learners. For example, Dupeyrat and Marine (2005) found that when adults in continuing education courses adopted mastery goals there were positive affects on learning outcomes, whereas adults who displayed performance goals had more negative learning outcomes. Investigations have frequently demonstrated that mastery goals are related to effective cognitive strategies that involve elaboration, organization and metacognitive strategies such as planning, monitoring and regulating cognition. A central question driving the current study is whether mastery oriented students will be better at assessing their own knowledge than performance oriented students.

1.2 Performance Goals

Performance goals are based on measuring competence in comparison to others. Performance goals lead students to be motivated to appear competent or avoid appearing incompetent when compared to others (Dweck, 1986; Dweck & Elliot, 1983; Dweck & Legget, 1988; Elliot & Dweck, 2005; Lepper, 1988; Brophy, 2005). In contrast to students adopting a mastery orientation, students adopting performance goals are more likely to become frustrated and defensive in the face of failure. The performance-oriented student is likely to attribute success to internal, stable causes (e.g., intelligence) and failure to more external factors such as luck, task difficulty, and an uncontrollable lack of ability (Dweck, 1986). A plethora of research has been conducted to examine the effect of performance goals on academic achievement. A portion of this research has demonstrated that in some contexts and under certain conditions, a performance goal orientation leads to higher academic achievement (e.g., Midgley, Kaplan, & Middleton, 2001). Because of such findings, goal theory has bifurcated performance goals into performance-approach and performance-avoidance goals (cf. Elliot, 1999). Students adopting performance-approach goals wish to measure themselves against others to demonstrating their ability. This desire is reflected in the use of the term ego-social goal orientation by some researchers (Somuncuoglo and Yildirim, 1999). Somuncuoglo and Yildirim (1999) stated that ego-social orientation leads to an emphasis on high grades and outperforming others to gain approval and enhance one's self-esteem. When students adopt performance-approach goals and these goals are based on a need for achievement, the student may use deep processing strategies (Meece, Blumenfield, & Hoyle, 2008; Sins, van Joolingen, Savelsbergh, & van Hout-Wolters, 2008). Put differently, when the student's foundational motivation is congruent with the task at hand, the student is likely to adopt more deep processing strategies. However, when the goals and underlying motivation are incongruent (e.g., the student is attempting to avoid an aversive situation such as a poor grade) she is likely to use more surface processing strategies. In either case the student adopting performance-approach goals is likely to perform well, at least in the short-term. In contrast, performance-avoidant goals are almost always associated with poor performance. The performance-avoidant oriented student uses normative standards to avoid demonstrating incompetence (Elliot, 2005).

Nicholls (1984) reported that individuals who are ego-involved and have high self-efficacy (performance-approach orientation) seek to demonstrate their ability in comparison to others, whereas those who are ego-involved and have low self-efficacy seek to avoid demonstrating their lack of ability relative to others (performance-avoidant orientation). It is quite possible that the foundation of the distinction between performance-approach and performance-avoidant goals is the individual's level of self-efficacy. Whereas performance-approach oriented students seek to demonstrate their ability, because they feel they do have high ability, performance-avoidance oriented students view themselves as lacking in ability and therefore wish to avoid public demonstrations that would confirm that lack of ability. Performance-avoidant oriented students tend to use their last performance as a measure of competence and because their last performance was likely poor, they are unable to then build a strong sense of self-efficacy. To protect their self-worth, they may begin to adopt failure-avoiding strategies including weak effort, avoiding academic risks, setting unrealistically high or low goals, and procrastination. Although these strategies are self-handicapping, the ensuing failure is consequently attributed to a lack of ability. In extreme cases, a student may begin to accept failure and adopt the behavior typically of learned helplessness. It is important to note that other goal orientations, alternative models, and other frameworks of achievement goal orientations have been proposed. For example, work-avoidant orientation, also described as academic alienation (Brophy, 1983; Nicholls, Patashnick, & Nolen, 1985; Nolen, 1988), is an orientation adopted when a student views achievement as completing a task with as little effort as possible (cf. Harackiewicz, Barron, Tauer, & Elliot, 2002). Work-avoidant goal orientation has received little attention in the extant literature. The research that has included the work-avoidant orientation suggests that work-avoidant goals are extremely detrimental to achievement outcomes (e.g., Duda & Nicholls, 1992; Nicholls, et al, 1985).

The trichotomous framework of orientations described above is based on the work of Elliot and colleagues (Elliot & Church, 1997; Elliot & Harackiewicz, 1996). As described, performance goals in this framework are divided into approach and avoidance goals. In a revision of the model, Elliot (1999) presented a 2 x 2 framework in which mastery goals, like performance goals, are divided into approach and avoidance orientations. However, at that time Elliot (1999) conceded that there was not a great deal of evidence for mastery-avoidant goals, and the trichotomous framework continued to be the dominant theoretical perspective of achievement goal theory. In a later revision of this theory, Elliot, Murayama, and Pekrun (2011) explained that within mastery and performance goal constructs are considerations for the task, self, and others and that these goal orientations are complex enough to be considered distinct constructs. Therefore, Elliot et al, (2011) proposed a 3 (task, self, others) x 2 (approach vs. avoidant) framework of goal orientations. Although the proposed 3 x 2 framework is compelling, it has yet to be vetted on a good deal of empirical data and the trichotomous framework has been quite successful at explaining a great deal of variance in behaviors and academic outcomes. For these reasons, the trichotomous framework was chosen as the foundation for the current investigation. Clearly, the goal orientation a student adopts affects the academic behaviors (e.g., study strategies) of the student and in turn the student's academic outcomes. These relationships have been studied in depth and the paths between goal orientations, behaviors and academic outcomes have been mapped. However, there is still a great deal of variance in academic outcomes not explained by students' goal orientations. One individual difference that goal orientations may affect, and in turn may impact academic outcomes, is knowledge monitoring.

1.3 Metacognitive Knowledge Monitoring

Tobias and Everson (2009) stated that effective knowledge monitoring is necessary for new learning from instruction. To support this argument, Tobias and Everson (2009) presented a model of metacognition in which knowledge monitoring is the foundation of higher-order metacognitive processes. Knowledge monitoring is simply described as one's ability to distinguish between what one knows and/or understands from what one does not know or understand. Tobias and Everson (2009) explained that without accurate knowledge monitoring a student is less likely to successfully employ higher-order metacognitive skills, such as choosing effective learning strategies, necessary for positive academic outcomes. Indeed, a great deal of evidence has been provided that demonstrates students who are able to more accurately access general knowledge also perform better in classroom contexts. For example, Isaacson, Was and colleagues (Hartwig, Was, Isaacson, & Dunlosky, 2012; Isaacson & Was, 2010) have demonstrated that a simple assessment of students' knowledge monitoring accuracy administered at the beginning of a semester accounts for a significant amount of variance in final exam scores at the end of the semester.

To further understand the relationship between knowledge monitoring and academic outcomes Smith, Was, and Isaacson (2012) conducted a study in which two distinct constructs of knowledge monitoring calibration, sensitivity and specificity (cf. Schraw, Kuch, & Guitierrez, 2013), were used along with the more traditional gamma (Υ) (a measure of general measure of knowledge monitoring) to predict performance on tests in an undergraduate educational psychology course. It was found that sensitivity, a measure of correctly identifying known items, accounted for the most unique variance in final exam scores. Indeed, when gamma and specificity were included in the regression equation, sensitivity accounted for a significant amount of unique variance in final exam scores. Specificity, a measure of correctly identifying unknown items, had no significant impact on exam performance. Results suggested that sensitivity and specificity may represent distinct psychological constructs and that sensitivity may be more meaningful measures of knowledge monitoring calibration when it comes to predicting academic achievement.

1.4 The Current Study

The goal of the current investigation was to examine the relationships between knowledge monitoring accuracy, achievement goal orientation and performance in a post-secondary classroom. Little is known about the interaction of the distinct goal orientations students adopt and their knowledge monitoring accuracy in relation to academic outcomes. For example, imagine a class of college students faced with an upcoming exam. Students in the course who have adopted mastery goals are focused on learning and mastering the material while preparing for the exam. To meet this goal, the students must be able to accurately assess when content has been mastered or knowledge has been obtained. The mastery-oriented student might rely on sensitivity (accurately assessing what is known) to self-regulate learning. In contrast, students in the course who have adopted performance-approach goals are not focused on learning goals, but instead focus cognitive resources on shallow processing of information in order to simply perform well on the exam, not master the content. It is likely that these students focus their energy on determining what is unknown. Put differently, the performance-approach oriented student wants to know, what she does not know in order to gain that knowledge and perform well on the assessment of that knowledge. Hence, the performance-approach oriented student is likely to rely on specificity (accurate assessment of what is unknown).

Performance-avoidant oriented students, as previously discussed, have unrealistically negative views regarding their ability and are therefore not likely to possess accurate knowledge monitoring. The performance-avoidant oriented students are not likely to be effective at either type of knowledge monitoring. The goal of the current study was to examine the relationships between the constructs described. More specifically, the goal was to determine if the relationships between goal orientations, knowledge monitoring, and academic achievement described above are accurately portrayed. Figure 1 presents a hypothesized path model representing all of the relationships of interest in the current study (possible correlations among the goal orientations and the possible correlations between sensitivity and specificity are not presented for ease of readability of the figure). Paths A, E, and I represent the direct effects each of the goal orientations is hypothesized to have on academic success. In the current study, a cumulative final exam administered at the end of the semester will be the measure of academic success. It is hypothesized that the Path A (the parameter between performance-approach and academic success) and Path I (between mastery orientation and academic success) will be significant and positive whereas Path E (the parameter between performance-avoidant orientation and academic success) will be a negative parameter. Paths B, D, and G represent the influence goal orientations will have on sensitivity and Paths C, F and H represent the influence of the goal orientations on specificity. It is hypothesized that the performance-approach orientation will be predictive of specificity and mastery orientation will be predictive of sensitivity. Paths J and K represent the relationship between academic success and sensitivity and specificity respectively. Based on the findings of Smith, et al. (2012) it is predicted that sensitivity will be a predictor of academic success and specificity will not.

2. Methods

Participants: One hundred and twenty undergraduates enrolled in an educational psychology course at a Mid-western university participated in the research in exchange for course credit. Eighty females and forty males participated in the study. Age ranged from a minimum of 19 to a maximum of 59. Mean age was 25.10 (SD=8.34). American Psychological Association ethical standards were upheld during the investigation and participants were able to earn the course credit in alternative ways if they chose not to participate in this study. The author of this manuscript was not the instructor of the course in which students were enrolled.

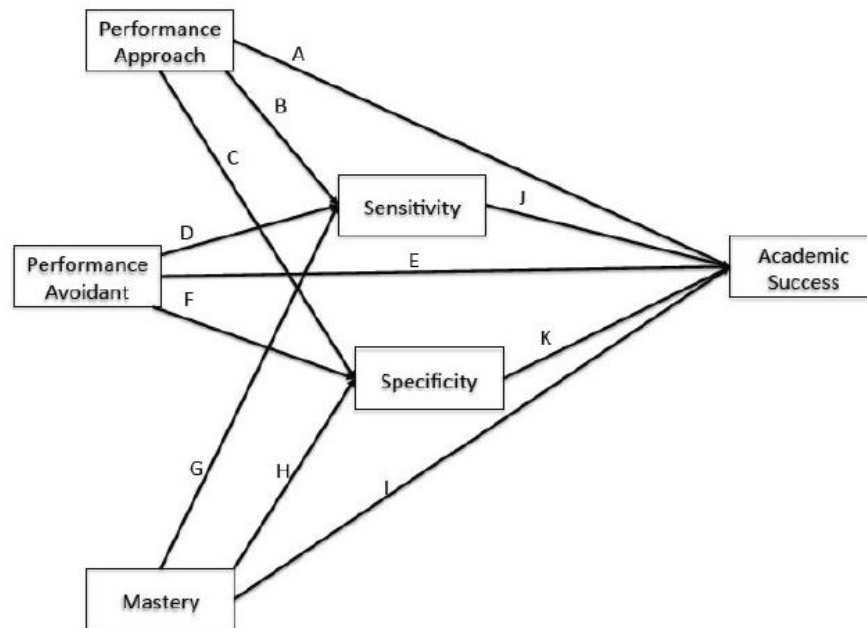


Figure 1: Hypothesized Full Path Model

2.1 Materials

Goal Orientation Questionnaire: Participants completed an achievement goal questionnaire developed by Elliot (1999; Elliot & Chuch, 1997). The questionnaire contained six items related to performance-approach goals (e.g., it is important for me to do better than other students), six items related to performance-avoidant goals (e.g., I just want to avoid doing poorly in this class), and six items related to mastery goals (e.g., I want to learn as much as possible from this class). Participants responded to each item using a 10-point scale ranging from 1-not very true of me to 10- very true of me. Participants were instructed to respond in a manner reflecting their attitudes toward the educational psychology course in which they were enrolled.

Table 1: 2x2 Contingency Table for KMA Results

Feeling of Knowing	Response Accuracy	
	Correct	Incorrect
Know	[A]	[B]
Don't Know	[D]	[D]

Note. $\text{Gamma} = \frac{AD-BC}{AD+BC}$ $\text{Sensitivity} = \frac{A}{A+C}$ $\text{Specificity} = \frac{D}{D+B}$

2.1.1 Knowledge Monitoring Assessment: The knowledge monitoring assessment (e.g., Tobias & Everson 2009, Hartwig, et al., 2012) used in the current study required participants to indicate whether they believed they know or did not know the meaning of 50 English words, and then respond to a multiple choice test in which the 50 items were presented individually accompanied by four distractors and one synonym. The procedure generates a 2 (known vs. unknown) x 2 (correct meaning vs. incorrect meaning) contingency table (Table 1). Hence, the four possible cells are: A – identified as known and the correct synonym chosen; B - identified as known and an incorrect distractor chosen; C – identified as unknown and the correct synonym chosen; and D – identified as unknown and the an incorrect distractor chosen. 2.1.2 Final Exam: A comprehensive final exam was administered at the end of the semester. The exam consisted of 100 items: 20 true/false and 80 multiple-choice items derived from course content.

2.2 Design and Procedures

Participants completed the knowledge monitoring assessment (KMA) and the achievement questionnaire online with deadline of the Friday of the second full week of class. To complete the knowledge monitoring assessment, participants logged into the course related website. After logging in and choosing the KMA tool, participants were instructed that they would be presented with 50 English words and during the first portion of the task, they were to simply respond by pressing the 1 key to indicate they know the meaning of the word, or the 2 key to indicate they did not know the meaning of the work. During each administration, participants were presented with 50 vocabulary words one at a time. Thirty-three of the words represented vocabulary items derived from the text used for the educational psychology course and 17 represented general vocabulary items. Each word appeared in the middle of the computer screen with the reminder 1 = Know and 2 = Do Not Know appearing under the word. After all 50 items were presented, each vocabulary word again appeared one at a time in the middle of the screen along with five possible synonyms presented below the target word and numbered in order from top to bottom. The multiple choice vocabulary items appeared in the same order as in the knowledge judgment portion of the task. Participants used the number keypad to respond by pressing the key (1 – 5) corresponding to what they believed to be the correct synonym. To complete the achievement goal orientation questionnaire, participants again logged into the course related website chose the achievement goals tool and were instructed to use the 10-point scale (1= not very true of me to 10= very true of me) to indicate their attitudes towards the educational psychology course. The Questions were presented randomly one at a time on the computer. Participants answered questions at their own pace. For the purposes of the present study, we operationalize academic achievement as performance on a cumulative final exam at the end of the 15-week semester. The final exam was made up of 20 true/false questions as well as 80 multiple-choice items. Students were allowed as two and a half hours to complete the exam and all students completed the exam in the time allotted.

2.3 Analyses

Of the 120 participants, 18 were missing data on one of the measures. This resulted in 15% of the data missing. Correlations were completed using list-wise deletion. Data missing in the path analysis was replaced by estimating means and intercepts. The first step in the data analysis was to calculate the two measures of knowledge monitoring accuracy. Sensitivity [$A/(A+C)$], and specificity [$D/(B+D)$] were calculated for each participant (see Table 1). Because these measures are proportion scores the two measures range between 0 and 1. For example, sensitivity is the proportion of items identified as know and responded to correctly divided by all items identified as known, whether the synonym was correctly identified or not. Scores for the goal orientations were calculated by summing the responses of the six items in the achievement goal questionnaire that represent the specific orientation. Final exam scores are presented as the number of correct answers out of 100 items. Table 2 presents the means and standard deviations for each of the measures.

Table 2: Means and Standard Deviations of Measures

Variable	Mean	sd
Final Exam Score	78.40	10.86
Sensitivity	.67	.16
Specificity	.58	.17
Mastery	54.80	3.97
Performance-Approach	45.42	7.93
Performance-Avoidant	46.46	6.63

3. Results

Table 3 presents the correlations among the six variables. As predicted, mastery goal orientation correlates with sensitivity. Contrary to the hypothesis, mastery orientation negatively correlated with specificity. As in previous research, Smith, et al. (2012) sensitivity correlated with final exam score. However, in the current study specificity was negatively correlated with final exam score.¹³ none of the goal orientations were significantly correlated with final exam score, although the correlation between performance-approach orientation and final exam score did approach significance.

³ After controlling for the number of vocabulary items that were correctly matched to a synonym, sensitivity and specificity correlated significantly with final exam score ($r = .26, p = .009$ and $r = -.22, p = .029$ respectively). Therefore, it is clear that the relationships between the two measure of knowledge monitoring accuracy and final exam score are not due simply to vocabulary knowledge.

Table 3: Correlations Among the Six Variables

Variable	1	2	3	4	5	6
1. Final Exam Score	-					
2. Sensitivity	.28**	-				
3. Specificity	-.21*	-.62**	-			
4. Mastery	.18	.27*	-.29**	-		
5. Performance-Approach	.20	.12	.06	.03	-	
6. Performance-Avoidant	.17	.16	.09	-.18	.49*	-

Note: *p < .05, **p < .01

Because of the number of unsuspected correlations and lack of significant correlations a saturated path model was used to estimate the relationships among the variables (see Figure 1). LISREL 8.8 (Jöreskog and Sörbom 1993; Jöreskog et al. 1996) was used to calculate parameter estimates. Table 4 presents the standardized direct, indirect, and total effects of the knowledge monitoring measures and goal orientation measure on final exam score based on the saturated path model. Based on the estimates generated in the saturated model, a parsimonious model was tested by removing those parameters that were not significant in the saturated model.

Table 4: Standardized Direct, Indirect and Total Effects on Final Exam of Saturated Model.

	Variable				
	Mastery	Performance-Approach	Performance-Avoidance	Sensitivity	Specificity
Direct	.05	.36	-.26	.28	.02
Indirect	.06	-.04	-.03	.00	.00
Total	.11	.33	-.28	.28	.02

Figure 2 represents the parsimonious model. The chi-square test indicated that the data did not differ significantly from the tested model, $\chi^2(8) = 10.8$, $p = .21$, $\chi^2/df = 1.35$. Other fit indices support the model as a good fit to the data (CFI = .97, RMSEA = .054). In the model tested, performance-approach and performance-avoidant orientations have a moderate relationship ($r = .49$). There is also a moderate negative correlation between sensitivity and specificity ($r = -.58$). Mastery orientation is predictive of both sensitivity ($b = .26$) and specificity ($b = -.29$). Contributing to variance in final exam scores are performance-approach ($b = .36$), performance-avoidance ($b = -.27$), and sensitivity ($b = .28$).

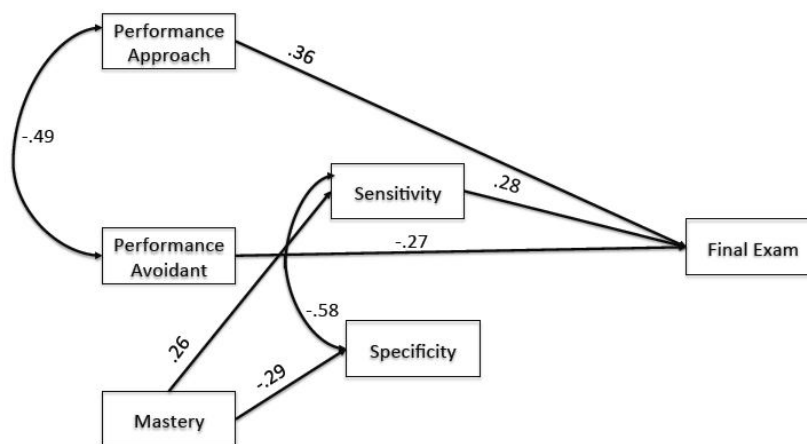


Figure 2: Parsimonious model with Standardized Parameter Estimates

Although mastery orientation did not correlate significantly with final exam score, $r = .18$, $p = .07$, a Sobel test indicated that the indirect effects of mastery on final exam through sensitivity were significant, $t_{Sobel} = 1.98$, $p = .04$

4. Discussion

The analyses of the current data resulted in intriguing findings. First, as expected performance approach goals predicted achievement on the final exam. It was also expected that performance-avoidant goals would negatively relate to performance on the final exam, as they did. These findings are common in the literature. Students setting performance-approach goals are likely to be successful on exam because they employ strategies that lead to short-term success. However, these strategies are not likely to lead to long-term retention of information. Students setting performance-avoidant strategies are likely to adopt self-handicapping behaviors in an attempt to protect their ego. These self-preserving strategies are the types of strategies that typically lead to failure. The findings regarding performance goal orientations and the relationships to academic achievement are consistent with previous research. Contrary to expectations, the performance goal orientations had no relationship to either sensitivity or specificity. One interpretation of this finding is that students setting performance goals of either type are using external metrics to gauge their understanding as well as their success and failure. Therefore, these students do not possess internal knowledge monitoring skills. Al-Harthy, Was, and Isaacson (2013) demonstrated that performance oriented students were more likely to use surface processing techniques, such as simple rehearsal, to prepare for exams than more deep processing techniques such as organization and elaboration. One interpretation of the current results is these deep processing skills require knowledge monitoring whereas simple rehearsal does not. Although causality is impossible to infer, according to the current results performance oriented students are less likely to rely on accurate knowledge monitoring in preparation. Future investigations could focus on understanding these complex relationships. Also, in contrast to the predicted outcomes results of the current study did not include a clear indication that mastery orientation predicts academic achievement. Although there was clearly a trend for mastery-oriented students to perform well on the final exam it was not significant. However, the indirect effect of mastery on final exam through sensitivity was significant. Perhaps, it is necessary for the mastery-oriented student to be able to accurately assess what is known, for their goal of learning to be achieved. It may also be the case that mastery was not predictive of the final exam because of the long-term outcomes which mastery is often associated. For example, Harackiewicz, et al., (2000) found that mastery goals positively predicted college students' long-term interest in a course and likelihood to take more related courses, but not performance. In the same study, performance goals predicted performance, but not interest. The findings of Harackiewicz, et al. (2000) may help to understand the lack of a relationship between final exam performance and mastery goals and the positive relationship between performance goals and final exam performance. In support of previous findings (e.g., Smith et al., 2012), the current study demonstrated that sensitivity was predictive of academic success and specificity was not. Indeed, the current results indicated that specificity was negatively related to final exam score. One interpretation of the current results is that knowing what one knows is the foundation of good metacognitive regulation.

A possible alternate interpretation of these findings is that the relationships between the final exam score and sensitivity and specificity are simply artifacts of the data. To investigate this interpretation, a paired-sample t-test was conducted. This test revealed that overall participants in the study identified more items on the knowledge monitoring assessment as known and then subsequently identified the correct synonym (Table 1 cell A, $M = 19.16$, $sd = 5.52$) then items which they identified as unknown and did not correctly identify the synonym (Table 1 cell D, $M = 8.90$, $sd = 4.05$), $t(99) = 11.15$, $p < .001$, $CI[8.43;12.09]$. Furthermore, the correlations between cell A and final exam score, and cell D and final exam score were .22 and -.28 respectively. A simple interpretation of the findings is that those who started off the semester with a greater vocabulary or knowledge of the content did better on the final exam than those with a lesser vocabulary even if those with a lesser vocabulary were aware of their shortcomings. However, as described in the results section a test of the partial correlation between the measures of knowledge monitoring and final exam score revealed that after controlling for the number of correctly identified vocabulary items the correlations remained virtually unchanged. This finding renders the vocabulary knowledge hypothesis untenable. Two distinct issues limit interpretation of the results of this investigation. The first issue is related to the construct and measurement of achievement goal orientations. In this investigation goal orientations were operationalized using the trichotomous framework (Elliot & Church, 1997; Elliot & Harackiewicz, 1996), which includes mastery, performance-approach and performance-avoidant goals. Elliot and McGregor (2001) proposed a 2 (mastery vs. performance) x 2 (approach vs. avoidance) framework of achievement goals. Huang (2012) complete a meta-analysis of 151 studies in which the validity of a 2-factor framework (mastery vs. performance), the trichotomous framework (3-factor), and the 2 x 2 framework (4-factor) were compared in relationship to achievement outcomes. Discriminate validity of each framework was sound and although each framework was accounted for significant variance in academic achievement, the 4-factor model accounted for the most variance in academic achievement.

Note that the 2-factor model accounted for 2% of the variance in academic achievement, the 3-factor model accounted for 4% of variance and the 4 factor model accounted for 6% of the variance. It is clear from Huang's (2012) meta-analysis that goal orientations regardless of the framework, are only accounting for a small amount of variance in academic achievement. Furthermore, Brophy (2005) presented a review of the literature that indicated students rarely spontaneously generate performance goals and then urged researchers to investigate other distinctions such as outcome goals or constructs that focus on achievement. Similarly, Tobias and Everson (2009) reviewed literature that indicated mastery goals are not important to students and studies that question the validity of the mastery goal construct. As mentioned in the introduction Elliot et al. (2011) have proposed a new 3 x 2 framework of goal orientations, but this framework has not yet been vetted and the trichotomous framework continues to be the standard in educational contexts. The second limitation of the current investigation is related to the measure of knowledge monitoring. Earlier investigations using similar knowledge monitoring assessments have presented challenges to the validity of the KMA. Specifically, the measurement challenge of disentangling individual differences in word knowledge from differences in knowledge monitoring accuracy, particularly when attempting to use KMA scores in a correlational or predictive validity framework when the criterion measure is similar in content to the word measure of the KMA as is the case in the design of the current investigation. However, recall the partial correlational analysis conducted to alleviate this concern.

5. Conclusions

The results of the current study support the conclusion that sensitivity, or knowing what one knows, is an important factor in academic success. The results also indicate that specific goal orientations may relate to knowledge monitoring in different ways. Although adopting a performance-approach orientation to classroom goals may lead to success as measured by comparison to others, or even high scores on an exam, the results of the learning strategies adopted are not necessarily robust, nor do they lead to accurate assessments of one's own knowledge. Although a mastery orientation may not lead to short-term success on an exam, the current study does provide evidence that a mastery orientation is more likely to lead to the ability to accurately assess what one knows and the ability to judge what one knows is linked to successful performance and learning.

References

- Ames, C. (1992). Classrooms: Goal structures, and student motivation. *Journal of Educational Psychology*, 84(3), 261-271.
- Archer, J. (1994). Achievement goals as a measure of motivation in university students. *Contemporary Educational Psychology*, 19(4), 430-446.
- Ames, C. & Archer, J. (1988). Achievement goal in the classroom: Student learning strategies and achievement motivation. *Journal of Educational Psychology*, 18(3), 409-414.
- Brophy, J. (1983). Research on the self-fulfilling prophecy and teacher expectations. *Journal of Educational Psychology*, 84(5), 706-722.
- Brophy, J. (2005). Goal theorists should move on from performance goals. *Educational Psychologist*, 40(3), 167-176.
- Duda, J. & Nicholls, J. (1992). Dimensions of achievement motivation in schoolwork and sport. *Journal of Educational Psychology*, 84(3), 290-299.
- Dupeyrat, C. & Marine, C. (2005). Implicit theories of intelligence, goal orientation, cognitive engagement, and achievement: A test of Dweck's model with returning to school adults. *Contemporary Educational Psychology*, 41(10), 1040-1048.
- Dweck, C. S. (1986). Motivational processes affect learning. *American Psychologist*, 41(10), 1040-1048.
- Dweck, C. S. & Elliot, E. S. (1983). Achievement motivation. In P. Mussen and E. M. Hetherington (Eds.) *Handbook of Child Psychology*, New York: Wiley.
- Dweck, C.S., & Leggett, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review*, 95, 256- 273.
- Elliot, A. J. (1996). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, 34, 149-169.
- Elliot, A. J. & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, 72(1), 218-232.

- Elliot, A. J. & Harackiewicz, J. M. (1996). Approach and avoidance goals and intrinsic motivation. *Journal of Personality and Social Psychology*, 70(3), 461-475.
- Elliot, A. J., & McGregor, H. A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology*, 80(3), 501-519.
- Elliot, A. J., Murayama, K., & Pekrun, R. (2011). A 3 X 2 achievement goal mode. *Journal of Educational Psychology*, 103(3), 632-648.
- Harackiewicz, J. M., Barron, K. E., Tauer, J. M., Carter, C. M., & Elliot, A. J. (2000). Short-term and long-term consequences of achievement goals: Predicting interest and performance over time. *Journal of Educational Psychology*, 92(2), 316-330.
- Harackiewicz, J. M. & Elliot, A. J. (1993). Achievement goals and intrinsic motivation. *Journal of Personality and Social Psychology*, 65(5), 904-915.
- Hartwig, M. K., Was, C. A., Isaacson, R. M., & Dunlosky, J. (2012). General knowledge monitoring as a predictor of in-class exam performance. *British Journal of Educational Psychology*, 83(3), 456-468.
- Isaacson, R. M., & Was, C. A. (2010). Believing You're Correct vs. Knowing You're Correct: A Significant difference? *The Researcher*, 23(1), 1-12.
- Jöreskog, K. G., Dag Sörbom, and Spss Inc. (1996). *Lisrel 8 User's Reference Guide*. Chicago, IL :: Scientific Software International.
- Jöreskog, Karl G. and Dag Sörbom. (1993). *New Features in Lisrel 8*. Chicago: Scientific Software International.
- Lepper, M. R. (1988). Motivational considerations in the study of instruction. *Cognition and Instruction*, 5(4), 289-309.
- Maehr, M. L. (1984). Meaning and Motivation. In R. Ames and C. Ames (Eds.) *Research in motivation in education: Student motivation* (Vol. 1, pp. 115-144), New York:Academic Press.
- Meece, J. L., Blumenfield, P. C., & Hoyle, R. H. (1988). Students' goal orientation and cognitive engagement in classroom activities. *Journal of Educational Psychology*, 80(4), 514-523.
- Middleton, M. J. & Midgley, C. (1997). Avoiding the demonstration of the lack of ability: An unexpected aspect of goal theory. *Journal of Educational Psychology*, 89(4), 710-718.
- Nicholls, J. (1983). Conceptions of ability and achievement motivation: A theory and its applications for education. In S. G. Paris, G. M. Olson, & H. W. Stevenson (Eds.), *Learning and motivation in the classroom* (pp. 211-237). Hillsdale, NJ.
- Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91(3), 328-246.
- Nicholls, J. (1989). *The Competitive Ethos and Democratic Education*. Cambridge, MA: Harvard University Press.
- Nicholls J. & Miller, A. (1984). Development and its discontents: The differentiation of ability. In J. Nicholls (Ed.) *Advances in motivation and achievement*. (Vol. 3, pp. 185-218). Greenwich, CT: JAI.
- Nicholls, J. Patashnick, M., & Nolen, S. (1985). Adolescents' theories of education. *Journal of Educational Psychology*, 77(6), 683-692.
- Nolen, S. (1988). Reasons for studying: Motivational orientations and study strategies. *Cognition and Instruction*, 5, 269-287.
- Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, 92(3), 544-555.
- Schraw, G., Kuch, F., & Gutierrez, A. (in press). Assessing the dimensionality of calibration measures used in monitoring research. *Learning and Instruction*.
- Sins, P. H. M., van Joolingen, W. R., Savelsbergh, E. R., & van, B. Hout-Wouters, B. (2008). Motivation and performance within a collaborative computer-based modeling task: Relations between students' achievement goal orientation, self-efficacy, cognitive processing, and achievement. *Contemporary Educational Psychology*, 33, 58-77.
- Smith, F. X., Was, C. A., & Isaacson, R. M. (October, 2012). Sensitivity and Specificity as Predictors of Academic Achievement, ". 30th Annual Conference of the Northern Rocky Mountain Education Research Association. Park City, UT.
- Somuncuoglu, Y. & Yildirim, A. (1999). Relationship between achievement goal orientations and use of learning strategies. *The Journal of Educational Research*, 92(5), 267-277.

- Tobias, S., & Everson, H. (2009). The importance of knowing what you know: A knowledge monitoring framework for studying metacognition in education. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of Metacognition in Education*. (pp. 107-1, 28). New York, NY: Routledge.
- Vrugt, A. & Oort, F. J. (2008). Metacognition, achievement goals, study strategies and academic achievement: Pathways to achievement. *Metacognition and Learning*, 30, 123–146.
- Wolters, C. A., Yu, S. L., & Pintrich, P. R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and Individual Differences*, 8, 211-238.