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RETHINKING INTELLIGENCE: THE ROLE OF MINDSET IN PROMOTING SUCCESS FOR ACADEMICALLY HIGH-RISK STUDENTS

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ABSTRACT

This study utilized an experimental pretest-posttest control group design to determine if changing the way academically high-risk college students view intelligence affected their academic effort and achievement when compared to students in a control intervention. Results indicated that students taught to view intelligence as malleable reported significantly higher levels of the multivariate variable academic effort and the univariate variable study skills than did the students who were directly taught study skills. No significant difference in GPA was found between the two groups. Implications for future research and current practice are discussed.

When describing a simple yet effective method for colleges to ensure student success, Kuh, Kinzie, Schuh, and Whitt (2005) suggest that “the surest way to increase the number of ‘successful’ students . . . is to admit only well-prepared, academically talented students” (pp. 7-8). The problem with such an approach, they admit, is that limiting admission to only the best and brightest students hinders other values that colleges espouse, such as diversity and accessibility. Moreover, such an approach fails to convey how the college experience itself can change students in cognitive and psychosocial ways. Although prior academic achievement is the best predictor of academic success in college, researchers have also found a meaningful link between non-cognitive variables and academic

success. Besides prior academic achievement, the motivation and energy students apply to their education is the best predictor of their learning and development (Kuh et al., 2005; Pace, 1982; Pascarella & Terenzini, 2005; Robbins, Allen, Casillas, Peterson, & Le, 2006). Although such findings are valuable, they also unveil another complex challenge: how colleges can help to foster this kind of academic motivation in their students.

THE TWO MINDSETS

A first step toward improving the academic achievement of students is to convince students that they actually *can* improve. Dweck (2006) described how people's self-theories—the beliefs they have about themselves—create different psychological worlds that lead to a host of thoughts, feelings, and actions. These beliefs shape a student's perception of what can be influenced versus what is out of the student's control. Dweck's (1999) research particularly focused on the effects of implicit theories of intelligence, also known as *mindsets*. If a student's implicit beliefs about intelligence lead him or her to perceive intelligence as unchangeable, then that student has a *fixed mindset*. Consequently, the student may feel he or she cannot avoid failure because intelligence is seen as outside of the student's control; the student may not be internally motivated to exert much academic effort.

Other people, however, believe intelligence can be cultivated and improved. People with this implicit theory have a *growth mindset*. They do not deny differences in ability among people, but they also believe people can increase their intellectual abilities through effort (Dweck, 1999, 2006). Although Dweck defines people's implicit theories of intelligence as reflecting either a fixed or growth mindset, it is possible to be a mix of the two categories or to have a growth mindset about one domain (such as personality) and a fixed mindset within another domain (such as intelligence). However, studies show that 85% of people report themselves as one or the other within a given domain (Dweck, Chiu, & Hong, 1995).

THE ROLE OF MINDSET IN COLLEGE STUDENT SUCCESS

Although the majority of research on implicit theories of intelligence has been conducted on children, some studies have examined mindset in college students. Such research indicates that mindset plays a role in college student success and can be altered through interventions with this population. Several studies conducted by Chiu, Hong, and Dweck (1997) indicated that college students with a fixed mindset were more likely to judge another person's character based upon a single action. They found that such judgment toward others parallels the self-evaluations students with a fixed mindset make regarding their own competence and ability. If they do well, then they think highly of themselves, but poor performance leads to low self-evaluations and low self-worth.

Robins and Pals (2002) conducted a path analysis on 508 college students to explore the relationship between mindset and academic performance. They found that the mindset of these students did not significantly change from high school through college, indicating that mindset is a relatively stable construct. College students with a fixed mindset adopted performance goals and displayed a helpless response pattern, while growth mindset students embraced learning goals and exhibited a mastery-oriented response. They reported that college students with a fixed mindset “approach achievement situations in ways that make them more psychologically vulnerable in the academic environment” (p. 325). Furthermore, such students attributed their academic performance, whether in the context of successes or failures, to factors outside of their control. These findings illustrate how mindset can be a precursor to locus of control in students (Findley & Cooper, 1983). And although the fixed mindset students in this sample had higher academic *ability*, this ability did not lead to higher *achievement* in college. The fixed mindset of these students may have impeded these students from achieving higher grades by lessening their emphasis on effort.

The stability of mindset during the college experience does not, however, preclude the possibility of changing mindset through intervention. Aronson, Fried, and Good (2002) conducted a controlled experiment to determine if encouraging a growth mindset could foster higher academic achievement in African-American students. In this study, 109 undergraduates were divided into three groups: an experimental condition promoting a growth mindset, a control group promoting a fixed mindset, and a control group with no intervention. They discovered that the African-American students who were taught a growth mindset in the study reported greater enjoyment of the academic process, higher levels of academic engagement, and had significantly higher grades, even after controlling for SAT scores between the groups. The results indicate that mindset has the potential to change students in ways that produce desired academic outcomes, especially with vulnerable populations.

Three additional studies tested the hypothesis that mindset also affects effort versus ability attributions in college students (Hong, Chiu, Dweck, Lin, & Wan, 1999). The researchers found that, after receiving negative feedback on academic work, students with a growth mindset were more likely to attribute their results to effort than were fixed mindset students. Furthermore, college students with a growth mindset were more likely to take advantage of remedial opportunities if their performance was judged as unsatisfactory. When a growth or fixed mindset was induced through intervention, findings indicated that the remedial action taken by growth mindset students was mediated by their effort attributions. These results support Dweck and Leggett’s (1988) original findings that mindset and effort are directly linked. As they noted, individuals with a fixed mindset view effort and ability as inversely related: low effort indicates high ability, while higher levels of effort signify lower levels of ability.

CURRENT EFFORTS TO ASSIST ACADEMICALLY HIGH-RISK STUDENTS

Although colleges have implemented programs to assist academically underprepared students since the late 1600s (Arendale, 2002), controversy exists concerning their policies, their effectiveness, and whether they should continue to exist within higher education in the United States (Attewell, Lavin, Domina, & Levey, 2006; Bettinger & Long, 2008; Calcagno & Long, 2008). These efforts are often labeled academic support programs, developmental education, or remedial education. But whatever the label, this type of intervention requires high-risk students to take specialized courses meant to improve their skills related to a particular academic area or to improve general study skills. In fall 2000, American postsecondary institutions provided remedial education to 28% of all entering freshmen (National Center for Education Statistics, 2004). Despite this assistance provided by institutions, graduation rates remain low. Only 36% of that cohort graduated within 4 years, and less than 58% graduated within 6 years (Knapp, Kelly-Reid, Ginder, & Miller, 2008).

As budgets are strained, some state legislatures have considered connecting higher education funding to graduation rates, a decision that would hurt colleges that enroll a large proportion of high-risk students, while other states have attempted to limit or completely ban remedial education (Barefoot, 2004; Bettinger & Long, 2008; Maloney, 2003). Although current efforts to assist academically high-risk students are not especially effective (Schmidt, 2008), higher education institutions have a goal to help the students they enroll succeed, and these institutions must find new methods for assistance that are more effective than previous ones.

To address a paucity of research on remedial education, scholars have recently conducted sound quantitative studies to examine the effects of these programs. This research, however, provides evidence that remedial programs are not generally effective among 4-year institutions. For instance, Attewell and colleagues (2006) not only found that students who take remedial courses are two-thirds as likely to graduate, but they also determined that remedial coursework may have a negative effect on students enrolled in 4-year institutions. After controlling for academic preparation, high school skills, and family background in a sample of approximately 7,000 students, Attewell et al. observed that remedial coursework surprisingly reduced the average likelihood that a student would graduate by 6% to 7%.

A summary of three studies that found similar results on the effects of remedial education concluded that “on the whole, such programs do not have much long-term influence on students’ success” (Schmidt, 2008, p. A18). Two of these three studies, all with large sample sizes, found that students who took remedial classes were less likely to complete a year of college or graduate when compared to similar students who did not receive remedial education (Calcagno &

Long, 2008; Martorell & McFarlin, 2007). The third study found mildly positive effects of remedial programs on transferring to a more selective college and earning a degree (Bettinger & Long, 2008), but as Martorell and McFarlin note, the study did not consider the differences between colleges and their remediation policies, thereby possibly overstating the positive effects of these programs.

Although recent research indicates remedial education is not particularly effective, these results do not undermine the importance of such programs to higher education. Remedial programs are directly connected to the larger postsecondary goal of student degree completion (Adelman, 2006). As Barefoot (2004) notes, "Over the past 20 years, few topics in American higher education have commanded as much attention from as many college and university administrators as student retention" (p. 9). Students who enter postsecondary education with lower academic credentials take a longer time to finish college (Choy, 2002), and efforts to improve persistence are hindered by the increasing number of students who enter with a high-risk profile. As Robbins et al. (2006) note, the key question is whether intervention can change the factors known to contribute to student success. They write:

Enrollment in remedial courses, tutoring, and other academic support programs are useful interventions for students lacking academic preparedness, but more research is needed to determine what, if any, interventions can help students who lack academic discipline or commitment to college. . . . (p. 614)

If funding for remedial education is to continue for academically high-risk students, then scholars and practitioners must discover programs and policies that help these students succeed.

THE ROLE OF MINDSET IN HELPING HIGH-RISK STUDENTS

In her work with first-year, high-risk students, Pizzolato (2004) found that students encountered numerous situations with peers or faculty members that highlighted their feelings of incompetence. When these students compared themselves to peers who were not considered high-risk, they struggled with feelings of deficiency. As one high-risk student commented, "It's difficult when you feel dumber than everyone in your class, but it's worse when a professor acts like you're dumb just because of who you are . . . without giving you a real chance" (Pizzolato, 2004, p. 431). Pizzolato observed that these feelings ultimately led high-risk students to feel a lack of control over their academic achievement.

Implicit theories of intelligence could be especially important for academically high-risk students, who struggle with a stigma associated with taking remedial classes or participating in special programs. Participating in activities perceived as remedial could induce a counterproductive attitude in which the student performs at a lower level because the student feels labeled as less intelligent. If

high-risk students believe intelligence is a fixed entity that cannot be changed, then programs designed to improve their academic achievement, motivation, and behavior may be impeded. However, changing the mindset of high-risk students by helping them understand intelligence as malleable may have the opposite effect: it may lead students to place more emphasis on effort and thereby improve their academic performance.

PURPOSE OF THE STUDY

In summary, current research suggests that mindsets create a personal framework in individuals that affects their goal orientations, effort attributions, and, ultimately, their behavior. Prior studies indicate that a growth mindset contributes to constructive responses and behaviors in students, while a fixed mindset can foster negative views of effort and a helpless response pattern. Scholars have demonstrated that interventions can promote a growth mindset, thereby fostering healthy views of effort and academic achievement.

Although such research on college students is promising, none of the current studies examine mindset in academically high-risk students or as a way to bolster the current effectiveness of remedial programs. Competence beliefs have a significant role in human agency, and there is a clear connection between students' perceptions of their competence and academic performance (Schunk & Pajares, 2005). Perceptions of academic competence are fragile, and membership in a group that is stereotyped as incompetent or academically inferior can negatively impact academic performance (Aronson & Steele, 2005). Moreover, the existing research suggests that students with a growth mindset attribute success to effort more than those with a fixed mindset, but no studies have empirically demonstrated that students with a growth mindset actually exert more effort. In other words, these studies emphasize the level to which success or failure is attributed to effort, rather than gathering data on the actual effort students report exerting. Therefore, the current study sought to address whether or not the participation of academically high-risk students in an intervention promoting a growth mindset fosters higher levels of academic effort and, ultimately, higher academic achievement.

METHODOLOGY AND RESULTS

The pretest-posttest control group design of this study compared groups on mindset and on the dependent variables of academic effort and academic achievement. High-risk, first-year students at a large private university in the southwestern United States were randomly assigned to participate in one of two groups during the 2009-2010 academic year. There were three research questions addressed by this study: (a) are there significant differences in mindset before and after students participate in a treatment condition (designed to promote a

growth mindset) and a control condition (intended to foster study skills); (b) are there significant differences in academic effort between students who participate in a mindset intervention and those who do not, after controlling for preexisting levels of academic effort; and ©) are there significant differences in academic achievement between students who participate in a mindset intervention and those who do not, after controlling for college entrance test scores and class rank?

Definition of Terms

The three most significant constructs in this study are: (a) mindset, (b) level of academic effort, and ©) academic achievement. The population consists of academically high-risk students in remedial programs. The following definitions explain these constructs and describe how they were measured and interpreted in this study.

Mindset

Mindset refers to the implicit beliefs people have about the malleability of intelligence. Individuals with a growth mindset view intelligence as malleable, but those with a fixed mindset believe intelligence is innate and unalterable. The three-item *Implicit Theory of Intelligence Scale* is used to determine the extent to which a student holds a growth or fixed mindset (Dweck et al., 1995). Only three items are used due to the unitary theme of the construct. Concerning reliability, the scale has a Cronbach's alpha of .94 to .98 and a test-retest reliability of .80 for a 2-week period. The three items in this measure are: (a) *you have a certain amount of intelligence and you really can't do much to change it*; (b) *your intelligence is something about you that you can't change very much*; and ©) *you can learn new things, but you can't really change your basic intelligence* (Dweck et al., 1995).

Level of Academic Effort

Six variables were used to capture unique aspects of academic effort: academic discipline, academic self-confidence, commitment to college, general determination, goal striving, and study skills. Each of these variables represents a scale on the *Student Readiness Inventory* (Peterson, Casillas, & Robbins, 2006). The *SRI* is a 108-item instrument comprising 10 scales. The instrument was designed to assist higher education institutions to identify and intervene with high-risk students.

Academic Discipline

Academic discipline (Cronbach's alpha = .83) is defined as the level of effort a student puts into his or her schoolwork and the degree to which the student is hardworking. *Academic self-confidence* (Cronbach's alpha = .83) represents the belief a student has in his or her ability to do well in school. *Commitment to college*

(Cronbach's alpha = .85) demonstrates the level of commitment a student has to persist in college and obtain a degree. *General determination* (Cronbach's alpha = .87) represents the amount a student strives to follow through on commitments and responsibilities. *Goal striving* (Cronbach's alpha = .84) is the strength of students' efforts to achieve stated goals or objectives. *Study skills* (Cronbach's alpha = .86) demonstrate students' ability to assess problems related to coursework, organize possible solutions, and complete assignments successfully (Robbins et al., 2006).

Academic Achievement

Academic achievement was operationalized as students' first-semester cumulative grade point average (GPA) obtained from university records.

Remedial Programs

Remedial programs, academic support programs, and developmental education are terms that are used interchangeably in this study to refer to the general category of specialized courses for students identified as high-risk.

Participants

To assess the impact of the intervention on students early in their college career, the sample for this study was all first-year students who were considered high-risk by the institution ($N = 190$) based upon college entrance scores and high school class rank percentile. Although the institution was selective in the admissions process (SAT scores for first-year students are typically between 1150-1200), high-risk students on average have SAT scores 200 points lower. These students were required by the institution to enroll in a remedial course designed to promote academic achievement. Of the 105 participants with usable data, 66.7% were female ($n = 70$) and 33.3% were male ($n = 35$). According to university records, 58% were European American ($n = 61$), 21.9% were Hispanic ($n = 23$), 12.4% were African American ($n = 13$), 3.8% self-identified as *other* ($n = 4$), 2.9% were Asian ($n = 3$), and 1% was Native American ($n = 1$). The treatment group had 60 participants, and the control group had 45 participants. This study was approved by the institution's IRB, and all students granted permission for their data to be used in this study.

Interventions and Data Collection

As an assignment for the remedial course, students were asked to engage in web-based activities designed to help them succeed. Students were randomly assigned to either a control website that taught study skills or a treatment website designed to teach students that intelligence can be improved. Students received a

pretest before spending four sessions on the website, with one session occurring each week. Students also completed a posttest at the end of all four sessions.

Each of the four sessions for the treatment condition consisted of a 15-minute online session designed to help students view intelligence as malleable. The four sessions were each comprised of these basic components: (a) a quote that illustrated a growth mindset of intelligence from a famous person in history; (b) questions posed to prepare students for engaging with a particular movie clip; (c) a movie clip that portrayed an issue related to either a fixed or growth mindset; (d) questions posed to help students reflect upon the movie clip they just watched; (e) a short video of a lecture about intelligence, the brain, and its malleability; (f) a summary of research pertaining to mindset; and (g) teaser questions that introduced the topic for the next session the following week. The themes and messages of the experimental condition were largely based on previous mindset intervention studies (Aronson et al., 2002; Blackwell, Trzesniewski, & Dweck, 2007; Chiu et al., 1997). These studies taught about the anatomy and function of the brain, used videos and articles to promote a growth mindset of intelligence, and attempted to convince participants that the brain can be strengthened like a muscle.

Each of the four sessions of the control condition consisted of a 15-minute online session designed to help students improve their study skills. The control website followed the same basic structure and used similar media as the experimental website to demonstrate that any differences between groups were due to content rather than the type of intervention experienced.

Data Analysis

Treatment Fidelity

Before examining the impact of a growth mindset intervention on academic effort and achievement, *t* tests were conducted to determine treatment fidelity—whether or not the growth mindset intervention did in fact lead to a significant change in the treatment group's view of intelligence. Table 1 summarizes the

Table 1. Paired Sample *t* Test Differences between Pretest and Posttest Mindset Scores

Group	<i>N</i>	Pretest		Posttest		<i>df</i>	<i>t</i>	<i>d</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Treatment	60	4.56	1.22	5.41	.837	59	−5.42***	.812
Control	45	4.70	1.24	4.70	1.33	44	.000	.000

Note: Pretest and Posttest = scores on the *Implicit Theory of Intelligence Scale*.

****p* < .001.

results of the t tests utilized to evaluate treatment fidelity. Students in the treatment intervention reported significantly higher scores in growth mindset from pretest to posttest. Students in the control group did not report significantly different mindset scores after the intervention.

Academic Effort

After establishing that a growth mindset increased for the treatment group but not for the control group, a one-way MANCOVA was conducted to determine the effect of a growth mindset intervention on academic effort in academically high-risk, first-year students. The pretest scores of academic discipline, academic self-confidence, commitment to college, general determination, goal striving, and study skills were used as covariates, and the type of condition (treatment or control) was used as the independent variable (see Tables 2 and 3). For all multivariate analyses, an alpha of .05 was utilized. For subsequent univariate analyses, Bonferroni's method was used to establish a more conservative alpha of .008 (Mertler & Vannatta, 2005).

The results indicated that the new multivariate variable labeled academic effort significantly differed between the treatment and control groups (Wilks' Lambda = .787, $F(6, 89) = 4.02$, $p < .01$, partial $\eta^2 = .213$; see Table 2). The growth mindset group had higher adjusted posttest mean scores across all of the dependent variables comprising academic effort except academic discipline.

In addition, univariate ANCOVAs were conducted for each individual dependent variable to ascertain which variables most contributed to the significant difference and large effect size of the multivariate variable (academic effort) between the two groups. Results in Table 3 indicate that of the six dependent variables, the growth mindset treatment condition only significantly affected the study skills variable.

Academic Effort and Conditional Effects

Further data analysis was conducted to examine conditional effects of the growth mindset intervention based on gender and race. Conditional effects were not part of the original research questions, so efforts were not taken to ensure even distribution among groups by gender and race beyond randomly assigning each student to the treatment or control intervention. Nonetheless, to gain an estimate of conditional effects, separate one-way MANCOVAs were conducted to determine the effect of a growth mindset intervention on academic effort in European American students, students of color, males, and females. The pretest scores of the six variables comprising academic effort were used as covariates, and the type of condition (treatment or control) was used as the independent variable.

The results indicated that the multivariate variable academic effort significantly differed between the treatment and control groups for European American students (Wilks' Lambda = .732, $F(6, 47) = 2.87$, $p < .01$, partial $\eta^2 = .268$) and

Table 2. Multivariate Analysis of Covariance of Posttest Academic Effort as a Function of Treatment Condition

Source	Univariate							
	Multivariate		Academic discipline		Academic self-confidence		Commitment to college	
	<i>F</i> (6, 89)	η^2	<i>F</i> (1, 94)	η^2	<i>F</i> (1, 94)	η^2	<i>F</i> (1, 94)	η^2
Condition	4.02**	.213	1.23	.013	3.85	.039	.089	.001
Pretest academic discipline (covariate)	15.08***	.504	71.07***	.431	.228	.002	.084	.001
Pretest academic self-confidence (covariate)	33.34***	.692	.838	.009	159.55***	.629	.102	.001
Pretest commitment to college (covariate)	45.98***	.756	1.21	.013	2.02	.021	186.42***	.665
Pretest general determination (covariate)	10.95***	.425	1.48	.015	1.53	.016	.589	.006
Pretest goal striving (covariate)	12.09***	.449	.361	.004	7.33**	.072	.002	.000
Pretest study skills (covariate)	17.55***	.542	3.03**	.031	.799	.008	.268	.003

Note: Multivariate *F* ratios were generated from the Wilks' Lambda statistic.

p* < .05; *p* < .01; ****p* < .001.

Table 3. Multivariate Analysis of Covariance of Posttest Academic Effort as a Function of Treatment Condition

Source	Univariate							
	Multivariate		General determination		Goal striving		Study skills	
	$F(6, 89)$	η^2	$F(1, 94)$	η^2	$F(1, 94)$	η^2	$F(1, 94)$	η^2
Condition	4.02**	.213	.382	.004	.059	.001	14.33***	.132
Pretest academic discipline (covariate)	15.08***	.504	8.09**	.079	.326	.003	.080	.001
Pretest academic self-confidence (covariate)	33.34***	.692	.682	.007	2.44	.025	.223	.002
Pretest commitment to college (covariate)	45.98***	.756	.003	.000	1.66	.017	.030	.000
Pretest general determination (covariate)	10.95***	.425	43.53***	.316	4.18*	.043	1.12	.012
Pretest goal striving (covariate)	12.09***	.449	.040	.000	31.83***	.253	.178	.002
Pretest study skills (covariate)	17.55***	.542	1.91	.020	2.84**	.029	92.01***	.495

Note: Multivariate F ratios were generated from the Wilks' Lambda statistic.

* $p < .05$; ** $p < .01$; *** $p < .001$.

females (Wilks' Lambda = .718, $F(6, 54) = 3.53$, $p < .01$, partial $\eta^2 = .282$). Adjusted means for the two groups revealed that the growth mindset group had higher adjusted posttest mean scores across all of the dependent variables for European American students. For females, the growth mindset group had higher adjusted means for academic self-confidence, general determination, and study skills.

Univariate ANCOVAs were conducted for each individual dependent variable to ascertain which variables most contributed to the significant difference and large effect size of the multivariate variable (academic effort) between the two groups. Of the six dependent variables, the growth mindset treatment condition significantly affected academic self-confidence and study skills for European American students and study skills for females. When conducting MANCOVAs on males and students of color, respectively, no significant differences were found for the multivariate variable. Therefore, univariate ANCOVAs were not analyzed.

Academic Achievement for Semester

A one-way ANCOVA was conducted to determine if there were significant differences in academic achievement between the two groups. *Academic index* was used as the covariate—a score the institution derives by converting SAT scores and high school class rank to 100-point scales, respectively, and adding the two numbers for each student.

The results indicated that academic achievement did not significantly differ between the treatment and control groups, $F(1, 96) = 2.41$, $\eta^2 = .024$. The control group ($M = 3.08$, $SE = .086$) had higher adjusted posttest mean scores than the treatment group ($M = 2.90$, $SE = .074$), but this difference was not significant. There was no significant difference in academic index scores before the intervention between the two groups.

DISCUSSION AND IMPLICATIONS

Programs, practices, and policies colleges employ to increase the effort of students are critical to student success. Although scholars have previously found a positive effect of mindset on college students' ability to overcome stereotype threat and seek remedial assistance, the research in this study is the first attempt to empirically explore the effects of a mindset intervention on academic effort or with academically high-risk students. Specifically, the current study sought to address whether or not participation of academically high-risk students in an intervention promoting a growth mindset fostered significantly higher levels of academic effort and academic achievement. Results indicated that a growth mindset can influence effort behaviors in both a statistically and practically significant manner, but no effect on achievement was found. Furthermore, results revealed conditional effects that have not been found in other studies. Overall,

the findings of this study are somewhat surprising when compared to the literature and provide stimulus for further research on mindset with college students.

Mindset

As expected, the control group's mindset did not change from the pretest to the posttest. These findings confirm the stability of mindset as a construct and support other research that measured the mindset of college students at different intervals without applying any intervention (Robins & Pals, 2002). The treatment group's mindset changed significantly from pretest to posttest ($p < .001$, $d = .812$), affirming one of this study's hypotheses and indicating treatment fidelity. These results also confirm the findings of other studies demonstrating that even though mindset is a stable construct, it can be changed in college students through intervention and in a relatively short amount of time (Aronson et al., 2002; Hong et al., 1999).

Academic Effort

The most significant finding of this study is that a growth mindset did lead to increased academic effort in these college students. A MANCOVA analysis on six related variables revealed that there was a significant difference ($p = .001$) with a large effect size (partial $\eta^2 = .213$) between the treatment and control groups in academic effort, with the treatment group reporting higher levels of academic effort than the control group. The large effect size indicated that 21.3% of the variance in academic effort in these students can be explained by the growth mindset treatment intervention.

Study Skills

Of the six related variables comprising academic effort in this study—academic discipline, academic self-confidence, commitment to college, general determination, goal striving, and study skills—univariate analyses indicated that only the study skills component was significantly higher for the growth mindset group. In other words, although there was a significant difference between the two groups in the combination of variables that defined academic effort in this study, the study skills variable reflected the majority of that difference ($p < .001$; partial $\eta^2 = .132$). Although study skills highly correlate with the other five variables (Robbins et al., 2006), the lack of significance across the remaining five scales is surprising and indicates that the growth mindset intervention had more of an influence on changing the academic behaviors of students than on increasing their overarching internal motivation. Therefore, a mindset intervention may be best suited as one component of a broader academic intervention meant to increase effort in college students.

These results also present a certain level of irony, however, when considering the nature of how the study was implemented. To establish that any effects of the mindset intervention were due to content as opposed to the extra attention students received through an added intervention, the control group participated in a study skills intervention that mirrored the mindset treatment. Interestingly, the findings indicate that students who were encouraged to view intelligence as malleable reported employing study skills significantly more than the students who were directly taught study skills. A growth mindset appears to lead students to engage in the academic tasks presented to them in significantly different ways and at a level that goes beyond what typical remedial courses foster.

Such results warrant further exploration. Perhaps a growth mindset provided a seed of a belief that effort could make a difference in helping students reach goals and succeed. However, continuing with the metaphor, this seed was a new thought that had only begun to germinate. In other words, planting this seed did not change students' self-conceptions immediately, especially considering that self-theories develop over many years. But the new mindset, even in such a relatively short amount of time, made enough of an impact to change some of the effort behaviors these students exhibited. This new possibility of viewing themselves led these students to implement the study skills they were asked to utilize.

Conditional Effects for Academic Effort

Examination of the conditional effects of the intervention indicated that the growth mindset content had the greatest impact for European American students and females. These conditional effects are surprising, especially in the context of other mindset research. The results comparing the females in the treatment and control conditions mirrored the results of the entire sample, with a significant difference and large effect size found for both the multivariate variable of academic effort ($p < .01$, partial $\eta^2 = .282$) and the univariate variable of study skills ($p < .01$, partial $\eta^2 = .176$). This significant difference did not remain when only examining males. These findings confirm the difficulty of increasing the engagement of males as found in the literature on male disidentification with academics (Blazina, 1997; Cokley, 2002; Osborne, 1995). Other mindset studies on college students, however, did not find a significant difference in effects based upon gender (Chiu et al., 1997; Robins & Pals, 2002). Future research can determine whether or not mindset interventions affect males and females in significantly different ways.

In addition to differences in academic effort ($p < .05$, partial $\eta^2 = .268$) and study skills ($p < .01$, partial $\eta^2 = .150$), European American students in the growth mindset condition also had significantly higher academic self-confidence ($p < .01$, partial $\eta^2 = .131$) than European-American students in the control group. The significant difference in academic effort between the treatment and control

conditions did not remain when examining students of color. Although Aronson and colleagues (2002) found conditional effects with mindset and race, their results indicated greater impact from the mindset intervention on African-American students than on European Americans. Once again, the results from this study are surprising when considering the findings of similar studies. Other studies have particularly highlighted the positive influence a growth mindset intervention can make for students of color, helping them overcome the stereotype threats they encounter in their educational experiences (Aronson et al., 2002; Aronson & Steele, 2005). Therefore, although it is disappointing that the growth mindset intervention did not significantly increase the effort of students of color when compared to the control group, stereotype threat may help explain why such students' efforts may be harder to change (Purdie-Vaughns, Steele, Davies, Dittmann, & Crosby, 2008). If these students had faced years of negative stereotypes due to their race, then a short mindset intervention may not have enough power to undo those negative consequences.

Academic Achievement

The change in academic effort from the 4-week mindset intervention did not make a statistically significant difference in grades between the two groups. Blackwell and colleagues (2007) found a statistically significant difference in grades between a growth mindset and control condition in seventh graders. Additionally, utilizing a college student population, Aronson and his colleagues (2002) found a significant difference in grade point average with their controlled experiment utilizing a mindset intervention. However, the difference in grades was only statistically significant among African Americans. There were not enough African Americans in this study to compare groups on this condition, but secondary analyses comparing all students of color did not reveal any significant differences in academic achievement.

The present research hinges upon the link between academic effort and achievement found extensively in the literature (Pascarella & Terenzini, 2005; Robbins et al., 2006). Assuming such a link does exist, the fact that the experimental group with the mindset intervention reported a significant increase in academic effort without a subsequent increase in achievement is peculiar. Although only a few studies reported an increase in grades as a result of a mindset intervention, their findings were enough to warrant a similar expectation for this study.

Analyzing the intervention methods used in other studies may explain the inconsistency of this study's results. Blackwell and her associates (2007) utilized eight 25-minute computer sessions 1 week apart from each other, totaling 200 minutes. Aronson and colleagues (2002) utilized three 1-hour laboratory sessions 10 days apart, totaling 180 minutes. Both studies had participants spend a considerably longer amount of time on the intervention when compared to the four 15-minute online sessions that totaled 60 minutes in this study. Perhaps more time

or a longer intervention is needed before a significant difference in grades results from the increased effort found in this study. Therefore, future research should address not only the role a growth mindset intervention plays in boosting academic effort, but also how to sustain such an increase in effort so that it makes a meaningful difference in academic achievement.

Limitations of the Study

This study utilized an experimental design with random assignment, one of the most rigorous approaches available to researchers (Creswell, 2005). The design is considered the “gold standard” of educational impact studies (Song & Herman, 2010), allowing the researcher to draw conclusions about cause and effect between the independent and dependent variables. However, this study has limitations that should be considered when interpreting and applying the findings. One limitation of this study is that the instruments measuring mindset and academic effort rely on the self-reporting of data. Reliance on self-reports is an accepted practice for research conducted in the social sciences, but self-reports are nevertheless open to challenges.

Although this study was designed to minimize compromises in drawing appropriate conclusions from the results, threats to internal and external validity may affect the findings. Mortality poses the greatest threat to internal validity, as 85 students dropped out of both groups in the study due to not completing the pretest, the posttest, or all four sessions for the treatment or control groups. No concerning differences between the participants who completed the study and those who dropped out were detected. Regarding external validity, the participants in this study are not representative of the entire college population within the United States. The students in this study were traditionally aged, academically high-risk, first-year students. Therefore, results may differ for students at other institutions, students with other classifications or ages at the same institution, students in other programs, or students who are not considered academically high-risk.

Implications for Future Research

The results and limitations of this study lead to several suggestions for further research. First and foremost, the findings of this study reveal the worthiness of additional investigations on the effect of mindset on academic effort in college students. Broadening this scope includes conducting similar research at other institutions and with other populations.

As the number of colleges and universities that utilize first-year experience programs continues to increase (Kuh et al., 2005; Robbins, Oh, Le, & Button, 2009), it is worth examining how a mindset intervention could amplify current efforts to promote student success in these programs. It may also be worth observing the impact of a mindset intervention in programs designed for the brightest students, such as honors programs. Studying honors programs would

help determine if having a fixed view of intelligence is as destructive with high-achieving students as with academically high-risk students. The conditional effects found in this study are contrary to the findings of previous research. Therefore, further research should intentionally explore conditional effects of a mindset intervention based upon gender, race, and other relevant subcategories that comprise social identity.

Future studies can also determine if longer mindset interventions have an even more significant impact on college student outcomes. Additional studies could analyze the effects of incorporating the growth mindset material into the course curriculum, perhaps extending the intervention to the entire semester. Moreover, as the effects on academic effort were mostly driven by academic skills, longitudinal studies would provide information on how mindset may also affect general motivation and academic achievement in college students.

This study's interventions highlight the possibilities of online programs utilized to intervene with and improve college student success. Future research can further explore how online delivery potentially increases the accessibility, distribution, and customization of such interventions. Finally, qualitative investigations into how implicit theories of intelligence influence the student attributes related to academic success could help to uncover how a fixed or growth mindset impedes or amplifies motivation.

Implications for Current Practice and Policy

As Robbins and colleagues (2009) note, "Millions of dollars are being spent on intervention strategies to promote educational success that may or may not be helping" (p. 1164). Findings from their meta-analysis indicated that academic skills interventions have the strongest effect on academic performance outcomes, and self-management interventions have the strongest effect on retention. Though this meta-analysis did not include remedial intervention programs for academically high-risk students, joining these findings with the present study provides a framework for the type of interventions that are most likely to be effective and that are most worthy of institutional investment.

The results of this study are relevant for any campus administrator who works directly or indirectly toward helping students succeed in terms of their retention, engagement, achievement, and development. As previous research has shown the importance of academic effort to the educational process, these results offer an additional method for improving effort in students, especially those who are most at-risk for failure in college. What Astin (1985) noted almost three decades ago is still relevant today: "The effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase student involvement" (p. 36). Increasing the motivation of students is a difficult task; this study demonstrates that teaching students a growth mindset is a worthy avenue for improving their motivation toward

their academic experiences, but scholars and practitioners need to find ways to sustain such improvement.

At minimum, these findings call for higher education administrators to be more aware of how the beliefs students possess concerning themselves may influence their academic behavior and success. If assistance offered by an institution is filtered by a student's self-theory, and if that self-theory conveys that he or she cannot change internally in meaningful ways, then attempts to help may be wasted. In other words, administrators would be unwise to try and alter the external behaviors of students without also paying attention to their internal mental frameworks.

Accordingly, a question for faculty, staff, and campus leaders likely develops: How can we promote a growth mindset in students on our campus? Programs, policies, and curricular endeavors can help establish and affirm a growth mindset in college students. Some of these methods may certainly be the creation of new programs aimed to promote a growth mindset, but faculty and staff can also be keenly aware of opportunities to incorporate growth mindset curriculum in the programs and interventions that currently exist, thereby utilizing a growth mindset as an amplifying loop to increase the benefit of evidence-based interventions.

Considering the context of this study, the results are especially relevant to policies and programs related to remedial programs. If higher education institutions, in addition to state and federal governments, desire the maximum benefit from developmental education, then administrators can interweave a growth mindset intervention into current programs. The academic skills that remedial programs teach could be blocked by mental filters students possess that tell them they cannot change in significant ways. A growth mindset removes these filters, helping students see that change is not only possible, but also worth the effort. Remedial programs will maintain or increase their fiscal support only by demonstrating a greater impact upon student success; a growth mindset may be a contributing component in the ability of these programs to help students.

This study underscores the importance of understanding how mindset and self-theories shape student behavior and motivation. Attention should be turned to how interventions can influence and improve the self-theories of college students. Perhaps programs designed to foster student success can begin to utilize mindset interventions to remove unwanted filters that may be blocking students from changing in healthy ways. To help students succeed, colleges must change the way students think in addition to altering the way they behave. As Tagg (2003) noted, "If I believe that my IQ is my destiny, it will be—but only because I believe it" (p. 60). Mindset is especially important in a society where a fixed view of intelligence dominates (Dweck, 2006; Tagg, 2003). The first step toward improving the achievement of postsecondary students is to show them that they really can improve in fundamental ways. A growth mindset not only opens that door, but also encourages college students to walk through it.

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