Envisioning college success: the role of student identity centrality

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Abstract

This paper examines the recently developed construct of student identity centrality, which describes the importance of being a student to a person's sense of self. The present study uses multiple college student surveys and institutional data to expand upon initial work in several ways. First, it shows that this construct is measured reliably using a single three-item scale. Second, it employs measurement invariance analyses, which indicate that this scale is valid for examining and comparing different groups of students. Third, it provides evidence for convergent and divergent validity through exploring relationships between student identity centrality and relevant psychological and experiential constructs. Fourth, even when controlling for demographics, prior academic achievement, stereotype threat, and grit, it finds that student identity is positively and significantly associated with college credits earned; grades in science, technology, engineering and mathematics coursework; academic confidence; college sense of belonging; and subjective well-being. Implications for future research, assessment, and higher education practice are discussed.

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1 Introduction

Considerable research has explored whether and how psychological factors might affect college adjustment, academic achievement, and persistence (for reviews, see Farrington et al. 2012; Poropat 2009; Robbins et al. 2004). While some constructs have been established for decades and others have gained recent attention as nuanced or repackaged versions of existing concepts (e.g., Credé et al. 2017), researchers are still seeking to identify and understand potentially important factors. This paper explores a recently proposed construct of student identity centrality, which describes the extent to which being a student is an important part of one's self-image or identity. First, it examines the measurement properties of a short scale designed to measure student identity centrality. Next, it investigates whether that scale predicts desired college academic and psychosocial outcomes above and beyond student demographics, precollege academic achievement, college experiences, and other psychological constructs. Finally, it explores whether the link between student identity centrality and these outcomes is explained by greater engagement in social and academic experiences.

1.1 Literature review

1.1.1 Identity theory and identity centrality

According to social identity theory (e.g., Tajfel and Turner 1979, 1986), personal identity and social identity constitute two distinct facets of self-concept. Personal identity includes a person's values, belief systems, goals, and emotions, whereas social identity is a function of one's social group memberships. Social groups consist of a collection of people who see themselves as belonging to the same social category; the meaning and definition people give to these social groups defines their social identity. Reitzes and Burke (1980) note that identity differs from self-esteem, which constitutes an evaluation of the self, by focusing on the cognitive and affective meanings that individuals attribute to themselves. Thus, as people join and become members of larger social groups, these meanings become a derivative of their social identity.

Identity theory has a rich history. Stryker and Burke (2000) assert that "identity theory began with questions about the origins of differential salience of identities in persons' self-structures and why identity salience may change over time" (p. 287). Researchers have aimed to understand identity salience and behaviors associated with particular identities. As a related construct, researchers have used the term "identity centrality" to describe the enduring tendency to think of oneself consistently through the lens of a particular identity; in other words, it describes the extent to which an aspect of one's self-concept is critical to answering the question "who am I?" (e.g., Sellers et al. 1997). Research has focused on various facets of identity centrality, such as gender (Settles 2004; Settles et al. 2009) and race/ethnicity (Rowley et al. 1998; Sellers et al. 1997; Sellers et al. 1998). In this line of inquiry,

the centrality characteristic is often measured by directly asking respondents how important and relevant a particular identity is within their life. Identity centrality generally predicts behaviors and attitudes that are consistent with the particular identity. For example, people who hold a driver identity as central to their self-concept choose to take a greater proportion of trips in cars, whereas those who hold a public transport identity as central to their self-concept select this form of transportation more often (Murtagh et al. 2010). For graduate business students, those who hold a leader identity more centrally tend to have higher levels of multiple types of motivation to lead (Guillen and Korotov 2011).

Some studies have examined whether identity centrality is related to academic and psychosocial outcomes. Among female students majoring in science, technology, engineering, or math (STEM) fields, having a higher identity centrality of being a scientist was related to higher grades and greater life satisfaction (Settles 2004). Later work also found that this scientist identity was associated with decreased depressive symptoms and increased satisfaction with one's scientific performance (Settles et al. 2009). Racial identity centrality was positively related to college GPA for Black students (Sellers et al. 1998) as well as having Black best friends, taking Black studies courses, and interacting with others of the same racial identity (Sellers et al. 1997). Identity centrality, however, is not always associated with positive outcomes. Quinn and Chaudoir (2009) examined those who had concealable stigmatized identities and found that the centrality of those stigmatized identities predicted greater psychological distress.

In addition, Jones and McEwen (2000) conducted interviews to develop a model of multiple identities that also accounts for the centrality of particular identities. Their model describes how people hold multiple identities that may be more or less central to their life. The central part of one's identity, which they name the core, is "frequently described by participants as their 'inner identity' or 'inside self' as contrasted with what they referred to as their 'outside' identity" (p. 408). Participants describe the aspects of their outside identity as less meaningful than their inside identities, which they keep close to themselves and protect from outside influence. This personal importance and stability over time constitute key features of identity centrality.

1.1.2 Student identity centrality

The concept of student identity centrality had early origins in the work of Reitzes and Burke (1980). The researchers attempted to understand the meaning that college students assigned to being a college student versus several roles that were contrary to being a college student: high school student, graduate student, employed college graduate, and non-college peer. Their study found that individuals tended to engage in activities that were consistent with the meanings of their identities; for example, students who most closely identified with the college student role engaged in more social activities than those who most closely identified with the graduate student role. However, considerable overlap existed among the definitions of some roles, and most students reported identities that were more similar to one of the non-undergraduate roles than to the college student role. Given that students can hold

identities that correspond closely with multiple roles, this comparative approach may not be ideal for measuring the presence of a college student identity.

Another relevant concept pertains to college students' academic identification. Steele (1997) proposed that stereotype threat adversely affects educational outcomes by reducing the extent to which students from marginalized identities identify with academic pursuits, which then leads to academic disengagement. Delving into this potential mechanism, Major et al. (1998) describe disengagement as "a defensive detachment of self-esteem from outcomes in a particular domain, such that feelings of self-worth are not dependent on success or failures in that domain" (p. 35). Their study supported the assertion that students devalued or discounted the feedback that they received as a coping strategy to maintain their self-esteem. Schmader et al. (2001) extend this inquiry by arguing that students can still view themselves as a student and/or value academics even while discounting or devaluing certain facets of the academic realm. Importantly, academic (dis)identification is not synonymous with viewing oneself as a student, especially since it does not include non-academic aspects of the college experience.

Bowman and Felix (2017) recently proposed the construct of student identity centrality, which indicates how important being a student is for defining oneself. Like other researchers who have explored identity centrality (Bilali 2012; Das et al. 2008; Guillen and Korotov 2011; Settles 2004; Settles et al. 2009), these authors adapted the identity subscale of Luhtanen and Crocker's (1992) collective self-esteem scale to explore a particular type of identity centrality. They posited that student identity centrality should promote commitment to the goal of persisting in college, since being a college student involves living out a key aspect of one's identity, whereas dropping out would involve losing that important part of oneself. Therefore, students who are high in student identity centrality should be more likely to persist, even when faced with potential challenges and stressors that might lead someone to consider dropping out (e.g., family health problems, financial difficulty, poor academic performance). Moreover, student identity centrality should buffer potential negative psychosocial effects, such that external stressors (e.g., failing a test) should be less detrimental for people who view being a student as an important part of who they are.

In general, Bowman and Felix (2017) found support for these hypotheses. Student identity centrality was positively and significantly related to goal commitment, institutional commitment, and intent to persist. In fact, these relationships were similar in strength as those for social and academic integration, which are widely used constructs for studying college attrition (see Mayhew et al. 2016; Pan 2010; Robbins et al. 2004). Student identity centrality also buffered the negative relationship of external stress on goal commitment, along with reducing relationships for other predictors. For instance, academic and social integration were both strongly related to goal commitment among students who were low in student identity centrality. In contrast, these associations were far more modest among those who were high in centrality, since those students' commitment to staying in college were less contingent on their experiences at that institution.

Although this study's results were promising, additional work is needed for several reasons. First, the study only examined students taking psychology courses at

one institution, so obtaining positive results with other samples would suggest that the initial findings are generalizable. Second, the initial study provided limited information about the validity of the student identity centrality measure, so a more thorough investigation is needed. Third, the outcomes in that initial study were based on Tinto's (1993) theoretical framework, so a broader range of outcomes—including objective measures obtained from institutional data—would shed light into the scope of the potential influence of this construct. Fourth, other psychological constructs have also been proposed as being integral for promoting or hindering student success, such as grit (Duckworth et al. 2007), mental toughness (Bédard-Thom and Guay 2018), and stereotype threat (Steele 1997). If student identity centrality indeed plays a critical role in shaping student success, then it should provide predictive power above and beyond other commonly used psychological constructs.

1.2 Present study

The present study aims to address the limitations in previous literature. First, this study examined a sample that constitutes a diverse group of first-year college students. Second, the analyses explored the measurement properties of the student identity centrality scale, including factor structure and loadings, measurement invariance, convergent and divergent validity, and predictive validity. Third, various outcomes were used, including college grades, credits earned, academic confidence, college sense of belonging, subjective well-being, and perceived physical health. In addition, given the role of math and other STEM coursework in contributing to college attrition (e.g., Nagaoka et al. 2009), STEM grades and credits earned were examined in addition to overall college grades and credits. Finally, regression analyses examined the extent to which various predictors were uniquely associated with college outcomes.

2 Method

2.1 Data source and participants

Participants were 224 undergraduates attending a public, doctoral university in the Midwest. In the summer of 2015, incoming first-year students were recruited via email to participate in a research study. Administration of the online survey occurred between summer orientation and the start of the academic year. Students who participated in the initial data collection were invited to complete a second survey in Spring 2016 regarding their first-year college experiences, perceptions of their experience, and psychological variables, including student identity centrality. Overall, 79% of students were female, 54% were White/Caucasian, 23% were Black/African American, 10% were multiracial or multiethnic, 9% were Latino/Hispanic, 4% were Asian/Pacific Islander, less than 1% were American Indian/Alaskan Native, and 1% did not wish to identify (due to rounding, racial percentages add up to slightly over

100 percent). Students of color were intentionally oversampled in the follow-up survey to facilitate subgroup analyses.

2.2 Measures

2.2.1 Outcome variables

Institutional data were obtained to indicate students' college GPA, credits earned, STEM GPA, and STEM credits earned during their first year. All survey-based outcomes were assessed during the spring survey. College sense of belonging was assessed using a composite measure of four items (e.g., "I feel like I belong at [school name]"; 1 = strongly disagree, to 6 = strongly agree, α = .90), which was used in Walton and Cohen (2007, 2011). The subjective well-being measure consisted of five items (α = .79) measuring happiness (e.g. "In general I consider myself: 1 = not a very happy person, to 10 = a very happy person"), life satisfaction (e.g. "All things considered, how satisfied are you with your life as a whole?" 1 = totally dissatisfied, 10 = totally satisfied), and flourishing (e.g., "Right now how much do you feel your life at [school name] has a sense of direction or meaning to it"; 1 = not at all, to 5 = a great deal); this scale is from Diener et al. (1985). Academic confidence was measured using a single item: "Right now, how confident do you feel that that you have the ability to do well at [school name]?" (1 = not at all confident, to 7 = extremely confident). Physical health was also indicated with a single item that was adapted from Ware and Sherbourne (1992): "In general, how has your physical health been this past academic year?" (1 = poor, to 5 = excellent)

2.2.2 Key independent variables

Student identity centrality was measured using the four items created by Bowman and Felix (2017), which were adapted from Luhtanen and Crocker (1992). These items employed a seven-point scale (1 = strongly disagree, to 7 = strongly agree), and they included the following: "being a student is an important reflection of who I am," "overall, being a student has very little to do with how I feel about myself" (reverse coded), "in general, being a student is an important part of my self-image," and "being a student is unimportant to my sense of what kind of a person I am" (reverse coded)

Two additional psychological measures were also used. A short version of the grit perseverance of effort subscale was used (Duckworth and Quinn 2009), since this measure is more strongly related to educational outcomes than the consistency of interest or the overall scale (see Bowman et al. 2015; Credé et al. 2017). Given previous research that found one of the items does not load well with the others (e.g., Bowman et al. 2015), only three items were used to comprise the scale (α = .75): "I can finish whatever I begin," "I stay interested in goals, even if they take a long time (months or years) to complete," and "I am a hard worker" (1 = not at all true, 5 = completely true). A stereotype threat scale (α = .80) was created using four items from Cohen and Garcia (2005) that assessed stereotype threat in general and

also based on race, gender, and social class (e.g. "At [school name], to what extent do you worry that people negatively judge you based on what they think about your [race, gender, social class]" 1 = not at all, to 7 = an extreme amount).

For college experiences, extracurricular activities were indicated by asking students to list extracurricular experiences they have had and the degree to which they have been involved (Stuart et al. 2011). Students who had no involvement were coded as zero, whereas those who were involved in any activities were coded from one ("not very involved") to five ("very involved"). Academic behaviors consist of the average frequency of four behaviors: meeting with professors outside of class, meeting with academic advisors, seeking academic tutoring, and participation in formal and informal study groups (α = .59). A composite measure of close friends was created using two items (α = .79) from Cohen et al. (1985): "Thinking back on this academic year so far, I feel that I have made some close friends at [school name]" and "I feel that there is no one at [school name] I can share my personal worries and fears with" (reverse coded).

2.2.3 Additional variables

Some variables from the initial student survey were included to provide additional evidence of convergent and divergent validity. Academic potential is based on a single item that asked students the following on the initial survey (Vallerand et al. 1992): "Using a percentile rank, assess your potential right now, compared with other first-year students at [school name], to succeed at [school name]. Marking 50% means you believe you have more potential than half of first-year students at [school name], and less potential than half." Concerns about college transition were assessed using a three-item scale (e.g., "How difficult do you think that the transition to [school name] could be at first"; α = .68). College enthusiasm was a composite measure of three items asking about one's enthusiasm or excitement to come to that institution (e.g., "how excited are you about coming to [school name]," 1 = none, to 7 = an extreme amount; α = .88).

Institutional data were used to provide precollege control variables, such as race/ethnicity (categories for Black/African American, Latino/Hispanic, and other race/ethnicity, with White/Caucasian as the referent group in regression analyses), sex (0 = male, 1 = female), parental education (1 = less than high school, to 7 = graduate degree or terminal degree), high school GPA, and ACT composite score. All continuous variables were standardized with a mean of zero and a standard deviation of one to facilitate effect size interpretation (Cohen et al. 2003).

2.3 Analyses

Several sets of analyses were conducted. First, exploratory analyses were used to examine the factor structure of the student identity centrality scale. The determination of the number of factors to retain was made by exploring how many components have an Eigenvalue greater than 1.0, the shape of the scree plot, the strength of the factor loadings (along with other indicators of the strength of association), and

the internal consistency reliability (see Furr and Bacharach 2008). These analyses also considered whether all items should be included within the final factor(s).

Second, structural equation modeling was used to explore the factor structure and construct validity of the latent student identity centrality construct (see Bollen 2002; Kline 2016). Goodness-of-fit indices were used to determine the adequacy of the measurement model, including the confirmatory fit index (CFI), the Tucker-Lewis index (TLI), and the standardized root mean square residual (SRMR). After exploration of the construct validity and overall model, confirmatory factor analyses were used to further explore measurement invariance across race/ethnicity (students of color versus White/Caucasian students), sex (female versus male), socioeconomic status (first-generation versus continuing-generation college students), and precollege achievement (median split of high school GPA). Factorial invariance was explored through a series of nested follow-up tests (Cheung and Rensvold 2000; Gregorich 2006; Jöreskog 1969; Meredith 1993; Meredith and Teresi 2006). That is, each step added an additional set of constraints upon the model, and Chi square tests examined whether the model was significantly worse as a result of making the stronger assumption associated with those constraints. Dimensional invariance was first explored to determine the appropriateness of further factorial invariance testing. Once the assumption of dimensional invariance was met, the assumption that the student identity centrality scale measures the same latent construct across each group was tested. The following hierarchy of factorial invariance tests were conducted: (1) configural invariance (same number of common factors present for each subgroup); (2) metric invariance (factor loadings are identical across groups), (3) strong factorial invariance (loadings and intercepts are identical across groups); (4) strict factorial invariance (loadings, intercepts, and residuals are invariant); (5) strict factorial invariance adding invariant factor means (testing if the population means of the latent variable student identity centrality differs across groups); and (6) strict factorial invariance adding both invariant factor means and invariant factor variances (testing if the population covariance structure is invariant across groups). The purpose of these invariance tests is to ensure that a scale is measuring the same construct across different demographic groups.

Third, convergent and divergent validity were considered by computing bivariate correlations between student identity centrality and each of the variables included within the study. We expected that student identity centrality would exhibit convergent validity through significant correlations with related psychological and experiential constructs, such as campus friendships, extracurricular activities, college sense of belonging, and academic confidence. At the same time, we expected that these relationships would not be so strong as to imply that the constructs are nearly identical, thereby exhibiting divergent validity.

Finally, multiple regression analyses explored the predictive validity of student identity centrality for academic and psychosocial outcomes: college GPA, credits earned, STEM GPA, and STEM credits earned, academic confidence, college sense of belonging, subjective well-being, and perceived physical health. Two models were used to examine each outcome to determine the extent to which the relationship for the student identity centrality measure persisted across different sets of control variables. Model 1 included precollege attributes and psychological indicators,

while Model 2 added college behaviors, which may explain any association between student identity centrality and college outcomes.

3 Results and discussion

Exploratory factor analyses provided strong support for a single-factor solution for student identity centrality. Only one factor met the minimum eigenvalue of 1.0 (with an eigenvalue of 2.52), and the scree plot showed a clear bend between the first and second component, with virtually no bend between the second and third. Thus, the data seem to support a one factor structure. This student identity centrality construct had an acceptable reliability ($\alpha = .78$). However, one item did not fit well with the others. Three of the items all had strong factor loadings that ranged from .51 to .54, whereas "being a student has very little to do with how I feel about myself" (reverse-coded) had the lowest factor loading at .39. Similarly, that item had the lowest item-test correlation at .71, whereas the other three items had item-scale correlations that ranged from .79 to .83. The Cronbach's alpha would also increase to .83 if the weakest item were removed. Therefore, this item was dropped to create a three-item construct of student identity centrality; Table 1 provides some of its salient measurement properties.

The bivariate correlations between the three-item student identity centrality measure and each of the other variables in the study illustrate convergent and divergent validity (see Table 2). In support of its convergent validity, student identity centrality was significantly correlated in the expected direction with college experiences (i.e., extracurricular activities, physical health, close friendships,), college adjustment (i.e., difficulty transitioning, college enthusiasm, sense of belonging, and stereotype threat), subjective well-being, academic confidence, and grit. However, student identity centrality was clearly distinct from all of these other constructs. The highest correlation was .30, which provides evidence for its divergent validity from other relevant constructs. Interestingly, student identity centrality was significantly negatively correlated with being female but not significantly correlated with any indicator of demographics or precollege achievement, including race, parental education, high school grade point average, and ACT composite score. Therefore, similar to grit (Bowman et al. 2015), it seems student identity centrality may be unrelated to aspects of privilege; it was also independent of prior academic achievement.

Structural equation modeling with asymptotic distribution free estimation was used to explore an underlying latent factor structure using the three student identity centrality items. Asymptotic distribution free estimation was used to relax the assumption of normality with the student identity centrality measure, because the sample responses to the student identity centrality items were skewed (Browne 1984; StataCorp 2015). The results from this confirmatory factor analysis are presented in Table 3. The initial three-item model for student identity centrality resulted in a saturated model. In this case, there were three items used to represent the latent construct of student identity centrality, which only allows for 6 estimations to occur: the three variances and three covariances in the model. Since there were no issues fitting the overall model and the measurement model loadings were significant and

Table 1 Measurement properties of the three-item student identity centrality measure

Item	Factor loading	Item-test correlation	Item-rest correlation	Average inter-item covariance
In general, being a student is an important part of my self-image	.60	.87	.71	.90
Being a student is an important reflection of who I am	.60	.86	.72	1.03
Being a student is unimportant to my sense of what kind of person I am (reverse-coded)	.54	.86	.60	.92

Cronbach's alpha = .83

Table 2 Descriptive statistics and correlations with student identity centrality

Variable	Mean	SD	Min	Max	Correlation with student identity centrality
Student identity centrality	0	1	− 3.94	1.59	–
Black/African American	.23	.42	0	1	− .05
Latino/Hispanic	.09	.29	0	1	.01
Other race	.14	.35	0	1	− .11
Sex (Female = 1)	.21	.41	0	1	− .18***
Parental education	0	1	− 2.13	1.43	.08
High school GPA	0	1	− 2.05	2.46	.16
ACT composite score	0	1	− 1.75	3.30	− .03
Stereotype threat	0	1	− .82	4.08	− .16*
Grit	0	1	− 4.38	1.46	.30***
Extracurricular activities	0	1	− 1.60	1.44	.15*
Close friends	0	1	− 3.44	.93	.27***
Academic behaviors	0	1	− 1.92	2.81	.12
Difficulty transitioning	0	1	− 2.64	3.14	− .09
College enthusiasm	0	1	− 3.12	1.32	.18**
Academic potential	0	1	− 2.93	1.89	.00
Academic confidence	0	1	− 2.99	1.29	.26***
Subjective well-being	0	1	− 2.99	1.66	.22***
Sense of belonging	0	1	− 3.85	1.10	.26***
Physical health	0	1	− 1.80	1.83	.17*

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

in the expected direction, the overall model fit was supported (Browne and Cudek 1993; Milfont and Fischer 2010; Widaman and Thompson 2003). Thus, we proceeded with exploring measurement invariance by race, sex, first-generation status, and median high school GPA. The first step in this process was to confirm the presence of dimensional invariance across the groups, which means that the same number of factors is present within each of the subgroups (Gregorich 2006; Meredith 1993). Principal components analyses with the three student identity centrality items were conducted for each subgroup (race, sex, first-generation status, and high school GPA split). Each group had a one-factor structure with eigenvalues for each group ranging from 2.11 to 2.35 (which are well above the minimum eigenvalue of 1.0), whereas the second factor eigenvalue within each group was below .64. Visual inspections of each individual scree plot also confirmed a single-factor structure for each subgroup. Finally, the factor loadings for each item within the subgroups fell within a range of .50–.62, which are generally considered "good" (Tabachnick and Fidell 2007). The results suggest that the three items represents the same common factor across each subgroup.

A hierarchy of factorial invariance was then tested for each subgroup (race, sex, first-generation status, and median high school GPA split) after the

Table 3 Measurement invariance for the three-item student identity centrality scale

	χ^2	df	$\Delta\chi^2$	Δdf
Race				
Model 1—Configural invariance				
Model 2—Metric invariance	3.83	2	3.83	2
Model 3—Strong factorial invariance	8.14	4	4.31	2
Model 4—Strict factorial invariance	10.06	7	1.92	3
Model 5—Strict factorial invariance and invariant factor means	11.61	8	1.55	1
Model 6—Strict factorial invariance and invariant factor means and variances	11.65	9	.04	1
Sex				
Model 1—Configural invariance				
Model 2—Metric invariance	1.80	2	1.80	2
Model 3—Strong factorial invariance	7.49	4	5.69	2
Model 4—Strict factorial invariance	10.41	7	2.92	3
Model 5—Strict factorial invariance and invariant factor means	14.15	8	3.74	1
Model 6—Strict factorial invariance and invariant factor means and variances*	19.27	9	5.12	1
First-generation status				
Model 1—Configural invariance				
Model 2—Metric invariance	2.69	2	2.69	2
Model 3—Strong factorial invariance	8.57	4	5.88	2
Model 4—Strict factorial invariance	9.31	7	.74	3
Model 5—Strict factorial invariance and invariant factor means	11.11	8	1.80	1
Model 6—Strict factorial invariance and invariant factor means and variances	11.14	9	.03	1
High school GPA				
Model 1—Configural invariance				
Model 2—Metric invariance	1.30	2	1.30	2
Model 3—Strong factorial invariance	2.83	4	1.53	2
Model 4—Strict factorial invariance	6.42	7	3.59	3
Model 5—Strict factorial invariance and invariant factor means	7.23	8	.81	1
Model 6—Strict factorial invariance and invariant factor means and variances	10.81	9	3.58	1

*$p < 0.05$, **$p < .01$, ***$p < .001$

assumptions for the overall model fit and dimensional invariance were met. The methods below follow common approaches to testing measurement invariance (e.g., Gregorich 2006; Meredith 1993). For each subgroup, configural invariance first tested the assumption that the common factor uses the same item sets across each subgroup, then metric invariance explored whether the factor loadings were identical across groups, and then strong factorial invariance tested whether the factor loadings and intercepts were identical across groups. Subsequently, tests of strict factorial invariance examined whether the loadings, intercepts, and residuals were identical across groups, while the final two tests constrained the factor means and then added invariant factor variances.

Table 3 provides a summary of the hierarchy of factorial invariance for each subgroup. The first model exploring configural invariance among groups resulted in model saturation, so most traditional model fit statistics were inappropriate for interpretation (e.g., Bollen and Long 1993; Hu and Bentler 1999; Kenny et al. 2015). To determine if the basic model structure was the same for each subgroup, paramater significance was explored for consistent significance values (Milfont and Fischer 2010). Each post-estimation exploration resulted in nonsignificant differences among the parameters within each subgroup and similar coefficient loadings. The hierarchy of invariance tests was followed by incorporating additional constraints and testing the change in the Chi square statistic. Strict factorial invariance held for all four student characteristics (i.e., race, sex, first-generation status, and high school GPA), which means that the items, factor loadings, intercepts, and residuals do not differ significantly across groups. Strict factorial invariance with invariant means and variances was observed for each subgroup except for sex; only strict factorial invariance with invariant means observed for sex, whereas the assumption of invariant variances did not hold.

Tables 4 and 5 display the results from blocked multiple regression analyses predicting academic and psychosocial outcomes, respectively. Student identity centrality was significantly and positively related to first-year overall credits earned and academic confidence in both models. This construct was also positively related to college sense of belonging and subjective well-being in the first model, but this relationship became non-significant with the inclusion of college experiences in Model 2. Follow-up analyses using a bootstrap multiple mediation model with 1000 resamples revealed that the three college experiences fully mediated the link between student identity centrality and each of these two psychosocial outcomes (MacKinnon et al. 1995; Preacher and Hayes 2008). For STEM GPA, the student identity centrality construct became significant in the second model with the addition of involvement, social variables, and academic behaviors; mediation models showed that STEM GPA was only partially mediated by college experiences. Given that there was a small correlation between student identity centrality and academeic behaviors as well as extracurricular activities, these variables might cofound the relationship between student identity centrality and STEM GPA.

For the other psychological indicators, stereotype threat was negatively and significantly associated with overall credits earned, academic confidence, college sense of belonging, and subjective well-being in both models. Grit was positively related to subjective well-being and to perceived physical health in both models, and it was significantly associated with academic confidence only in the first model. Therefore, student identity centrality was about as consistently related to college academic and psychosocial outcomes as these two widely discussed psychological constructs.

4 Limitations

There are limitations to the findings of this study, most notably this study is based on data collected at a single time point from one institution. Further studies should address the generalizability of these findings with a large, multi-institutional sample.

Table 4 Standardized coefficients for multiple regression analyses predicting first-year academic outcomes

	Overall credits earned		Overall GPA		STEM credits earned		STEM GPA	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Black/African American	−.12	−.10	−.19	−.18	.13	.12	−.08	−.07
	(.19)	(.20)	(.16)	(.16)	(.21)	(.22)	(.18)	(.17)
Latino/Hispanic	.40	.39	.01	.02	.47	.43	.22	.23
	(.23)	(.22)	(.20)	(.20)	(.30)	(.28)	(.19)	(.20)
Other race/ethnicity	.48**	.49**	−.12	−.12	.09	.11	−.17	−.17
	(.17)	(.17)	(.19)	(.20)	(.29)	(.29)	(.18)	(.18)
Sex	−.22	−.22	.03	.01	.12	.11	.23	.23
	(.19)	(.19)	(.17)	(.18)	(.21)	(.20)	(.18)	(.18)
Parental education	.02	.03	.20**	.18*	−.08	−.04	.14*	.13
	(.08)	(.08)	(.07)	(.07)	(.08)	(.08)	(.07)	(.07)
High school GPA	.21*	.22*	.40**	.39**	.06	.06	.37*	.37*
	(.10)	(.11)	(.14)	(.15)	(.10)	(.10)	(.16)	(.17)
ACT composite	.01	.02	.13	.14	.08	.06	.20	.21*
	(.10)	(.10)	(.10)	(.10)	(.10)	(.10)	(.11)	(.11)
Student identity centrality	.14*	.16*	.08	.10	.03	.02	.12	.15*
	(.07)	(.07)	(.06)	(.06)	(.08)	(.08)	(.08)	(.07)
Stereotype threat	−.23**	−.24**	−.03	−.04	−.07	−.06	−.01	−.00
	(.08)	(.08)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
Grit	−.00	.01	.08	.10	.08	.06	.04	.08
	(.07)	(.08)	(.07)	(.07)	(.08)	(.08)	(.07)	(.07)
Extracurricular involvement		−.11		.07		−.14		.05
		(.08)		(.07)		(.08)		(.07)
Close campus friendships		−.07		−.11		.14		−.15*
		(.06)		(.06)		(.07)		(.07)
Academic behaviors		.06		−.01		−.03		.00
		(.08)		(.07)		(.08)		(.06)
R^2	.206	.228	.337	.348	.046	.071	.325	.342

Robust standard errors in are parentheses. *$p < .05$, **$p < .01$, ***$p < .001$

Moreover, longitudinal research would be able to explore the stability of student identity centrality over time, factors that predict changes in student identity centrality, along with how earlier student identity centrality might predict changes in college outcomes as well as future outcomes. Many of the academic and psychosocial outcomes in this study are strong predictors of student retention and graduation (see Mayhew et al. 2016; Pascarella and Terenzini 2005; Robbins et al. 2004), but direct measures of these forms of academic success would provide additional evidence. Subsequent research is certainly needed to further understand this promising construct.

Table 5 Standardized coefficients for multiple regression analyses predicting first-year psychosocial outcomes

	Academic confidence		Subjective well-being		College sense of belonging		Perceived physical health	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Black/African American	.45**	.43**	.28	.28	−.01	−.04	−.22	−.21
	(.17)	(.16)	(.18)	(.16)	(.17)	(.13)	(.20)	(.20)
Latino/Hispanic	.02	.07	.31	.40	.18	.26	.31	.28
	(.17)	(.18)	(.26)	(.23)	(.21)	(.20)	(.21)	(.20)
Other race/ethnicity	.04	.02	.09	.06	−.13	−.15	.27	.28
	(.21)	(.19)	(.20)	(.16)	(.25)	(.21)	(.24)	(.24)
Sex	.08	.10	.17	.22	−.01	.05	−.39*	−.40*
	(.15)	(.14)	(.17)	(.15)	(.21)	(.18)	(.19)	(.19)
Parental education	.09	.07	.08	.05	−.02	−.05	.00	.01
	(.06)	(.07)	(.07)	(.06)	(.07)	(.07)	(.07)	(.07)
High school GPA	.13	.13	.17	.18	−.01	−.00	−.08	−.08
	(.10)	(.10)	(.10)	(.10)	(.08)	(.07)	(.10)	(.10)
ACT composite	.08	.07	−.15	−.16*	.04	.02	.02	.02
	(.08)	(.08)	(.08)	(.08)	(.08)	(.07)	(.09)	(.09)
Student identity centrality	.26**	.20*	.19*	.03	.15*	.02	.01	.02
	(.09)	(.09)	(.08)	(.08)	(.07)	(.06)	(.09)	(.10)
Stereotype threat	−.25**	−.24***	−.22**	−.19**	−.25**	−.21**	.08	.08
	(.08)	(.07)	(.08)	(.07)	(.09)	(.07)	(.08)	(.08)
Grit	.17*	.13	.23**	.15**	.12	.03	−.29***	−.27***
	(.08)	(.07)	(.07)	(.06)	(.08)	(.06)	(.08)	(.08)
Extracurricular involvement		.12		.12		.12		−.06
		(.07)		(.07)		(.06)		(.07)
Close campus friendships		.19*		.41***		.52***		−.10
		(.08)		(.06)		(.07)		(.07)
Academic behaviors		.02		.08		.06		−.01
		(.08)		(.08)		(.06)		(.07)
R²	.276	.337	.182	.385	.141	.442	.136	.151

Robust standard errors in are parentheses. *$p < .05$, **$p < .01$, ***$p < .001$

5 Conclusion and implications

Overall, this study supports the use of student identity centrality as a psychological indicator of college student success. The analyses showed that this construct can be measured with a short three-item scale that is internally reliable and has strong factor loadings. This measure has positive (yet small to moderate) correlations with related psychological constructs and college experiences, suggesting that student identity centrality is a valid and distinct construct. The measurement invariance analyses also demonstrated strict invariance across several

demographic and achievement categories, which means that this measure can be used appropriately for examining and comparing diverse groups of students. Finally, student identity centrality also predicts several important academic and psychosocial outcomes even when accounting for stereotype threat, grit, demographics, and precollege achievement. These relationships for college belonging and well-being are mediated by students' college experiences, but this is not the case for overall credits earned, STEM GPA, and academic confidence.

Given these results, higher education practitioners and administrators should seek to promote student identity centrality among their students. Although research has not yet directly examined how to do so, some strategies may prove fruitful. Psychologists have long established the potentially counterintuitive finding that people's behavior affects their attitudes and values (as people observe this behavior and infer their attitudes accordingly), as opposed to attitudes and values solely affecting behavior (e.g., Eagly and Chaiken 1993; Festinger 1957). Therefore, facilitating student engagement in college-related activities may promote student identity centrality. Students could see themselves as being engaged in college life in various ways, which may range from living on campus and attending college sporting events to making friends with college peers and studying together. A particularly targeted approach would be to elicit students' help in supporting the college transition and success of fellow students, which could more directly bolster their identity centrality as they see themselves work to help others in college. Examples of such involvement would include serving as a peer tutor or mentor, resident assistant, new student orientation or welcome week staff member, campus tour guide, or ambassador to prospective students.

Colleges and universities should also consider using this measure of student identity centrality in their campus assessments. Many institutions are using some form of early alert system to identify students who may be at risk of attrition, such as Skyfactor Mapworks. Student identity centrality may constitute another means of identifying students who may need additional support to help them adjust to college life. An interesting feature of student identity centrality is that it is uncorrelated with student demographics and precollege academic achievement. Therefore, this construct is a rare indicator that can be used to predict college student success without perpetuating inequalities; in contrast, SAT scores are notably associated with socioeconomic status and race/ethnicity (College Board 2013).

Compliance with ethical standards

Conflict of interest The authors declare that there are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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