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Effects of Psychosocial Factors on Gender Differences in First-Year College English and Mathematics Grades

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Abstract

This study assessed the role of motivation, social engagement, and self- regulation as psychosocial factors that might help serve to explain gender disparities in first-year college grades. The 10 scales captured by these factors were administered to entering freshmen from 57 postsecondary institutions (54% female, 46% male), and at the end of the school year, we also obtained data on their grades in English (N = 10,581) and mathematics (N = 2,887). After applying multilevel modeling that statistically controlled for pre-college achievement, differences in admission policy, and type of institution, results indicated that all psychosocial constructs (i.e., motivation, self-regulation, and, to a lesser extent, social engagement) explained gender gaps in first-year grades to a statistically significant extent. Specifically, increases in motivation and self-regulation traits were associated with a reduction in the gender gap in grades. Turning to interaction effects, these study data were generally unsupportive (i.e., no support for gender differences in grades being dependent on psychosocial skills), except in one isolated case: The psychosocial constructs *Commitment to College* – an aspect of motivation that gauged commitment to staying in college and pursuing a degree – was predictive of males having higher average mathematics grades than women. Conclusions have implications for gender-informed intervention policies aimed at improving college achievement.

Effects of Psychosocial Factors on Gender Differences in First-Year College English and Mathematics Grades

Research has suggested that, although boys and girls started kindergarten with approximately comparable test scores, gender gaps in English and mathematics begin to appear as they proceed through elementary, middle, and high school: girls generally outperform boys in English courses, while boys tend to perform better in mathematics and science (Dee, 2006; Robinson & Lubienski, 2011). These performance gaps also surface in pre-college standardized assessments; with male students obtaining better composite test scores (Bielinski & Davison, 200; DeMars, 2000; Liu & Wilson, 2009). Thus, at least on the basis of test scores, males entered college better academically prepared to excel in credit-bearing freshman year courses than females students and are less likely to require remediation (Combs, Slate, Moore, Bustamante, Onwuegbuzie, & Edmonson, 2010; Lichtenberger, Dietrich, & Southern Illinois University, 2012; Mattern, Shaw, & Marini, 2013; Smithwick-Rodriguez, 2011). However, research consistently shows that female students earn significantly higher grades in first-year credit-bearing college English and mathematics courses. A meta-analysis of 37 studies concluded that female students earned higher grades than male students in English courses (Young, 2001). Several other more recent studies have continued to support this finding (e.g., Conger & Long, 2010; Lorah & Ndum, 2013; Voyer & Voyer, 2014). In regard to college mathematics courses, Young (2001) concluded that, across 21 studies, female students earned better grades than male students in mathematics courses, a finding that confirmed prior observations (e.g., Bridgeman & Wendler, 1991) and aligned with subsequent studies (e.g., Ding, Song, & Richardson, 2007; Lorah & Ndum, 2013).

Whether in English or mathematics, these gender gaps may be rooted in different psychosocial behaviors in college. Psychosocial factors (PSFs) that affect regular attendance, doing homework, focusing on academic-related goals, or the overall classroom environment, could help explain gender differences in success to the extent that male and female students differ in these behaviors (Bembenutty, 2007; Newman, Groom, Handelman, & Pennebaker, 2008; Meece, Glienke, & Burg, 2006; Mori & Gobel, 2006; Sander, 2012). In addition to effects on homework and attendance, the PSFs could affect, through instilling better test-taking strategies, a stronger motivation to succeed, and a more positive perception of classroom and college environment (Crawford, & MacLeod, 1990; Fraser, Treagust, & Dennis, 1986). Studies have shown that college grades are correlated with a range of noncognitive psychosocial factors (e.g., Allen, Robbins & Sawyer, 2010; Bembenutty, 2007; Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Pintrich & Zusho, 2007), even above and beyond what is explained by traditional predictors of success (Robbins et al., 2006).

In addition to gender differences in course grades, multiple studies also provide evidence of gender differences in PSFs that might predict those grades. Meece et al. (2006) examined four theories of motivation (attribution, expectancy-value, self-efficacy, and goal-achievement) among college students and concluded that male students reported stronger abilities and interests in mathematics and science, whereas female students displayed higher confidence and interests in language arts and writing. Shekhar and Devi (2012) concluded that a statistically significant difference in achievement motivation exists between male and female college students. In a meta-analysis, Hyde, Fennema, Ryan, Frost, and Hopp (1990) found gender differences in self-confidence, with females

generally harboring more negative views. Other researchers have suggested that, as a consequence of gender stereotypes or school experiences, female students tended to rate their academic self-confidence in English and arts lower than male students, whereas male students exaggerated their abilities in mathematics and science, relative to female students (Meece et al., 2006; Rueben et al., 2013). Gender differences in other PSFs have been noted: females tended to outscore males in commitment in college (Barrow, Reilly, & Woodfield, 2009); they reported more anxiety than males (Ganley, Mingle, Ryan, Ryan, Vasilyeva, & Perry, 2013; Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013); and they exhibited better self-regulation of learning (Pintrich & Zusho, 2007).

Turning to more factors of academic success that are more distal than PSFs, affective and personality traits have been proposed as mediators of gender differences in English and mathematics grades. For example, Conger and Long (2010) noted that the gender gap in first-semester grades was explained by females' superior noncognitive skills (e.g., at least as captured indirectly through high-school grades); Ganley and Vasilyeva (2013) showed that anxiety was correlated with performance in mathematics; Kling, Noftle, and Robins (2012) noted that conscientiousness significantly mediated the differences between male and female grades in college. Often, studies that investigated either a mediation or a moderation effect of PSFs either focused on a single personality construct, based their data on pre-college K-12 assessments, or they paid little or no attention to the effect of institutional characteristics on students' chances of success – despite cumulating evidence of that effect (Sax, 1994; Rinn, 2004; Moller, Stearns, Potochnick, & Southworth, 2011). As a case in point, Young (2001) found smaller gender differences in grades in selective institutions, relative to other institutions,

suggesting the presence of an institution effect (e.g., range-restriction effects on gender differences at the high-end of the grading scale).

Objective of the study. This study extends current knowledge of PSFs that explain gender differences in success in first-year college courses. Success here is defined as obtaining a B or higher grade in first-year college English and mathematics courses. These are two courses often required of first-year college students, and they are critical in that doing poorly in these foundational courses are known to contribute to poor grades or even dropout in the future. Regarding the 10 PSFs we are examining individually to understand and predict gender differences in grades: We theoretically grouped these PSFs under the three broad constructs of motivation, self-regulation, or social engagement. These three broad constructs have been shown to correlate positively with college success (Le, Casillas, Robbins, & Langley, 2005; Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004). We statistically adjusted for the effects of institutional characteristics on student success by incorporating the type-of-institution (2-year or 4-year) and the institutional admission policy (selective or nonselective) into the model.

The mediation hypothesis. Our mediation hypothesis asserts that, on average, freshmen female students will exhibit better motivation, self-regulation, and social engagement than their male counterparts, and each of the 10 PSFs would be important in determining success in college English and mathematics courses (earning a B or higher grade). In other words, PSFs are the meditational mechanisms that explain gender differences in academic success.

Moderation analyses. In addition to the mediation hypothesis, we also offer a

moderation hypothesis that the power of PSFs to predict grades differs by gender; in other words, for each of 10 PSFs, there may be a gender-by-PSF interaction in predicting grades. Due to the scarcity of prior research of a similar nature, our moderation analysis is exploratory in nature. Although we examine very large data set that allows us to shed light on the nature of this hypothesized moderation effect, we have no *a prior* expectation about the PSFs that may be more important for one gender over the other.

Method

Participants

Data consisted of 10,581 and 2,887 students with first-year college grades in English, and mathematics, respectively. Students came from 57 distinct colleges or universities across the United States (35 4-year, 22 2-year), resulting in an average of 189 students in English courses per institution and 76 students in mathematics courses per institution. Only institutions with responses from at least 10 students were included in the analyses.

ACT classifies colleges or universities as either "Highly Selective" (i.e., accepts most of the top 10% high school graduates), "Selective" (accepts most of the top 25% high school graduates), "Traditional" (accepts most of the top 50% of high school graduates), "Liberal" (accepts some students from the lower 50% of high school graduates), or "Open" (accepts all high school graduates). Because of low frequencies of institutions within the highly selective categories, this study dichotomized admissions policies into selective institutions (i.e., "Highly Selective" and "Selective") and nonselective institutions ("Traditional," "Liberal," and "Open"), resulting in 12 selective and 45 nonselective institutions.

Demographic information was extracted from ACT assessment databases. A majority, 54%, of the students were females. This is representative of the total undergraduate fall enrollment in degree-granting institutions in the United States during the 2011-2012 academic year, which comprised 57% females and 43% males, 60.3% Whites, 14.9% Blacks, 15% Hispanics, 6.0% Asian, 0.3% Pacific Islander, 0.9% American Indian/Alaska Native, and 2.5% two or more races (National Center for Education Statistics, NCES, 2013). The participating institutions provided students' grades in first-year credit-bearing courses in English (N = 10,581) and mathematics (N = 2,887). Most students (96%) enrolled in Composition I as their English course; but students also enrolled in Composition II (2.7%), Literature (0.1%), and Speech/Rhetoric (1.2%). Most students (88.6%) enrolled in Algebra I as their mathematics course; but students also enrolled in Calculus (5.7%), Computer Science or Programming (1.9%), Pre-Calculus/Finite mathematics (3.3%), Statistics/Probability (0.3%), and Trigonometry (0.2%).

Measures

PSFs. Prior to enrollment (e.g., during orientation or online at home) or early in the first semester, each of the participating colleges administered a psychosocial instrument, now known as ACT Engage (ACT, 2012), to their students, using either online or in-class format. Students responded to 108 items on a 6-point Likert scale describing certain behaviors or beliefs, ranging from 1 (*Strongly Disagree*) to 6 (*Strongly Agree*). Item sums form ten scales (Table 1) that have been shown to differentially predict college performance and retention (Robbins et al., 2006; Le et al., 2005; Robbins et al., 2004). The 10 scales can be grouped into three broader domains: motivation, self-

regulation, and social engagement (ACT, 2012; Le et al., 2005). Motivation construct measures the personal characteristics that help students succeed academically by channeling their focus and energies on goal-driven activities. Social engagement measures interpersonal factors that influence students' successful integration into a college environment. Self-regulation construct assesses students' cognitive and affective processes involved in monitoring, regulating, and controlling behavior toward learning. Similar categorizations have appeared in the literature (Judge, Erez, Bono, & Thoresen, 2002; Meece et al., 2006), and further details on the PSFs in each domain and sample items are presented in Table 1. Additional technical and operational details concerning the survey instruments, including the interpretation of scores, and suggested interventions are provided in technical research reports available online (ACT, 2012; ACT, 2013a; ACT, 2013b).

Table 1

Definitions and Scales of Motivation, Self-Regulation, and Social Engagement

Domains	**Scales (Score Range)**	**Definition**	**Sample Item**
Motivation Personal characteristics that help students to succeed academically by focusing and maintaining energies on goal-directed activities	*Academic Discipline* (10 to 60)	The amount of effort a student puts into schoolwork and the degree to which a student sees him/herself as hardworking and conscientious.	I turn in my assignments on time.
	Commitment to College (10 to 60)	Commitment to staying in college and getting a degree.	I'm motivated to get a college degree.
	Communication Skills (10 to 60)	Attentiveness to others' feelings and flexibility in resolving conflicts with others.	In reaching an agreement, I consider the needs of others as well as my own needs.
	General Determination (11 to 66)	The extent to which one strives to follow through on commitments and obligation.	When I make plans, I follow through with them.
	Goal Striving (10 to 60)	The strength of one's efforts to achieve objectives and end goals.	I strive to achieve the goals I set for myself.
	Study Skills (12 to 72)	The extents to which students believe they know how to assess an academic problem, organize a solution, and successfully complete academic assignments.	I highlight key points when I read assigned materials.
Social Engagement Interpersonal factors that influence students' successful integration or adaptation into their environment.	*Social Activity* (10 to 60)	One's comfort in meeting and interacting with other people.	I make friends easily.
	Social Connection (11 to 66)	One's feelings of connection and involvement with the college community.	I have a sense of belonging when I am on campus.
Self-Regulation Cognitive and affective processes used to monitor, regulate, and control behavior related to learning.	*Academic Self-confidence* (12 to 72)	The belief in one's ability to perform well in college.	I'm a fast learner.
	Steadiness (12 to 72)	One's responses to and management of strong feelings.	I'm a patient person.

College grades. Grades are commonly used as measures of academic success in college. Traditionally, instructors assign final course grades to students based on some weighted combination of course exams, homework assignments, essays, and class participation relative to the course content. In assigning the grades, we presumed that instructors used reliable and construct valid measures of academic achievement such as those just mentioned (Allen, 2005) and abided by the institution's established grading policies and practices. As a measure of academic performance, first-year course grades can have critical cascading effects that ultimately lead to degree attainment, subsequent college plans (e.g., acceptance into graduate school), job placements (e.g., college transcripts can be used by prospective employers), self-esteem (e.g., good grades increases – and bad grades decreases – male and female students' self-esteem (Crocker, Quinn, Karpinski, & Chase, 2003), and a multitude of different decisions. Research suggests that students who obtain poor grades in their first year are more likely to struggle with subsequent courses; they are also much less likely to persist in their majors and earn a college degree (Allen & Robbins, 2008; Radunzel & Noble, 2012).

Consistent with other studies on the subject (e.g., Young, 2001; Lorah & Ndum, 2013; Westrick & Allen, 2014), we dichotomized individual grades to reflect a criterion of success (or failure). Success in a course was defined as a student having obtained a B or higher grade (i.e., a GPA of at least 3.00 on a 4.00 scale). The converse was classified as unsuccessful: grades of C, D, or F, or a withdrawal from a course (i.e., a grade of less than 3.0 on a 4.0 scale). This categorization was performed to reflect student's view of satisfactory academic success – students target higher grades and view a C or lesser grade as unsatisfactory. Radunzel and Noble (2012) showed that students who earned a B or

higher grade (GPA of 3.00 or more) had a better chance of completing a Bachelor's degree.

Procedure

Success was coded "1" if a student obtained a B or higher grade and coded "0" for a grade less than B. The data consist of students nested within institutions, a clustering effect that is appropriately analyzed with a two-level hierarchical linear model (Goldstein, 2003; Raudenbush & Bryk, 2002) to account for variation in success within institutions. Because multilevel mediation or moderation modeling accounts for the clustering of students within schools, it produces more accurate estimates (at least 20% less biased standard errors) than a single-level mediation model that ignores the clustering (Krull & MacKinon, 2001). In the current data set, students are at Level 1, and schools are at Level 2, where students are nested within schools. Correspondingly, Level 1 defines the student-level predictor variables, which comprise gender (GENDER: male = 1, female = 0), a PSF score (models were fit for each of the 10 PSFs), and ACT subject test score (English or mathematics). Level 2 was defined by both course type and institution codes (e.g., college algebra at college A is a different unit than calculus at college A). Level 2 predictors were institution type (TYPE: 4-year = 1, 2-year = 0) and admission policy (Selective: selective = 1, nonselective = 0). Thus, female students in 2-year nonselective colleges represent the baseline group. The PSFs and the ACT scores were institution-normalized to a mean of 0 and standard deviation of 1 before inclusion in the model.

Analytic strategy for mediation. Mediation analyses examined the extent to which male and female students differed in success as a result of gender differences in a

PSF which, in turn, affected success (Baron & Kenny, 1986; Kenny, Kashy, & Bolger, 1998; Wu & Zumbo, 2008). First, the existence of a mediation effect (indirect effect) was examined using parallel methods described in Baron and Kenny (1986), Kenny et al. (1998), and Wu and Zumbo (2008). Then, the mediation effect was estimated in accordance with methods proposed by MacKinnon and other researchers (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Ryu, West, & Sousa, 2009). Statistical significance of PSF mediation was tested by constructing a bootstrap bias-corrected confidence interval (BCCI) as described in MacKinnon, Lockwood, and Williams (2004), and Shrout and Bolger (2002).

Figure 1 captures the framework of the two-level mediation model. At Level 1, the success was expressed as a function of the effects attributable to the student's institution (random intercept), PSF, gender, and ACT subject test score. PSF score is a potential mediator of the gender effect. At Level 2, the institution effect was predicted from institution type and admissions policy (see Figure 1 for details).

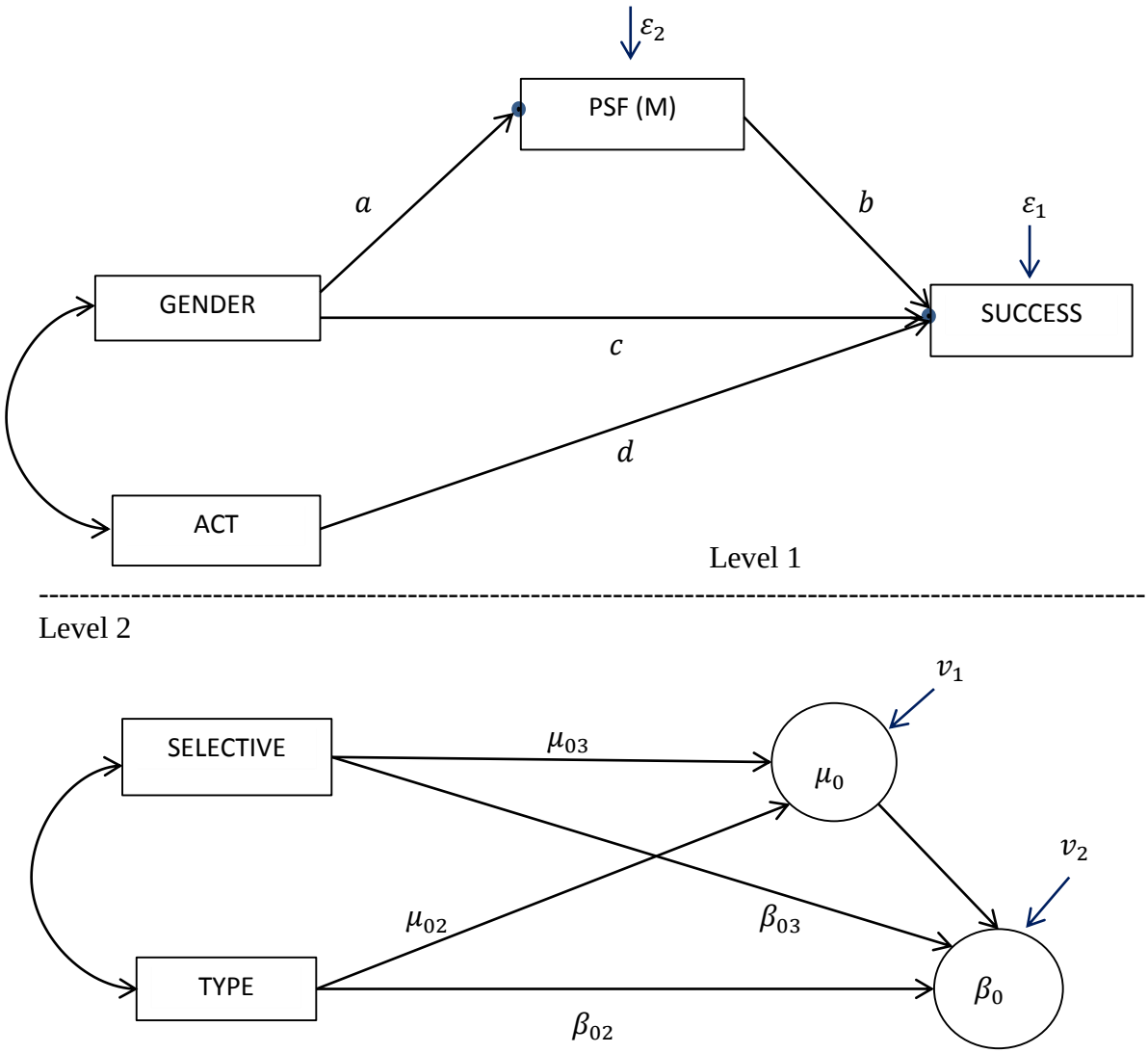

Figure 1. Multilevel mediation analysis of psychosocial factors (PSF) on gender difference in first-year college course success. Boxes represent observed variables, and circles denote latent factors.

The arrow from GENDER to PSF (path *a*) is estimated from a linear mixed effect model of PSF on GENDER, TYPE, and SELECTIVE. The arrows to *Success* are estimated from a mixed effect logistic regression model. Rectangles and circles represent the observed variables and latent variables, respectively, which are the estimated Level 1 and Level 2 intercepts and associated variances. The dots indicate random effect

specifications in the response variables PSF and SUCCESS. The bidirectional arrows indicate the correlations between the predictors. The letters a, b, c, and d represent parameters for the gender difference in PSF, the effect of a PSF on the probability of success, gender difference in the probability of success, and the effect of prior academic achievement (ACT) on the probability of success, respectively. The symbols, ε_2 and ε_2 denote residual variances in PSF scores and probability of success, correspondingly. At Level 2, the effects of institution type on PSF (μ_0) and probability of success (β_0) are given by the parameters μ_{02} and β_{02}, respectively. Similarly, the effect of admissions policy on PSF and probability of success are parameterized μ_{03} and β_{03}, respectively.

In line with research on mediation models (Baron et al., 1986; Kenny et al., 1998; MacKinnon et al., 2002; Preacher & Hayes, 2004; Wu et al., 2008; Ryu et al., 2009), the mediation (*indirect*) effect was estimated by ab, the product of *a*, and *b*. A *direct* effect of gender on success, which is independent of the effect of PSF on success, was denoted c. The sum of the direct and indirect effect estimates the *total* effect, *T*: $T = c + ab$. Statistical significance of the total effects is not requisite for evidence of mediation (Zhao, Lynch, & Chen, 2010; Rucker, Preacher, Tormala, & Petty, 2011.

Studies have suggested various methods of testing for the statistical significance of the meditation effect (MacKinnon et al., 2004; MacKinnon, Fritz, Williams, & Lockwood, 2007; Preacher & Hayes, 2004; Williams & MacKinnon, 2008; Shrout et al. 2002; Sobel, 1982). An assessment of these methods can be found in other papers (Briggs, 2006; Cheung, 2009; Hayes, 2009; Wu & Jia, 2013). In the current study, we tested the significance of the mediation effects by constructing an asymmetric bootstrap bias-corrected confidence interval (BCCI) (MacKinnon et al., 2004; Preacher & Hayes,

2004; see supportive simulation work by Briggs, 2006; Cheung, 2009; Williams & MacKinnon, 2008; Shrout et al. 2002). The BCCI is a nonparametric resampling technique that works by correcting for bias in median of the mediation estimates from the resamples. We generated 2000 samples of the original data, resulting in 2000 mediation estimates. The BCCI results are included in Table 4 and Table 5 for English and mathematics, respectively. Specifically, we conclude that a mediation effect was statistically significant (distinguishable from zero) if the *BCCI 95% Lower* and *BCCI 95% Upper* confidence limits did not include zero.

Analytical strategy for moderation. Moderation is equivalent to statistical interaction effects, and therefore moderation is fundamentally different from mediation. Baron and Kenny (1986) and Wu and Zumbo (2008) outlined research designs, conceptual differences, and statistical differences between mediation and moderation. In this study, the conceptual goal of the moderation analysis was to understand how gender differences in success depended on, or was influenced by, each PSF. This was achieved through testing for statistical significance of the interaction effect between gender and PSF in predicting success (i.e., does PSF predict success differently for females vs. males?). Given statistical significance for moderation, a follow-up analysis probed for dependence at specific levels of each PSF: 1 standard deviation below the mean (low), at the mean (*average*), and 1 standard deviation above the mean (*high*). Figure 2 presents the conceptual model for moderation at the student level (Level 1) and the institutional level (Level 2).

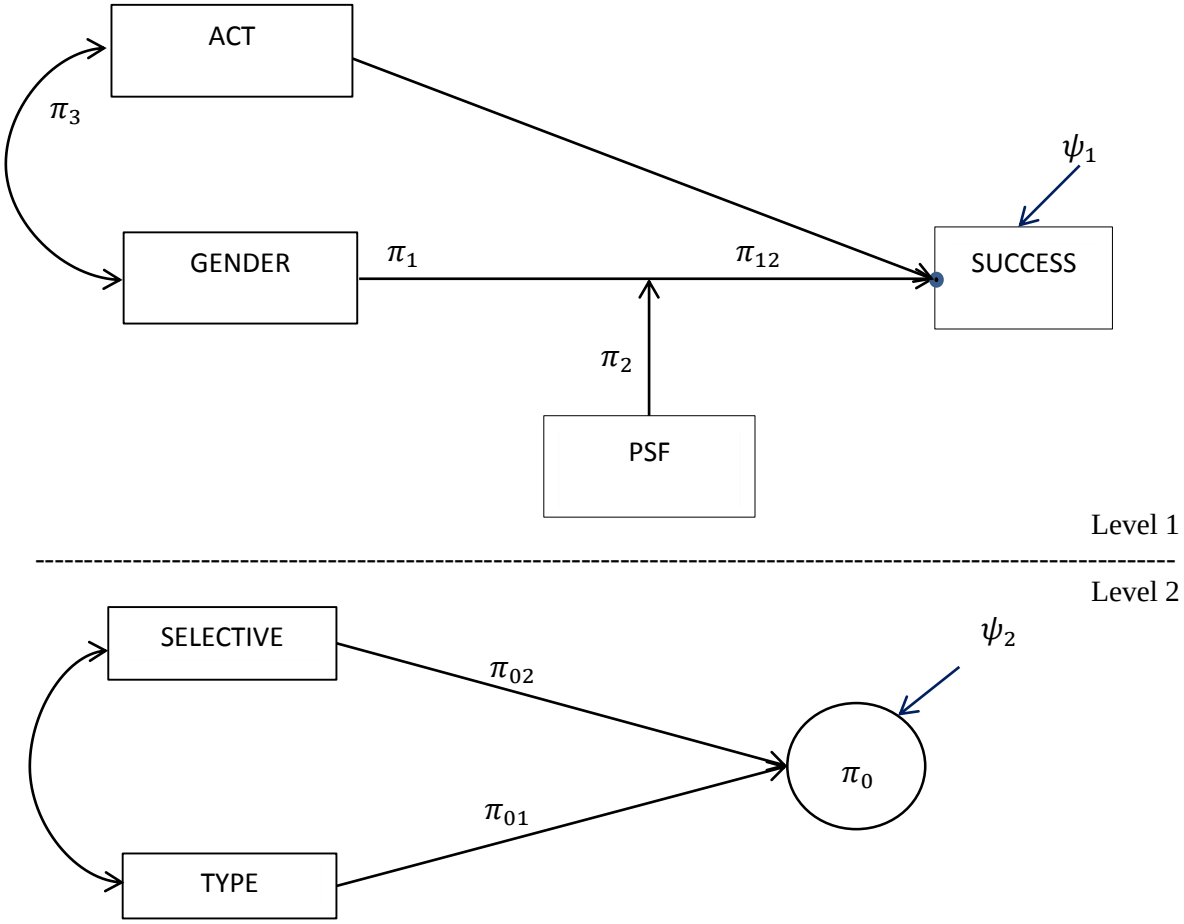

Figure 2. Model diagram for a two-level analysis to assess moderation effect of PSF on the gender gap in success. Boxes denote observed variables and circles represent unobserved or latent factors. The vertical arrow from PSF to the regression of SUCCESS on GENDER models the dependence of the gender gap on the PSF effect.

The parameters π_1 and π_2 represent the main effects of gender and PSF on the probability of success, respectively. The moderation effect was measured by the interaction term, π_{12}. The effect of prior academic achievement on the probability of success is denoted π_3. At level 1, ψ_1 symbolizes the residual variance associated with the probability of success. At level 2, π_{01} and π_{02} denotes the effects of type of institution

and its admission policy on average probability of success (π_0), with residual variance ψ_2.

Terms involving GENDER could be grouped and factored to the function, $(\pi_1 + \pi_{12}PSF) * \text{GENDER}$. Also referred to as the conditional effect of gender on success or simple slope for gender (Wu & Zumbo, 2008), the function estimated how much female students were expected to differ from male students at a specified value or level of a given PSF.

Results

Descriptive statistics. Table 2 shows sample estimates of alpha reliability for the 10 PSFs ranging from .77 (for Steadiness) to .91 (Study Skills) and a median value of .86, overall. These reliability indices are moderate to high, and they consistent with alphas reported in the ACT Engage User Guide and technical manual (range = .80 to .87; median = .84; ACT, 2012). Similarly, estimates by gender demonstrate comparable moderate-to-high internal consistencies across all PSFs.

Table 2

Reliability Estimates of Psychosocial Factors, Overall and by Gender

	Overall				Male		Female	
Domain	PSF	No. of items	*N*	*α*	*N*	*α*	*N*	*α*
Motivation	AD	10	7897	.87	3543	.88	4354	.86
	CC	10	7888	.84	3536	.84	4352	.81
	CS	10	7895	.79	3540	.79	4355	.77
	GD	11	7901	.86	3543	.87	4358	.84
	GS	10	7876	.87	3533	.88	4343	.85
	SS	10	7883	.91	3537	.91	4346	.90
Social Engagement	SA	10	7900	.88	3543	.88	4357	.88
	SC	11	7897	.87	3542	.88	4355	.86
Self-Regulation	ASC	12	7877	.78	3532	.78	4345	.78
	ST	12	7899	.77	3542	.77	4357	.77

Note. α (alpha) is the standardized Cronbach's coefficient alpha. AD – *Academic Discipline*, CC – *Commitment to College*, CS – *Communication Skills*, GD – *General Determination*, GS – *Goal Striving*, SS – *Study Skills*, ASC – *Academic Self-confidence*, ST – *Steadiness*, SA – *Social Activity*, and CS – *Social Connection*.

In support of the three overarching PSF constructs, we found that PSFs within the same domain correlated more strongly with each other than with PSFs from different domains. For instance, the motivation scales – *Academic Discipline, Commitment to College*, *Communication Skills*, *General Determination*, *Goal Striving*, and *Study Skills* – correlated more strongly with each other (average $r = .57$, with median $r = .59$, and range $r = .36$ to $.79$) than they were correlated with the other scales (average $r = .37$, with median $r = .37$, and range $r = .20$ to $.52$). Similar correlational patterns were observed among the PSFs in the social engagement and self-regulation domains.

Turning to an examination of readiness for college courses, a similar percentage of males (69%) and females (70%) met the ACT College Readiness Benchmark[1] (Allen, 2013) for English; however, more males (48%) than females (31%) reached the readiness benchmark for college mathematics, and the readiness percentages were lower overall for mathematics versus English readiness. However, as measured by ratings in the 10 PSFs, incoming female and male students showed unequal psychosocial readiness (Table 3), both in the English course data and in the mathematics course data. On average, females scored higher than males on all motivation and social engagement scales. The female advantage was most pronounced on the motivation scales, particularly Academic Discipline, Commitment to College, Communication Skills, and General Determination, where standardized mean differences were in the neighborhood of .35 to .55 standard deviations, favoring females. This would be considered small-to-medium effect sizes by conventional standards. For the self-regulation scales, the gender differences were very small.

All PSFs correlated positively with success in English, with *Academic Discipline* ($r = 0.23$, $p < .01$) and *Social Engagement* ($r = 0.04$, $p < .01$) having the strongest and weakest relationships, respectively. In mathematics, *Academic Discipline*, *Communication Skills*, and *General Determination* (three components of motivation), and *Academic Self-Discipline* (an aspect of self-regulation) correlated positively with success. Neither social engagement scale correlated with B or higher mathematics grades.

[1] The Benchmarks are scores on the ACT subject-area tests that represent the level of achievement required for students to have a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in corresponding credit-bearing first-year college courses.

Gender differences in success in English and mathematics courses.

Preliminary analysis showed that female students were 9-13% more successful than males in their English courses (75% versus 62%, respectively) and mathematics courses (48% versus 39%, respectively). Statistically adjusting for prior achievement (i.e., ACT subject test score) and taking into account differences due to the nature of the institution (4-year vs. 2-year) and selectivity of the institution's admission policy (selective vs. not selective), the logistic regression coefficient for gender (male=1, female=0) was -0.562 (se = 0.051, $p < .0001$) for success in English courses and -0.724 (se = 0.093, $p < .0001$) for success in mathematics. This serves as evidence of gender differences in English and mathematics courses, with females generally outperforming male students by odds of 75% to 106%.

Table 3

Statistics for each Psychosocial Factor by Gender and Grade for English and mathematics

		English (*N* = 10,581)				Mathematics (*N* = 2,887)			
		Male (*N* = 4,728)	Female (*N* = 5,853)		B or Higher	Male (N = 1,448)	Female (N = 1,439)		B or Higher
Domain	PSF	*M (SD)*	*M (SD)*	*d*	*r*	*M (SD)*	*M (SD)*	*d*	*r*
Motivation	AD	45 (8)	49 (7)	-0.56**	0.23**	44 (9)	49 (8)	-0.58**	0.21**
	CC	53 (7)	55 (6)	-0.38**	0.13**	52 (8)	55 (6)	-0.42**	0.03
	CS	49 (7)	52 (6)	-0.51**	0.10**	48 (7)	51 (6)	-0.42**	0.05**
	GD	56 (7)	59 (6)	-0.37**	0.12**	55 (8)	58 (6)	-0.36**	0.06**
	GS	50 (7)	52 (6)	-0.16**	0.07**	50 (7)	51 (6)	-0.16**	0.01
	SS	51 (9)	54 (9)	-0.26**	0.07**	51 (9)	53 (9)	-0.14**	0.03
Social Engagement	SA	43 (9)	44 (9)	-0.14**	0.04**	41 (9)	43 (10)	-0.14**	-0.03
	SC	50 (8)	52 (8)	-0.18**	0.11**	49 (8)	51 (9)	-0.21**	0.02
Self-Regulation	ASC	53 (9)	53 (9)	0.09**	0.11**	53 (10)	53 (10)	0.01	0.09**
	ST	50 (10)	50 (10)	0.03	0.06**	49 (10)	49 (10)	0.03	-0.01

Note. Mean (M), Standard Deviation (SD), and Correlation Coefficient (r) for each Psychosocial Factor (PSF). ** $p < .01$. *d* – (Cohen's d) statistics is the difference between the means in standard deviation units. AD – *Academic Discipline*, CC – *Commitment to College*, CS – *Communication Skills*, GD – *General Determination*, GS – *Goal Striving*, SS – *Study Skills*, ASC – *Academic Self-confidence*, ST – *Steadiness*, SA – *Social Activity*, and CS – *Social Connection*.

Mediation Results

For both courses, gender had a significant direct effect on grades, suggesting that male students considerably underperformed relative to female students, even after accounting for the effect of a psychosocial factor on grades. The direct effect of gender was smallest for the models using PSF scales from the motivation domain, particularly *Academic Discipline* (English: c = -0.344, se = 0.053, $p < .0001$; mathematics: c = -0.513, se = 0.097, $p < .0001$); and largest for the models using PSF scales from the self-regulation domain, particularly *Academic Self-Confidence* (c = -0.578, se = 0.051, $p < .0001$) in English and *Steadiness* (c = -0.722, se = 0.093, $p < .0001$) in mathematics.

English. On average, female students on average significantly outscored male students on 9 of the 10 PSF scales – with the exception of *Steadiness* (a = -0.027, se = 0.020, *ns*[2]), where both groups scored about the same (Table 4). In turn, each PSF significantly predicted the probability of success in English, with the exception of *Social Activity*. Overall, female students rated themselves more motivated and socially engaged than male students. For the self-regulation domain, females generally scored higher on *Steadiness* while males scored higher on *Academic Self-Confidence*.

All six PSFs of the motivation domain significantly mediated the gender difference in English: *Academic Discipline* (ab = -0.224, 95% BCCI [-0.248, -0.200]), *Commitment to College* (ab = -0.057, 95% BCCI [-0.070, -0.040]), *Communication Skills* (ab = -0.050, 95% BCCI [-0.066, -0.029]), *General Determination* (ab = -0.073, 95% BCCI [-0.085, -0.056]), *Goal Striving* (ab = -0.019, 95% BCCI [-0.026, -0.014]), and *Study Skills* (ab = -0.032, 95% BCCI [-0.042, -0.022]). Thus, motivation mediated

[2] *ns* – not significant, with p-value ≥ 0.05.

roughly 4 percent (*Goal Striving*) to 40 percent (*Academic Discipline*) of the total gender difference in success in college English (see Table 4).

Among the social engagement scales, only *Social Connection* (ab = -0.015, 95% BCCI [-0.015, -0.005]) significantly mediated the gender gap in success in English. *Social Connection* accounted for about 3 percent of the total gender difference in earning a B or higher grade on English. The study found no evidence that a student's *Social Activity* (ab = 0.002, 95% BCCI [-0.002, 0.008], *ns*) explained the achievement gap between male and female students in English.

Unlike *Steadiness* (ab = -0.002, 95% BCCI [-0.006, 0.000], *ns*), the *Academic Self-Confidence* (ab = 0.011, 95% BCCI [0.007, 0.018]) aspect of self-regulation significantly mediated the gender difference in success in English. *Academic Self-Confidence* accounted for roughly 2 percent of the overall gender disparity in success.

Mathematics. Five of the six PSFs, theoretically grouped under motivation, indirectly explained the gender gap in success: *Academic Discipline* (ab = -0.223, 95% BCCI [-0.272, 0.177]), *Communication Skills* (ab = -0.040, 95% BCCI [-0.066, -0.012]), *General Determination* (ab = -0.055, 95% BCCI [-0.083, -0.031]), *Goal Striving* (ab = -0.018, 95% BCCI [-0.034, -0.008]), and *Study Skills* (ab = -0.019, 95% BCCI [-0.034, -0.002]). The 95% BCCI of *Commitment to College* (ab = -0.024, 95% BCCI [-0.054, 0.002], *ns*) was very narrow and overlapped zero, showing lack of evidence of a mediation effect. As shown in Table 5, motivation accounted for about 3 percent (*Goal Striving* and *Study Skills*) to 31 percent (*Academic Discipline*) of the total gender difference in success in mathematics courses.

Neither of the PSFs related to social engagement (*Social Activity:* ab = 0.006, 95% BCCI [-0.001, 0.015], *ns; and Social Connection:* ab = -0.010, 95% BCCI [-0.023, 0.007], *ns*) nor self-regulation (*Academic Self-Confidence:* ab = 0.002, 95% BCCI [-0.003, 0.009], *ns*; *Steadiness*: ab = 0.001, 95% BCCI [-0.001, 0.005], *ns*) accounted for gender difference in mathematics. These effects were not significant either because male and female students did not considerably differ on the PSFs (as was the case with *Academic Self-Confidence:* a = 0.025, *se* = 0.037, *ns*) or that the PSFs did not significantly impact success in mathematics (as with *Social Activity:* b = -0.053, *se* = 0.045, *ns*; *Social Connection:* b = 0.046, *se* = 0.045, *ns*), or both (as with *Steadiness:* a = 0.025, *se* = 0.038, *ns;* b = 0.024, *se* = 0.044, *ns*). See Table 5 for details.

Initially, we hypothesized that all ten PSFs would indirectly explain gender differences in English and mathematics. The results partially supported the hypothesis, especially for the gender gap in English, where 9 of the 10 PSFs mediated the gender gap – the result for *Steadiness* ran counter to the stated hypothesis. For mathematics, 5 of the 6 scales from the motivation domain supported the hypothesis. However, the results for the self-regulation and social engagement factors did not support the hypothesis.

Table 4

Success in college English: Direct effect of gender and mediation effects of PSFs

		English (N = 10,581)							
					Mediation Effect				
Domain	PSF	Direct Effect (c)	a	b	ab	*BCCI 95% Lower*	*BCCI 95% Upper*	$c + ab$	$\lvert ab/T \rvert$
Motivation	Academic Discipline	-0.344**	-0.510**	0.440**	-0.224*	-0.248	-0.200	-0.568	0.399
	Commitment to College	-0.504**	-0.379**	0.150**	-0.057*	-0.070	-0.040	-0.561	0.101
	Communication Skills	-0.509**	-0.480**	0.104**	-0.050*	-0.066	-0.029	-0.559	0.088
	General Determination	-0.489**	-0.341**	0.213**	-0.073*	-0.085	-0.056	-0.562	0.129
	Goal Striving	-0.541**	-0.132**	0.147**	-0.019*	-0.026	-0.014	-0.560	0.035
	Study Skills	-0.527**	-0.236**	0.136**	-0.032*	-0.042	-0.022	-0.559	0.057
Social Engagement	Social Activity	-0.562**	-0.145**	-0.015	0.002	-0.002	0.008	-0.560	0.004
	Social Connection	-0.543**	-0.213**	0.070*	-0.015*	-0.021	-0.005	-0.558	0.026
Self-Regulation	Academic Self-confidence	-0.578**	-0.098**	0.114**	0.011*	0.007	0.018	-0.567	0.020
	Steadiness	-0.560**	-0.027	0.090**	-0.002	-0.006	0.000	-0.562	0.004

Note. If a confidence interval did not contain 0, it indicated a significant mediation effect. Significance: *p < .05, **p < .01. $c, a,$ and b represent path coefficients as in Figure 1. $\left|\frac{ab}{T}\right|$ is the absolute value of the mediation effect as a proportion of the total gender effect (where T = -0.562). Only estimates of the parameters related to mediation analysis were shown. Because the focus was on mediation at the student level, estimates of institutional level effects were not included. BCCI was derived from 2,000 simulations.

Table 5.

Success in college mathematics: Direct effect of gender and mediation effects of PSFs

		Mathematics (N=2,887)							
					Mediation Effect				
Domain	Scales	Direct Effect (c)	a	b	ab	*BCCI 95% Lower*	*BCCI 95% Upper*	$c + ab$	$\lvert ab/T \rvert$
Motivation	Academic Discipline	-0.513**	-0.523**	0.426**	-0.223*	-0.272	-0.177	-0.736	0.308
	Commitment to College	-0.701**	-0.378**	0.064	-0.024	-0.054	0.002	-0.725	0.034
	Communication Skills	-0.684**	-0.384**	0.104*	-0.040*	-0.066	-0.012	-0.724	0.055
	General Determination	-0.672**	-0.329**	0.167**	-0.055*	-0.083	-0.031	-0.727	0.076
	Goal Striving	-0.710**	-0.156**	0.118**	-0.018*	-0.034	-0.008	-0.728	0.025
	Study Skills	-0.705**	-0.218**	0.088*	-0.019*	-0.034	-0.002	-0.724	0.026
Social Engagement	Social Activity	-0.734**	-0.110**	-0.053	0.006	-0.001	0.015	-0.728	0.008
	Social Connection	-0.716**	-0.207**	0.046	-0.010	-0.023	0.007	-0.726	0.013
Self-Regulation	Academic Self-confidence	-0.722**	0.025	0.096*	0.002	-0.003	0.009	-0.720	0.003
	Steadiness	-0.727**	0.025	0.024	0.001	-0.001	0.005	-0.726	0.001

Note. If a confidence interval did not contain 0, it indicated a significant mediation effect. Significance: *p < .05, **p < .01.

$c, a,$ and b represent path coefficients as in Figure 1. $\lvert \frac{ab}{T} \rvert$ is the magnitude of the proportion of mediation effect in the total gender effect (where T= -0.724).

Only estimates of the parameters related to mediation analysis were shown. Because the focus was on mediation at the student level, estimates of institutional level effects were not included. BCCI was derived from 2000 simulations.

Moderation Results

Moderation is reflected in a statistically significant interaction between a PSF and gender in predicting success. Results are presented in Table 6. In English, none of the ten PSFs significantly interacted with gender, even though one or both of the variables significantly predicted success. In mathematics, only the relationship between gender (π_1= -0.710, *se* = 0.095, p < .0001) and *Commitment to College* (π_2= -0.059, *se* = 0.071, *ns*) resulted in a statistically significant interaction effect (π_{12}= 0.217, *se* = 0.094, p = .0215) on success. The statistical significance of the main effect of gender indicated that among the students who demonstrated average *Commitment to College*, male students had about 49% ($e^{-0.710} = 0.492$) odds of success in mathematics relative to female students, adjusting for the other variables in the model. This highlights a female advantage in success that existed even among students with normal levels of *Commitment to College*. However, the positive interaction coefficient showed that the gender gap in success dwindled with increasing *Commitment to College* scores, to the benefit of male students.

Further analysis to understand the nature of the interaction showed no evidence of dependence at *low*, *average*, and *high* levels of *Commitment to College* – it is feasible that a different choice of cutoff scores would have resulted in a different conclusion. Thus, although the gender gap in success depended on the students' *Commitment to College* (an aspect of motivation), the achievement gap did not depend on whether or not the students rated at *low*, *average*, or *high* levels of commitment.

Table 6

Moderation Effects of Psychosocial Factors on Gender Differences in Success at College English and mathematics

		English (*N* = 10,581)				Mathematics (*N*=2,887)			
		Male	PSF	Moderation Effect		Male	PSF	Moderation Effect	
Domain	PSF adjusted for	π_1	π_2	π_{12}	*se* (π_{12})	π_1	π_2	π_{12}	*se* (π_{12})
Motivation	Academic Discipline	-0.349**	0.466**	-0.048	0.052	-0.510**	0.447**	-0.038	0.098
	Commitment to College	-0.505**	0.167**	-0.030	0.050	-0.710**	-0.059	0.217*	0.094
	Communication Skills	-0.509**	0.101**	0.005	0.051	-0.681**	0.152*	-0.089	0.092
	General Determination	-0.489**	0.211**	0.003	0.051	-0.676**	0.109	0.105	0.092
	Goal Striving	-0.541**	0.147**	0.000	0.050	-0.711**	0.078	0.072	0.090
	Study Skills	-0.526**	0.126**	0.022	0.050	-0.705**	0.105	-0.035	0.090
Social Engagement	Social Activity	-0.562**	0.001	-0.032	0.050	-0.734**	-0.049	-0.010	0.089
	Social Connection	-0.543**	0.086*	-0.031	0.050	-0.716**	0.057	-0.022	0.090
Self-Regulation	Academic Self-confidence	-0.584**	0.151**	-0.075	0.050	-0.721**	0.157*	-0.123	0.090
	Steadiness	-0.558**	0.055	0.072	0.050	-0.727**	-0.015	0.081	0.089

Note. *p < .05. **p < .01. *se* – standard error. The reference subgroup for gender was female students.

Discussion

Gender gaps in academic achievement have been observed for both standardized test scores and course grades. In English, there is overwhelming evidence that female students generally outperformed male students on both standardized tests and grade outcomes (cf. Bridgeman & Wendler, 1991; Conger & Long, 2010; Lorah & Ndum, 2013; Ning et al., 2010; Vrugt, Oort, & Waardenburg, 2009). In mathematics, studies showed that male students outscored female students on standardized tests (Bielinski and Davison, 2001; Liu & Wilson, 2009), whereas female students earned an equal (Lindberg, Hyde, Petersen, & Linn, 2010; Mikyake et al., 2010; Weinberger, 2005) or even better course grades (Bridgeman & Wendler, 1991; DeMars, 2000; Ding et al., 2007; Lorah & Ndum, 2013; Young, 2001).

The current research expanded the spectrum of potential explanatory PSFs for these findings, adjusting for the effect of pre-college achievement, and the type and admission policies of the college the student attended. Specifically, this study examined the mediation and moderation roles of ten PSFs on gender differences in college English and mathematics grades, while adjusting for the effects of the corresponding ACT subject test (taken in the high school), type-of-institution (4-year or 2-year), and its admission policy (selective or non-selective). Although assessed individually, the 10 PSFs were conceptually grouped into three broader domains: motivation, social engagement, and self-regulation (see Table 1 and ACT, 2012). The 10 PFSs have been shown to predict academic success and retention (Robbins et al., 2006; Le et al., 2005; Robbins et al., 2004).

In English courses, results showed that motivation, self-regulation, and to a lesser extent social regulation, partially explained the gender gap in course success. In mathematics, five of the motivation constructs, *Academic Discipline*, *Communication Skills*, *General Determination*,

Goal Striving, and *Study Skills* (all except *Commitment to College*) mediated the gender effect. Specifically, females rated significantly better than males on each of these PSFs, which, in turn, was associated with better chances of success in college mathematics. None of the PSFs grouped under social engagement or self-regulation helped account for the gender gap in mathematics.

Percentage of mediation. Attributes grouped under motivation had the largest mediation effects on gender gaps in English and mathematics. The last columns of Table 4 and Table 5 show each PSF mediation effect as a percentage of the total gender effect (|ab/T|×100%) in English and mathematics, respectively.

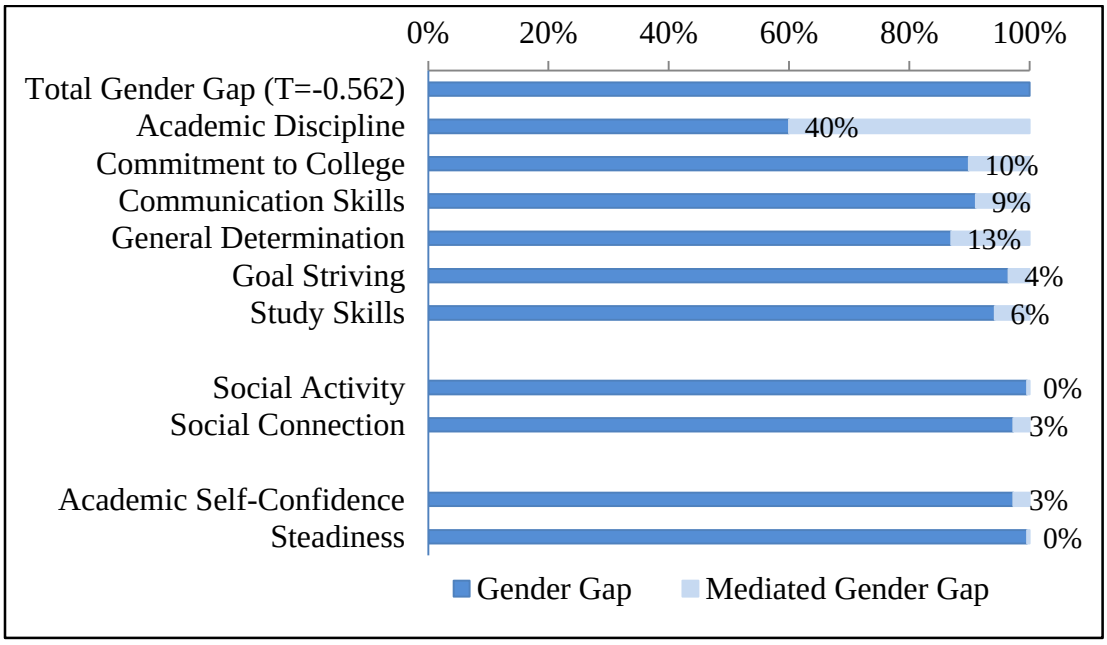

Figure 3. PSF mediation as a percentage of total gender gap in first-year English courses.

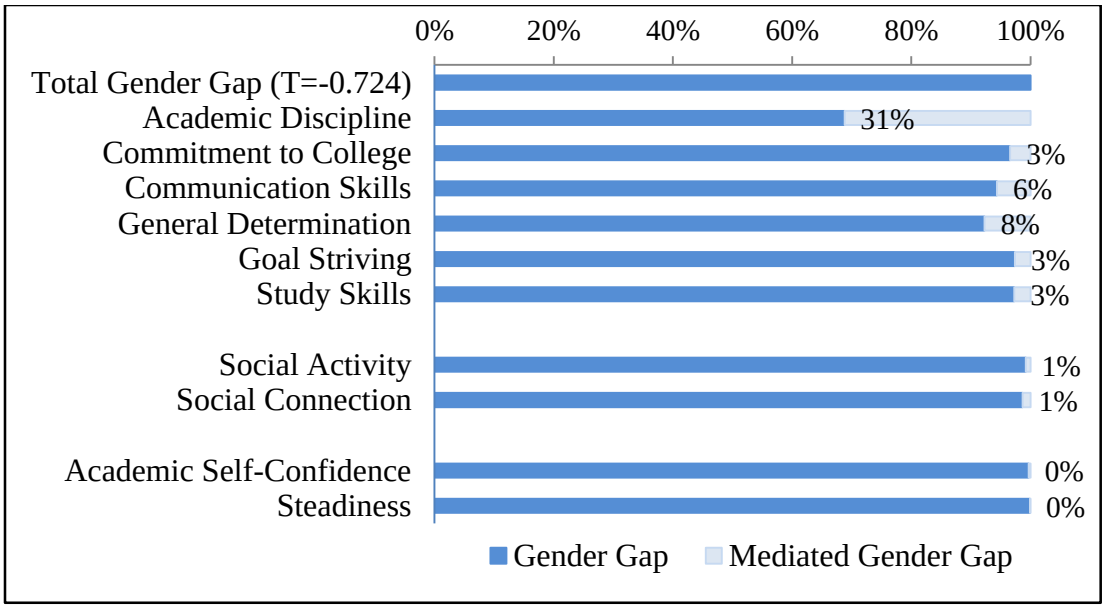

Figure 4. PSF mediation as a percentage of total gender gap in mathematics.

Among all ten psychosocial factors, *Academic Discipline* – a motivation trait that assessed the amount of efforts a student put into their academic-related work and the perception of themselves as hardworking and conscientious – explained the largest portion of the gap. Results showed that *Academic Discipline* explained about 40% of the total gender gap in English (Figure 3) and 31% in mathematics (Figure 4), far larger than any other PSF assessed. Female students self-rated more academic-disciplined than male students, a finding consistent with prior research in related contexts (e.g., Bembenutty, 2007; Duckworth & Seligman, 2006). This finding has been observed at earlier ages: Duckworth and Seligman (2006) suggested that 8th grade girls earned better grades partly due to their advantage in self-discipline. Students with higher *Academic Discipline* are more motivated to attend classes, have a positive view of their academic abilities, do their homework, and participate more in classwork and many other activities that directly impact academic performance.

In regards to the facets of Social engagement: *Social Connection* mediated, but did not moderate, gender gap in English. Due to its non-significant impact on success, *Social Activity* did

not mediate the gender gap in English. Neither *Social Connection* nor *Social Activity* mediated or moderated gender differences in mathematics, mainly because the attributes did not have an effect on the students' chances of success. When students feel connected and involved in a college community, they identify with the college, easily adjust to college environment, and develop healthy peer relationships, resulting in stronger support network (cf. Schussler & Fierros, 2008). It is plausible that these qualities of social connection increased confidence in self-expression that was beneficial to their English language skills, but not their Mathematical abilities. Meanwhile, the finding that *Social Activity* did not mediate the gender gap lends some credence to the logic that meeting and interacting with other people might distract students from their academic-related work, especially when done repeatedly. *Social Activity* was not predictive of success in either subject area (see Table 4 and Table 5).

Although self-regulation has been shown to be an important factor in his or her academic success (Pintrich & Zusho, 2007), our empirical findings show that self-regulation only partially explained the gender disparity in performance in English and had no explanatory effect in mathematics. Specifically, *Academic Self-Confidence* explained a small portion (about 3%) of the observed gender difference in English but not in mathematics – primarily because male and female students did not differ in self-regulation in the mathematics sample. On average, we observed that on average, male students scored equally or slightly better than female students on *Academic Self-Confidence* (Table 3). The gender gap in self-confidence has been called a "confidence gap" (Kay & Shipman, 2014), and reported in previous studies (Hyde et al., 1990; Meece et al., 2006; Rueben, Sapienza, & Zingales, 2013). The relatively small size of the effect *Academic Self-Confidence* on course success might be attributed to the small confidence gap at the onset of college, as self-confidence was important to academic success. Meanwhile,

Steadiness, a construct that expressed a student's responsiveness and management of strong feelings, did not explain why male and female students performed significantly different in either English or mathematics. Gender differences on Steadiness were very small, and the effect of Steadiness on success in mathematics was not significant.

The study did not find any significant moderation effect of motivation, self-regulation, or social engagement on gender gaps in English, suggesting that the explanatory effect of the PSFs on gender disparities in English did not depend on a particular PSF rating level. However, the size of the gender gap in mathematics depended on *Commitment to College*, albeit the sole psychosocial factor not to have mediated gender difference. To further explore the nature of dependence of the gender gap on *Commitment to College*, we plotted the predicted probability of success against scores on *Commitment to College*.

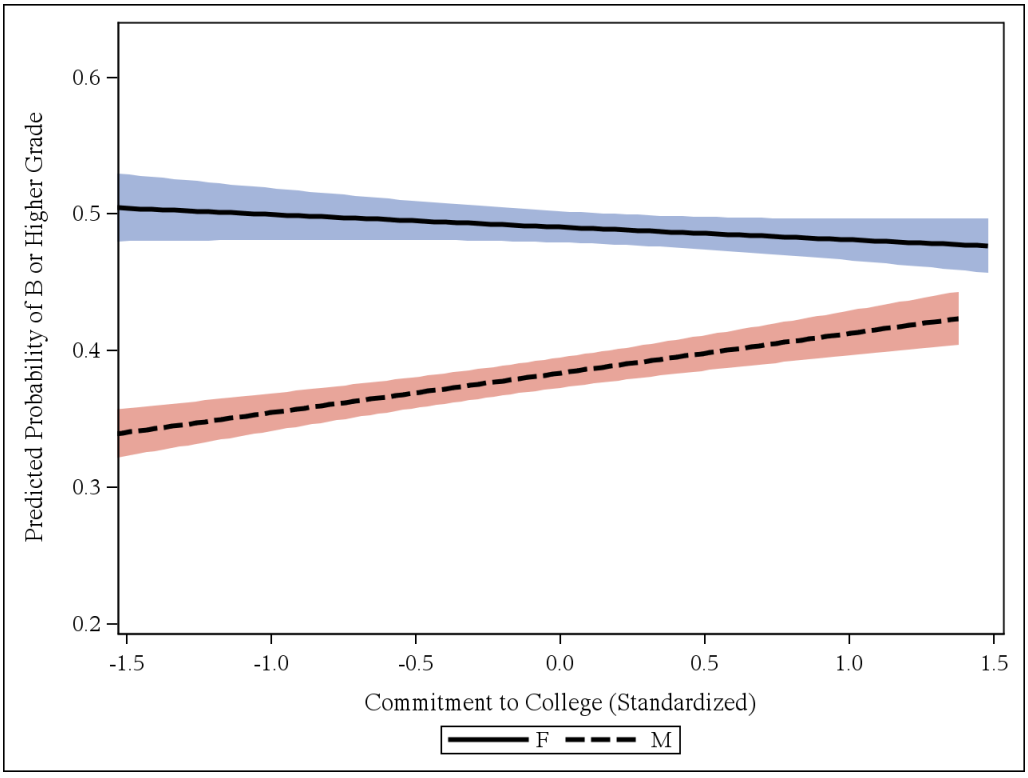

Figure 5. Probability of earning a B or higher grade in mathematics for male (M) and female (F), with increasing degree of *Commitment to College*. The band width represents the 95% confidence interval of the predicted probability.

The trend in Figure 5 showed that for female students, the predicted probability of success decreased significantly with increasing degree of *Commitment to College* (r = -.07, p < .05), whereas male students the predicted probability of success steadily increased with increasing *Commitment to College* (r = .12, p < .0001), resulting in a narrowing gender gap over the spectrum of scores on *Commitment to College*. Thus, males who expressed more *Commitment to College* benefitted, resulting in an improved chance of success, relative to their females counterparts. One explanation for this finding is that male and female students possibly interpreted *Commitment to College* differently. In the context of this study, *Commitment to College* underscored the determination to staying in college and getting a degree (ACT, 2012). It is possible that male students interpreted *Commitment to College* more in relation to the commitment and obligations to staying in college (in similarity with *General Determination*) and getting a degree – which has been shown to lead to gains in mathematics (Hagedorn, Siadat, Nora, & Pascarella,1997), whereas female students understood *Commitment to College* more from the perspective of connection with and involvement in the college community (more like *Social Connection*) which, as this study showed, had little or no impact on grades in mathematics. This suggestion is consistent with Barrow et al. (2009) who concluded that female students generally had higher means than male students on commitment (involvement) in college. However, note that these findings are inferred from the data post hoc. Although this current study did not delve into why male and female students would interpret commitment to college differently, a future study certainly could do so based on these tentative findings.

Practical implications. The findings in this study have practical implications for gender-informed preventive or interventional policies aimed at improving college achievement. Strategies to avoid or mitigate gender disparities in grades might focus on students' motivation, with emphasis on discipline toward academic-related work. Coupled with research that showed female undergraduate students entered college with higher noncognitive abilities (Conger & Long, 2010) and participated more frequently than male students in education-oriented activities (Kinzie, Gonyea, Kuh, Umbach, Blaich, & Korkmaz, 2007), the results from this study suggest that more males than females could benefit from such intervention. Addressing the gender gap in academic achievement in college could begin with getting male students more psychosocially prepared for college. Programs and activities should be put in place to increase students' motivational and learning strategies in high school and at the onset of college. In a meta-analysis study of academic performance (and retention) at college, Robbins, Oh, Le, and Button (2009) underscored the importance of academic skill and self-management-based interventions. If effective interventions are not put in place, the effects of gender differences in grades might carry over to other outcomes that are directly or indirectly related to grades. For instance, it has been reported that academic achievement in college played an integral role in entry into specialized programs of study (Kimmel, Miller, & Eccles, 2012; Newton & Moore, 2007; Perna, 2000; Xu, 2013).

On average, the mediation or indirect effects were smaller than the direct effects. Prior studies have also found small but significant indirect or mediation effects (e.g., Ganley et al., 2013; Kling et al., 2012). As a consequence of the sizes of the mediation effects, practitioners, educators, or counsellors might question the need for any preemptive or interventional measures. We note that the sizes of the mediation/moderation effects are consistent with results from prior

and recently published studies (cf. Ganley et al., 2013; Kling et al., 2012; Pulfrey, Darnon, & Butera, 2013). As a percentage of the total gender effect, the mediation effects could be large – ranging from 2% to 40% – depending on the psychosocial factor under consideration. The small sizes of some of the mediation effects (compared to the direct effect) might speak to imperfections in the measurement of the PSFs – the mediation effects would be larger if the PFSs were measured without error. This study showed that PSFs explained much, but not all, of the gender gap in success.

Limitations and Future Research

There are some limitations to the study. First, these effects should be interpreted as correlational or associative in nature. Although mediation effects were supported, as well as one moderation effect, as explanatory mechanisms, this was a large-scale institutional data collection effort, not a controlled study of psychosocial interventions; therefore, no indirect or direct causal relationships can be implied. A causal mediation analysis that partially explores the counterfactual or potential outcomes model is suggested in Loeys, Moerkerke, De Smet, Buysse, Steen, and Vansteellandt (2013). Also, the PSF measures were derived from a self-report instrument. Self-reported PSFs could have a gender bias. For instance, studies have revealed that, as a consequence of gender stereotypes, female students tended to underrate their *Academic Self-Confidence* in English and Arts, while male students overrated their self-confidence in mathematics and Science (Meece et al., 2006; Rueben et al., 2013). Thus, although the self-reported psychosocial factors provide a valid instrument for understanding behavior from a student's perspective, a second-party report on the student's PSFs would complement and solidify understanding of student behavior (ACT, 2013c).

We used students' grades as a measure academic success in college. It is conceivable that grades could be inflated (Farley, Princeton Univ., 1995). We believed that instructors abiding by standard grading policies and practices, coupled with the fact that grades were institutionally supplied, would lessen the impact of grade inflation. We categorized success in a course as having obtained a B or higher grade. Such a dichotomization could result in loss of information (for instance, A and B grades are lumped together, making them indistinguishable). Rousson (2014) showed that dichotomization decreases the value of correlation by $\sqrt{\pi/2}$ and raises the value of odds ratio by a power of $\sqrt{2}$, meaning, descriptively, it is not clear if dichotomizing a

continuous variable decreases or increases the resulting effect size. However, we dichotomized at B or higher grades to reflect a level of satisfactory academic success across all courses, thus aligning with students' comprehensive view of academic success.

Lastly, the research investigated the mediation and moderation roles of each psychosocial factor, individually. However, the inclusion of PSF as a single construct failed to take into consideration or might disguise the contributing effect of the PSFs not included in the model. With sufficient data, future research could explore mediation and moderation effects of combined psychosocial factors on gender differences in English and mathematics. Furthermore, it would be interesting to assess the mediation or moderation effects of constructs derived from a combination of self-report instrument and a third-party observed ratings (such as teacher ratings of the students). Lastly, future studies should gauge the effectiveness of various psychosocially driven intervention programs designed to close the gender achievement gaps in credit-bearing first-year college English and mathematics courses.

Conclusions

The first year of college can be a time of challenges, confusion, and disorientation to many students. They are expected to be prepared adequately to navigate the academic, emotional, social, and psychosocial challenges of the first year of college, while often living away from home for the first time. Grouping PSFs into three major domains – motivation, social engagement, and self-regulation – this study assessed mediation and moderation effects of 10 PSFs on gender gaps in first-year college English and mathematics grades. The model adjusted for the effects of academic achievement in several school characteristics, both in high school (corresponding ACT subject test) and in college (4-year or 2-year institution; selective or non-selective admissions policy). Although this research suggested that male students entered college

better academically prepared to succeed, we also found that female freshmen started college with higher motivation and social engagement scores, and that psychosocial readiness was important for success in introductory English and mathematics courses at college. Freshman females ultimately obtained better course grades than their male peers, even after controlling for pre-college achievement. Overall, 7 of the 10 PSFs – *Academic Discipline*, *Communication Skills*, *General Determination*, *Goal Striving Study Skills*, *Social Connection*, and *Academic Self-confidence* – were explanatory mediators for the gender gaps. There were no interactions that would support a moderator effect, with one exception being *Commitment to College* which doubled as a mediator of English grads and a moderator of mathematics grades. The PSFs of *Social Activity* and *Steadiness* neither mediated nor moderated the observed gender disparities in grades. None of the 10 PSFs simultaneously mediated and moderated the observed gender differences in success on the same college course.

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