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Becoming STEM Protégés:
Factors Predicting the Access and Development of Meaningful Faculty-Student Relationships

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Abstract

Faculty interaction is an essential component in the undergraduate experience that can impact student outcomes and promote matriculation into STEM graduate programs and into STEM research careers. We explore data from a national sample of 2,311 undergraduate students who started and persisted in STEM majors to understand how they access these critical relationships with faculty during college. This study draws from frameworks of mentorship (Johnson & Ridley, 2004; Mullen, 2005; Nora & Crisp, 2007; Ragins, 1999) and academic socialization processes (Becher, 1989; Stanton-Salazar, 2010) to examine the structures of opportunity within institutions and the characteristics and behaviors of students that facilitate or discourage STEM students' development of supportive mentoring relationships with faculty. Findings suggest that the extent of undergraduates' success in developing faculty support networks is influenced by differentiation in pre-college characteristics and behaviors; however, pre-college variables, such as SAT scores, matter more in determining the types of experiences students have in college that eventually connect them with faculty mentors. Predictors of being mentored by faculty in college include measures of college experiences, such as presenting research, joining academic clubs, meeting with counselors about career plans, measures of institutional climate, including feelings of isolation and perceptions of faculty, and structural characteristics of institutions, such as institutional control and selectivity.. Our findings have implications for elucidating the role of faculty and students in developing meaningful relationships that can promote college and post-college outcomes for STEM students.

Given the national significance of addressing low completion rates and racial disparities in the attainment of STEM bachelor's degrees, policymakers have called on institutions to reform STEM education by identifying factors that promote student success in STEM (Committee on Science, Engineering and Public Policy, 2007). The racial disparities manifested in STEM bachelor's degree completion rates become even more pronounced as students decide whether to enroll in STEM graduate programs, as Black and Latino students represent just 9.5% of biological sciences, 6.5% of physical sciences, 6.7% of engineering, and 7.0% of mathematics graduate students (National Science Foundation [NSF], 2009). Improving the rate at which students from all backgrounds matriculate into STEM graduate programs and into STEM research careers requires the cooperation and support of several constituencies, not the least of among them being faculty.

College faculty members have a unique role in both reforming STEM education at the postsecondary level and in providing direct encouragement to undergraduate students in support of their progression along STEM educational pathways. As the primary institutional agents students encounter in college, faculty are empowered to shape both the delivery of STEM curricula (Handelsman, Miller, & Pfund, 2007; Miller, Pfund, Pribbenow, & Handelsman, 2008) and the socialization of STEM students into their respective academic disciplines (Becher, 1989). Through these roles, faculty members can influence the STEM educational pathways of undergraduate students through course contact (Kuh & Hu, 2001; Lundberg & Schreiner, 2004), out-of-class interaction (Einarson & Clarkberg, 2010), and access to the structure of opportunity within institutions, including undergraduate research programs (Eagan, Sharkness, Hurtado, Mosqueda, & Chang, 2011) and mentoring relationships (Crisp & Cruz, 2009; Landefeld, 2009).

Interactions with faculty predict retention and persistence in higher education for students generally (Pascarella and Terenzini, 2005) and for minority students specifically (Davis, 1991; Hernandez, 2000; Jackson, Smith, and Hall, 2003; Nettles, 1991; Swisher, Hoisch, and Pavel, 1991). Likewise, faculty encouragement, support, and mentoring significantly and positively relate to student persistence and graduation in STEM majors (Maton & Hrabowski, 2004; Packard, 2004; Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, & Gary, 2009). Furthermore, the amount and quality of faculty support STEM students receive in college significantly predicts their likelihood of reporting plans to enroll in STEM graduate programs (Eagan, Chang, Hurtado, Garcia, Herrera, Garibay, 2010).

Contact between students and faculty also has been demonstrated to positively influence a variety of key educational outcomes that have implications for student success, such as student learning (Kuh & Hu, 2001; Lundberg & Schreiner, 2004), intellectual development (Endo & Harpel, 1982; Pascarella, Duby, Terenzini, & Iverson, 1983), college grades (Anaya & Cole, 2001), critical thinking and communication skills (Kim & Sax, 2007), intellectual self-concept (Cole, 2007), and graduate school aspirations (Kim & Sax, 2007). In the context of STEM, students rely on support, recognition, and encouragement from faculty members in their development of STEM identities (Carlone & Johnson, 2007), where a stronger identity with science leads to a greater commitment to pursue careers in STEM disciplines (Chemers, Zurbriggen, Syed, Goza, & Bearman, in press). Through their interactions with students and ability to provide access to educational and professional opportunities and resources, faculty members serve as important institutional agents in shaping students' educational experiences and trajectories (Landefeld, 2009). Specifically, faculty connect students to beneficial undergraduate

research opportunities (Seymour, Hunter, Laursen, & DeAntoni, 2004) and provide access to networks promoting educational and career development (Crisp & Cruz, 2009).

Having support from a faculty mentor is likely to "enhance a students' education experience, morale, career planning and placement, and professional competence" (National Academy of Science, National Academy of Engineering, & Institute of Medicine, 1997, p. 65). Despite the many documented benefits for students associated with greater faculty contact, few scholars have investigated the factors that help STEM students develop supportive, mentoring relationships with faculty during college. This study draws from frameworks of mentorship (Johnson & Ridley, 2004; Mullen, 2005; Nora & Crisp, 2007; Ragins, 1999) and academic socialization processes (Becher, 1989; Stanton-Salazar, 2010) to understand the structures of opportunity within institutions and the characteristics and behaviors of students that encourage or deter STEM students' development of supportive mentoring relationships with faculty during college.

The Importance of Mentorship

Not all individuals arrive at college having had the same quality of pre-college opportunities and successes, and mentoring relationships between faculty and students can help to bridge that divide with the support mechanisms mentorship provides on a personal, academic, and career level. In approaching this study, we draw from Blackwell's (1989) definition of mentorship, which describes mentoring as "a process by which persons of superior rank, special achievements, and prestige instruct, counsel, guide, and facilitate the intellectual and/or career development of protégés" (p. 9). In this case, faculty serve as the institutional agents that counsel, instruct, and guide the development of their students.

Mentors as institutional agents. Faculty members have an important role and responsibility in helping to socialize students in college, yet many students experience challenges in finding a faculty mentor and establishing the key mentoring relationships that can facilitate their academic advancement. Stanton-Salazar's (2010) Institutional Agents framework acknowledges the influence of significant others in the academic socialization processes. This framework focuses on the systematic inequities that are reproduced through the cultural capital inherited through an individual's social position (Bourdieu, 1986; Bourdieu & Passeron, 1977) and the social capital of relationships, which provide socially valued resources and opportunities (Stanton-Salazar, 1997). Stanton-Salazar (1997, 2001, 2010) defines institutional agents as individuals of high-status (e.g., faculty members) who have the capacity and commitment to provide institutional resources and opportunities that can impact the social mobility that students can garner from higher education. His work, which has focused on youth from working-class backgrounds, serves as a useful model that explicates the role of privilege and acknowledges how class, race, and gender often result in differential access to critical support systems of agents who can act on students' behalf to facilitate their success. This perspective is key to this study given our focus on the role of faculty mentoring relationships and the characteristics and behaviors of students that predict access to and participation in such relationships.

Within Stanton-Salazar's (2010) framework, faculty can offer students direct support, which includes a faculty member's enactment of his or her role as a resource agent, knowledge agent, advisor, and networking coach. Faculty serve as resource agents in providing personal and institutional resources that facilitate students' success. They may also work as knowledge agents and advisors through academic counseling and by informally transmitting knowledge about the educational system. Success in navigating undergraduate STEM pathways is often dependent on

students' abilities to network by building relationships with influential people in the scientific community. As networking coaches, faculty help students learn to network and provide opportunities for developing and modeling appropriate networking skills.

Stanton-Salazar (2010) distinguishes the role of an institutional agent as going beyond that of a mentor by working at the systems level to promote structural change and the "authentic empowerment" of the student. Therefore, not only is a faculty member's status within the institution key in enacting this transformational change but these agents also need to possess a critical awareness of the systematic barriers and inequities that hinder students' educational attainment. This critical awareness is particularly important for faculty operating within the context of STEM fields, as scholars have pointed to the culture of science and the norms and values imbued in science disciplines as a major contributor to the high attrition rates in STEM (Hunter, Laursen, Seymour, Thiry, & Melton, 2010; Seymour & Hewitt, 1997).

Academic socialization through mentorship. Undergraduate students endure a socialization process within their academic disciplines, which acclimates them to the norms and values of their majors and is often accelerated through their interactions with faculty. Becher (1989) examines the culture of academic disciplines and provides context for understanding the distinct nature of STEM disciplines compared to non-STEM fields. This perspective positions the study within the dominant disciplinary culture that generally dictates scientific teaching, learning, and practice (Cobb, 2004). The culture of science, defined through institutional and disciplinary norms, has two primary tenets: the collective socialization processes that define the disciplinary practices acknowledged as acceptable within science and the individual experience of the discipline, which refers to the ways in which students are initiated into scientific practices (Becher, 1989).

The role of faculty, as the primary agents of socialization, may have the greatest influence on how students experience the collective culture of science. By entering into a mentoring relationship with faculty, students may increase the rate at which they become socialized within science and become more accustomed to the norms of the culture of science. Likewise, this increased rate of socialization may provide access to a wider array of professional networks and opportunities, which may further advance success (Hunter et al., 2010).

Developing Mentoring Relationships

We conceptualize mentorship for this study as a set of interactions in which faculty, as mentors with status, resources, and institutional knowledge, assist in the educational and career development and advancement of students, their protégés. Mentorship opportunities within academia can be formal or informal in nature. In formal mentorships, institutionalized arrangements assign mentors and protégés to one another. Two types of formal mentoring relationships include the appointment of faculty advisors to students and the arrangement of peer mentoring pairs (Mullen, 2005).

By contrast, informal mentorship is not predetermined or managed but often occurs more as reciprocal, spontaneous, and gradually developed relationships (Campbell & Campbell, 1997). These informal partnerships are initiated and fostered through a commitment of both parties rather than a structural requirement; therefore, informal mentorship provides an opportunity for relationships of mutual understanding, respect, and trust (Johnson & Ridley, 2004) with a more interpersonal bond (Mullen, 2005). This study focuses on the process that facilitates the development of these informal relationships, whereby students and faculty develop a mutual trust and commitment designed to advance students' educational and career goals.

The development of informal mentoring relationships requires action by two parties: students and faculty members. Past research suggests that faculty members' sense of organizational citizenship, whereby employees "assist protégés without their behavior being mandated or compensated by the organization" (McManus & Russell, 1997, p. 149), may serve as a catalyst for them to seek out and mentor students (Eagan, Sharkness, Hurtado, Mosqueda, & Chang, 2011). From the student perspective, students who have the skills and the desire that enable them to both recognize the career and educational importance of faculty mentorship and to navigate the socialization processes to establish these relationships may be the most likely to seek out faculty mentors.

An alternative explanation as to how and why students and faculty seek out and cultivate mentorships may be explained by the rising star hypothesis (Ragins, 1999; Sinh, Ragins, & Tharenou, 2009). The rising star hypothesis suggests that potential protégés who demonstrate motivation, achievement, savvy, and a proactive career orientation have significantly better chances of entering into a mentoring relationship (Ragins & Cotton, 1993; Wanberg, Welsh, & Hezlett, 2003). Within undergraduate education, students who demonstrate higher levels of pre-college, or in-college, academic achievement and express educational and career ambitions that align with potential mentors likely have the best chances of identifying, or being selected by, a faculty mentor and entering into an informal mentoring relationship.

Past research on faculty-student interactions in college provides support to the rising star hypothesis, as students who enter college with advanced levels of academic preparation typically have significantly more frequent interactions with faculty (Anaya & Cole, 2001; Chapman & Pascarella, 1983; Cole & Jackson, 2005; Erekson, 1992; Terenzini & Pascarella, 1978). Similarly, past research has linked advanced degree aspirations at college entry with increased

contact with faculty during college (Cole, 1999; Phelan, 1979). Thus, expressing early interests in advanced educational opportunities increases the likelihood and frequency with which undergraduate students interact with their faculty members.

According to Pascarella (1980), having similar interests and aspirations as faculty members significantly and positively predicts the frequency and quality of students' interactions with faculty, which connects to the rising star hypothesis (Ragins, 1999). Faculty members' behaviors and students' experiences in and perceptions of the classroom are also significant in determining student-faculty interactions (Wilson, Wood, & Gaff, 1974). According to Wilson et al. (1974), certain "accessibility cues," which students interpret as a faculty members' interest in interacting with students outside the classroom, influence the extent to which a student attempts to interact with a faculty member (Loo & Rolison, 1986). Such accessibility cues are important in understanding the development of student-faculty support networks in STEM, as students often describe STEM faculty as "cold," "intimidating," and "unapproachable" (Seymour & Hewitt, 1997). Indeed, STEM students who perceive that their professors care about their academic and personal problems have higher frequencies of interacting with faculty members during their first year of college (Hurtado, Eagan, Tran, Newman, Chang, & Velasco, in press). Thus, accessibility cues and the climate propagated by faculty may influence the extent to which students take a proactive approach in seeking out a mentoring relationship with faculty.

Challenges in Establishing Mentoring Relationships

A critique of the rising star hypothesis is that students who need mentoring the most may be overlooked when mentors select protégés, or such students may not have the social and cultural capital necessary to successfully navigate the postsecondary terrain in search of a mentor. Students who arrive at college with lower levels of academic achievement and

preparation or who come from cultures that do not emphasize self-promotion in education or in the workplace may struggle in identifying opportunities for mentorship (Ragins, 1999). Minority students often report being hesitant in approaching faculty who are racially different often due to a fear that faculty have negative perceptions of their racial group (Schwitzer, Griffin, Ancis, & Thomas, 1999). Additionally, students of color who experience or perceive hostile racial campus climates typically have significantly less frequent interactions with faculty (Allen, 1992; Hurtado, 1994; Kraft, 1991; Nora & Cabrera, 1996; Thompson, Worthington, & Atkinson, 1994). These results indicate that race/ethnicity and perceptions of campus climate play an important role in attempting to understand the determinants and likelihood of faculty support.

Lundberg and Schreiner (2004) suggest that, despite having more frequent interactions with faculty members, African American and Native American students reported less satisfaction with these relationships. Such lower satisfaction with faculty contact has also been found for Latina/o and Asian Pacific students (Ancis, Sedlacek, & Mohr, 2000). This lower satisfaction is often predicated on findings that indicate that the nature of faculty contact for students of color is qualitatively different as students of color often report being ignored (Suarez-Balcazar, Orellana-Damacela, Portillo and Andrews-Guillen, 2003) and treated as academically incompetent (Fries-Britt & Turner, 2001), whether or not students are high achieving (Fries-Britt, 1998). According to Landefeld (2009), the high attrition rates of URMs along the STEM pipeline can be traced to a lack of sufficient mentorship opportunities that are a result of the paucity of faculty members that are familiar with minority students' issues coupled with the extremely low numbers of minority professors in STEM. Thus, the development of effective and caring mentors that are experienced in the area of minority affairs are critical in the mentorship and subsequent success of underrepresented racial minority students in STEM fields (Landefeld, 2009).

Institutional Influence on Mentoring Relationships

Faculty members from all disciplines, but particularly in STEM, frequently encounter institutional and departmental pressures that reward research productivity over mentoring and teaching undergraduates (O'Meara & Braskamp, 2005); however, these reward systems largely depend on institutional type. In turn, STEM faculty at certain types of institutions tend to spend more time conducting research and less time teaching and interacting with students than their colleagues in the arts, humanities and social sciences (Fairweather & Beach, 2002). Although it may detract from some faculty members' time in the classroom with undergraduate students, this increased focus on research actually provides faculty members with an additional opportunity to mentor undergraduate students by including them on their research projects. Indeed, faculty appear most willing to mentor undergraduates on research projects when they have monetary support to do so (Eagan et al., 2011), and such opportunities provide access to supportive faculty networks for students (Hurtado et al., in press).

Departmental considerations, opportunity structures, and overall climates within institutions influence the extent to which students can make meaningful connections with faculty. Kuh and Hu (2001) found differences across both disciplines and institutional type. Students majoring in math and science majors reported less faculty interaction, while those in humanities and social sciences reported more interaction. Beyond disciplinary differences, students attending private institutions reported were more likely to have contact with faculty than those at public institutions. Prior literature posits that institutional size matters (Astin, 1993; Pace, 1990), as the frequency and quality of student-faculty interaction are typically greater at smaller institutions. Faculty at smaller institutions may have an easier time connecting individually with students and determining the alignment between students' ambitions and

faculty members' interests. Similarly, for students, faculty at smaller institutions may appear as being more accessible given the typically smaller number of students in most classes. These differences in student-faculty interactions across institutional structural characteristics underscore the competing pressures and different missions that faculty encounter within their departments and their institutions (O'Meara & Braskamp, 2005).

The predictive power of institutional type on the frequency of student-faculty interactions is further illustrated by comparisons between historically Black colleges and universities (HBCUs) and predominantly White institutions (PWIs). HBCUs and Hispanic-Serving Institutions (HSIs) serve disproportionately larger numbers of URM students (Laden, 2004; Provasnik & Shafer, 2004) and are often known for cultivating an environment that is culturally responsive (Outcalt & Skewes-Cox, 2002). Black students attending HBCUs typically report increased levels of faculty support and more welcoming climates compared to their peers at PWIs (Allen, 1992). Such college contexts have an impact on the propensity that African American students interact with faculty (Nelson Laird, Bridges, Morelon-Quainoo, Williams & Salinas Holmes, 2007), as Hurtado et al. (in press) found that Black STEM students who attended an HBCU interacted with faculty significantly more often than their Black peers at PWIs. College contexts in which faculty appear more focused on the needs of undergraduate students appear to provide more space for both faculty and undergraduates to seek out mentoring relationships with one another. This study specifically examines how this space may differentially affect the extent to which certain types of students, who might not typically seek out or be selected for faculty mentorship, are able to connect in meaningful ways with faculty mentors.

Methods

Many of the studies reviewed above examine student-faculty interactions without providing explicit connections to mentoring activities between faculty and students. This study seeks to address this gap in the literature by examining the predictive power of student characteristics, pre-college activities and achievement behaviors, institutional climate measures, and structural characteristics in determining the frequency with which students report receiving mentorship from faculty during college.

Sample

We draw from several sources of data to analyze the individual and institutional predictors of students engaging with faculty in mentoring activities during college. The primary data source comes from the 2004 Freshman Survey and 2008 College Senior Survey (CSS), both administered by the Higher Education Research Institute at UCLA. The 2004 Freshman Survey collected information about students' background characteristics, pre-college experiences, expectations for college life, and educational and career goals. Administered four years after students first entered college, the 2008 CSS inquired about students' college experiences, their satisfaction with various dimensions of campus life, and their educational and career aspirations.

With funding from the National Institutes of Health and the National Science Foundation, we targeted a diverse representation of institutions for participation in this study, including colleges and universities with strong reputations for graduating high numbers of underrepresented racial minorities in STEM disciplines and institutions with undergraduate research programs. Within each targeted institution, we identified a matched sample with equivalent numbers of URM STEM majors, URM non-STEM majors, and White and Asian American STEM majors. Eagan et al. (2010) and Eagan (2009) provide additional details about

the sampling process. The longitudinal response rate for the student surveys was 23% with a total of 6,224 students across 240 institutions responding to both surveys, and Eagan (2009) provides details on how we weighted the data to adjust for non-response bias.

To supplement the student-level data, we aggregated STEM faculty responses from the 2007-2008 HERI Faculty Survey. The Faculty Survey asked faculty from all disciplines to answer questions related to workload, perceptions of undergraduate education, opinions about institutional priorities, and activities and experiences inside and outside the classroom. We aggregated STEM faculty members' responses across our targeted institutions for the students surveys to provide measures of institutional climate from the faculty perspective. Additionally, we collected several institutional data elements from the Integrated Postsecondary Educational Data System.

Because this study focuses on STEM students' engagement with faculty in various mentoring activities, we limited our final sample to students who started and persisted in STEM majors from 2004 through 2008. This selection, coupled with losing 26 institutions and 154 students where faculty survey data were unavailable, resulted in a final analytic sample of 2,311 students across 188 colleges and universities. Table 1 provides descriptive statistics for all variables included in the analysis. White students comprise 44% of the sample, with Latino, Asian American, and Black students accounting for 19%, 16%, and 16% of students, respectively. Approximately 28% of students indicated plans as entering freshmen for a medical degree, and an equal proportion of students reported aspirations for a Ph.D. or Ed.D. This sample of students who persisted in STEM discipline through four years of college arrived with relatively high levels of pre-college academic achievement, as students reported high school GPAs in the A to A+ range and average SAT scores of approximately 1,240. Our sample of

institutions were moderately selective (mean SAT of 1,125), 54% were privately controlled, and HBCUs comprised 7% of the sample.

Variables

A factor composed of seven items from the 2008 CSS represents the dependent variable for this study. This factor represents the extent to which students reported being mentored by faculty, and it includes the following items: frequency that faculty provided encouragement to pursue graduate or professional study; an opportunity to work on a research project; advice and guidance about the educational program; emotional support and encouragement; a letter of recommendation; feedback about academic work outside of grades; and help in achieving professional goals. The Cronbach's alpha for this factor, which we identified through principal axis factoring with promax rotation, was 0.88, and Table 1 provides the factor loadings for each of the seven items comprising the factor. This factor goes beyond more general student-faculty interaction factors that connect more generally with students' contact with faculty (e.g., Hurtado et al., in press), as our outcome focuses on the frequency with which students' reported receiving specific types of encouragement and support from faculty members.

Appendix A provides the full list of student- and institution-level variables included in the analyses. The student-level statistical model accounts for students' background characteristics, pre-college experiences and academic achievement, educational and career goals, college experiences, and perceptions of the campus climate. Notably, we control for race, with White as the reference group, gender, socioeconomic status, high school GPA, and SAT composite score. Stanton-Salazar (1997) suggests differential access to support networks across specific demographic groups, and Ragins (1999) posits that students from higher-achieving backgrounds have a better chance of being identified as potential protégés by interested mentors.

Likewise, Cole and Jackson (2005) concluded that higher-achieving students tended to interact with faculty significantly more frequently. Additionally, the model examines the predictive power of students' high school activities, including time spent studying with other students, asking teachers for advice after class, and talking with high school teachers outside of class, to account for students' propensity to connect with classmates and teachers. The propensity to interact with faculty in high school predicts their likelihood of having more frequent contact with faculty in college (Hurtado et al., in press).

We also account for students' incoming identification with STEM, represented by a four-item factor first identified by Chang, Eagan, Lin, and Hurtado (in press), as commitment to science may facilitate students' socialization into their discipline (Becher, 1989) and make them more attractive to potential STEM mentors (Ragins, 1999). Similarly, Pascarella (1980) suggested that students who share interests with faculty tend to report significantly more frequent contact with faculty. Additionally, the model controls for students' initial goal to be well-off financially in life, degree aspirations, and reasons for enrolling in college.. Degree aspirations may signal to faculty students' interest in and commitment to and their educational pathways.

Among students' college activities and perceptions, we examine the predictive power of failing one or more courses, joining an academic-related club, and presenting research at a conference on the extent to which students reported being mentored by faculty. These activities relate to students' ambition and commitment to the educational and career trajectories, and may indicate to faculty a level of seriousness that may make them desirable protégés. Additionally, we analyze how working on independent study projects, tutoring other students, meeting with advisors or counselors about career plans, and asking faculty for advice after class relate to students' sense of faculty mentorship. Students who report having these types of experiences

more frequently are likely the ones being most proactive in their learning, which make them more likely to be identified by mentors (Ragins & Cotton, 1993; Wanberg, Welsh, & Hezlett, 2003). Finally, the model accounts for the predictive power of students' positive cross-racial interactions in college, a construct developed by HERI (2010), opinions about faculty's interest in their personal and academic problems, and students' satisfaction with the racial/ethnic diversity of the student body on their self-reported frequency of being mentored by faculty. Scholars have concluded that faculty accessibility cues (Wilson, Wood, & Gaff, 1974) and classroom climate (Hurtado et al., in press) significantly relate to students' willingness to seek out faculty contact.

Among the institutional variables in the model, we account for institutional control, selectivity, and HBCU status. Prior studies have concluded that students at private institutions report significantly more faculty interaction than their peers at public institutions (Kuh & Hu, 2001), and students at HBCUs tend to report significantly more support from faculty than their peers at predominantly White institutions (Allen, 1992; Nelson Laird et al., 2007). Given the large proportion of students interested in pursuing medical degrees, we also examine the predictive power of attending an institution with a medical school on students' sense of faculty mentorship. Other structural characteristics include the proportion of undergraduate STEM majors and the proportion of undergraduate students who identify as White. We aggregated one student-level variable across the institution to get a picture of students' overall sense of the campus climate and particularly students' opinions regarding whether faculty at their institution had an interest in students' personal problems. Finally, we include three faculty aggregate variables in the model: the average hours per week STEM faculty reported advising or counseling students, the average frequency faculty reported mentoring new faculty, and the

average sense of faculty that professors and instructors on campus maintain a strong interest in undergraduates' academic problems.

Analyses

Several variables in our analyses had cases with missing data, and we relied upon the expectation maximization (EM) algorithm to account for cases with missing data. The EM algorithm relies on maximum likelihood estimates to replace missing values on variables where a relatively small proportion of data is missing (McLachlan & Krishnan, 1997), and this replacement technique represents a more robust method for handling missing data than mean replacement or listwise deletion (Allison, 2002). No variable in our model had more than 11% of cases with missing data, and we deleted cases that had missing data for the outcome variable and for demographic characteristics (i.e., race and gender).

After accounting for missing data and running some descriptive analyses on the data, we used hierarchical linear modeling (HLM) to analyze how student- and institution-level variables related to students' sense of faculty mentorship. HLM represents the most appropriate statistical technique when analyzing a continuous outcome with nested data (Raudenbush & Bryk, 2002). Within this study, students are clustered within institutions, and HLM accounts for the homogeneity of errors within groups and provides robust standard errors, which helps to prevent researchers from making a Type I statistical error (Raudenbush & Bryk). To justify the use of HLM, the outcome must significantly vary across institutions, and Raudenbush and Bryk (2002) recommend using the intra-class correlation coefficient (ICC) to determine the extent of this variation. After examining the results of a fully unconditional model, we calculated the ICC for our outcome variable to be 12.8%, which suggests that 11.6% of the variation in students' sense of faculty mentorship can be attributed to differences across colleges and universities. Finally, in

our model we grand-mean centered all continuous independent variables and left all dichotomous variables un-centered.

Limitations

Before discussing the results, it is important to note three important limitations of this study. First, as with any study relying on secondary data analysis, we are limited by the variables and their definitions available in the dataset. For example, our dependent variable measures the frequency with which students reported receiving different types of mentorship from faculty members; however, we lack information about the quality of the mentoring interactions and whether these mentors were faculty in STEM disciplines. Additionally, our data come from nearly 200 four-year colleges and universities and represent a large, diverse sample of students who started and persisted in STEM disciplines through four years of college. Even with this breadth and diversity in the sample, the data are limited in their generalizability. Finally, half of the variables included in this study were measured at the same time point of the outcome variable; thus, this study aims to show associations and relationships rather than make causal inferences about the types of behaviors that directly lead to increased mentorship form faculty.

Results

Table 3 presents the results from the HLM analyses, and we show two stages of our model: the model after controlling for all variables from the 2004 Freshman Survey and the full, final model. In comparing the results between Model 1 and Model 2, we note that many of students' background characteristics and pre-college activities become non-significant after accounting for their college experiences. After just controlling for students' demographics and pre-college experiences, we find Asian American students to report receiving significantly less frequent mentorship from faculty compared to their White classmates; however, we detect no

significant differences between White students and their Black, Latino, or Native American counterparts. These findings change slightly by Model 2, where the significant difference between Asian American students and White students disappears; however, after accounting for students' college experiences, it seems that Native American students receive significantly less frequent faculty mentorship than White students.

A notable finding between Models 1 and 2 is the diminishing importance of pre-college achievement, as measured by SAT composite scores. After controlling for just pre-college experiences, students with higher SAT scores tend to report significantly more mentorship from faculty during college, which would lend support to the rising-star hypothesis (Ragins, 1999), as faculty recognize the potential in high-achieving students and identify them as potential protégés. This finding also connects with work by Cole and Jackson (2005), which suggested that higher-achieving students tend to seek contact with faculty significantly more often. Once we added college experiences to the model, however, the significance of SAT scores was eliminated. This change suggests that high-achieving students appear to be participating in the types of experiences and opportunities that lend themselves to being mentored by faculty. The lack of significance of high school GPA in both models may relate to the relatively high levels of pre-college high school achievement reported by the STEM persisters in this sample.

Students' connections with high school faculty also initially significantly predict their frequency of being mentored by faculty in college, as it is likely that students who felt comfortable seeking out teachers in high school maintain that same level of comfort and social capital in seeking faculty interactions in college. The significance of students' propensity to interact with faculty in high school is diminished after accounting for students' frequency of connecting with faculty in college.

Enrolling in college to prepare for graduate school or choosing an institution because graduates from the college or university gain admission to top graduate or professional schools both initially had significant, positive associations with faculty mentorship in college. Having more general graduate school orientation maintained its predictive power after controlling for students' college experiences, which supports the tenet of the rising-star hypothesis that potential protégés who express ambition may make potential mentors take note of them (Ragins, 1999). Likewise, this significant association lends support to Pascarella (1980) who found that students who share interests, in this case, educational ambition, with faculty typically report more frequent contact with professors. By contrast, specifically choosing an institution based on its reputation for placing graduates into top graduate and professional schools loses significance by Model 2. In building the model, this variable appears to lose significance after accounting for whether students participated in a program while in college that prepares them for graduate school.

As shown in Model 1, students who enrolled in 2004 with a strong identification with science reported significantly more frequent faculty mentorship during college. This initial finding indicates that demonstrating an interest in and commitment to science may have attracted the attention of potential faculty mentors, which follows with the rising-star hypothesis (Ragins, 1999; Sinh, Ragins, & Tharenou, 2009) and supports Pascarella's (1980) finding that sharing interests with faculty leads students to connect with faculty more often. Students' science identity, however, becomes non-significant by Model 2, which suggests that students who strongly identify with STEM as freshmen are likely the same students who pursue opportunities such as presenting research, joining academic clubs, and participating in graduate school preparation programs. By contrast, students who came to college with the goal to be well-off

financially reported significantly less frequent mentoring interactions with faculty, and this association remained significant even after controlling for students' college experiences.

All of the student-level college experience variables exhibited a significant association with students' frequency of being mentored by faculty. Providing some support for the rising-star hypothesis (Ragins, 1999; Sinh, Ragins, & Tharenou, 2009), students who demonstrate interest in or ambition for continuing their education, whether by participating in programs to prepare for graduate school, wanting to have a career focused on the discovery and enhancement of knowledge, or meeting with advisors and counselors about career plans, report receiving mentorship from faculty significantly more frequently. Because students reported these experiences at the same time point that they reported their mentoring interaction with faculty, it remains unclear whether these behaviors made faculty take note of these students as possible protégés or whether students who had received mentorship from faculty decided to pursue these endeavors. Additionally, students who joined an academic-related club, worked on independent study projects, and presented research at conferences tended to have significantly more frequent mentoring interactions with faculty. Likewise, students who felt comfortable enough to challenge professors in class and talk with faculty outside of class and offices hours tended to more often be the beneficiaries of faculty mentorship. These two associations connect with prior research about faculty accessibility cues and their relationship to students' propensity to interact with faculty (Hurtado et al., in press; Wilson, Wood, & Gaff, 1974). Students who have a level of comfort in challenging faculty and seeking contact with them outside of class also report having significantly more mentoring-related interactions with their professors.

Not all college experiences and perceptions, however, had positive associations with being mentored by faculty. Students who failed at least one course in college reported

significantly less frequent faculty mentoring activities. Failing a class may signal to potential faculty mentors that students lack a certain degree of potential and may discourage faculty from wanting to mentor a student. By contrast, students who fail a course may have more negative views of faculty and become unwilling to seek out more meaningful connections with them.

Findings in Table 3 also indicate that students who felt intimidated by their professors or who more often felt isolated from campus life tended to experience significantly less mentorship from faculty. This finding further underscores the need for faculty to own their role as institutional agents and provide students with accessibility cues to signal to students that they can feel comfortable interacting with faculty and seeking faculty members' support (Wilson, Wood, & Gaff, 1974). Students have a responsibility for their learning and for making an effort to engage with faculty; however, faculty likewise have a responsibility to make themselves open to and supportive of interaction with students.

Connected to these accessibility cues and students' perceptions of them are the positive associations between receiving faculty mentorship and students' opinion that faculty are interested in both their personal and their academic problems. Students who sensed an ethic of care from faculty about their personal and academic lives reported receiving significantly more frequent faculty mentorship; however, it is possible that having received faculty mentorship prompted students to sense that faculty cared about them both personally and academically. This finding connects with research by Hurtado et al. (in press) that found that students reported more frequent, positive interactions with faculty when they sensed that faculty cared about them as individuals. Moreover, students who experienced more positive cross-racial interactions and were more satisfied with the racial/ethnic diversity of the student body, both of which have implications for campus racial climate, reported significantly more support from faculty. Such

findings confirm that a positive campus racial climate is conducive to the development of meaningful faculty-student relationships (Allen, 1992; Hurtado, 1994; Kraft, 1991; Nora & Cabrera, 1996; Thompson, Worthington, & Atkinson, 1994).

In addition to the student-level findings, the results in Table 3 demonstrate important differences across institutional characteristics. On average, students at private colleges and universities reported significantly more faculty mentorship than their counterparts at public institutions, which supports work by Kuh and Hu (2001). Additionally, institutional selectivity had a significant, positive association with faculty mentorship, as students at more selective institutions reported having more frequent mentoring interactions with their faculty. This finding provides disconfirming evidence from what Hurtado et al. (in press) reported; however, that study examined first-year science students' more general (i.e., not mentoring related) interactions with faculty. It may be that students at more selective institutions recognize the prestige that comes from attending such an institution (Zhang, 2005), and they try to capitalize by seeking out on that prestige by seeking faculty mentorship to maximize any benefit to their career and educational plans.

The findings also suggest that students who attended an HBCU received significantly more faculty mentorship compared to their peers at predominantly White institutions (PWIs). Research has concluded that HBCUs offer students more supportive environments, as students report receiving significantly more encouragement from faculty to succeed academically (Allen, 1992; Nelson Laird et al., 2007). Additionally, Hurtado et al. (in press) found that Black students at HBCUs had significantly more frequent interactions with faculty than did their Black peers at PWIs. Interestingly, the findings in Table 3 also suggest that attending an institution with a

higher proportion of White undergraduates also predicted significantly more frequent mentorship.

Attending an institution that enrolled a greater proportion of STEM undergraduates predicted receiving significantly less faculty mentorship. Given the limitations of our data, it is not clear whether this finding relates to competition among STEM majors for faculty members' attention, whether faculty at institutions with high concentrations of STEM students have less interest in mentoring, or whether this association is actually picking up on some other unobserved institutional characteristics. Two other aggregate climate measures had significant associations with students' receipt of faculty mentorship. Attending an institution where students, on average, felt that faculty at their institution were interested in students' personal problems significantly predicted more frequent mentorship from faculty. Likewise, students at colleges and universities where faculty, on average, reported spending more hours per week advising and counseling students tended to receive significantly more frequent mentorship.

The model statistics appear at the bottom of Table 3. The student-level model accounted for 49.8% of the within-institution variance in students' frequency of receiving faculty mentorship. Approximately 94.7% of the between-institution variance in the outcome was accounted for by our model. In sum, the variables presented in Table 3 accounted for 55.0% of the variation in the frequency with which students were mentored by faculty during college.

Conclusion and Implications

Being mentored by faculty members not only helps students become socialized into their undergraduate institution (Weidman, 1989) and academic discipline (Becher, 1989) but it also helps students to access important networks of information (Stanton-Salazar, 1997, 2010) that can help them progress along career and educational pathways (Crisp & Cruz, 2009; Landefeld,

2009; Seymour et al., 2004). Although scholars have recognized the importance of mentorship in predicting a host of college and post-college outcomes (e.g., Anaya & Cole, 2001; Kim & Sax, 2007; Lundberg & Schreiner, 2004), understanding how students access these critical relationships has been understudied. This study examined the characteristics and behaviors of students coupled with institutional climates and structures of opportunities that predict the frequency that students reported receiving mentorship from faculty during college. Our findings suggest pre-college characteristics and behaviors matter but that these pre-college variables matter more in determining the types of experiences students have in college that eventually connect them with faculty mentors. Indeed, the most significant predictors of being mentored by faculty in college appear to be the types of experiences students have in college and the institutional climates and structural barriers students encounter during their undergraduate careers.

Our findings provide some support for the rising-star hypothesis. Specifically, students who entered college with higher SAT scores, a strong identification with science, and graduate school inclinations reported receiving significantly more frequent faculty mentorship during college. Although several of these significant associations became non-significant after accounting for students college experiences, these findings suggest that students who have demonstrated academic potential and who share interests with faculty have the greatest chances of engaging in the college activities that provide them the best access to faculty mentors. Likewise, students who assumed a more proactive approach to their educational and career trajectories by presenting research at conferences, participating in graduate school preparation programs, and meeting with advisors and counselors about career plans tended to receive significantly more mentorship from faculty.

Just as important as students' agency in identifying and connecting with potential mentors is faculty's role in reaching out to students. Our findings indicate that students who perceive faculty as intimidating have less frequenting mentoring interactions with faculty. Likewise, students who perceive a lack of care or interest from faculty regarding students' personal and academic problems have a reluctance to seek out faculty mentors. By demonstrating an openness to working with students, faculty can go a long way in improving the likelihood that students will feel comfortable seeking them out for support and guidance; this support becomes critical to students as they advance along their educational and career pathways (Chemers et al., in press; Landefeld, 2009; Maton & Hrabowski, 2004; Packard, 2004; Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, & Gary, 2009). Importantly, faculty need to be critical of the rising star hypothesis and work to develop student talent rather than simply harvest. By connecting with students and identifying potential, rather than relying on eager, assertive, well-prepared, well-socialized students, faculty can support and guide a broader cross-section of the undergraduate student body.

Going forward, research needs to address the quality of these mentoring relationships between faculty and students, as this study considered only the frequency of specific mentoring interactions. Examining the quality and the benefits that both students and faculty report deriving from these relationships will provide further insight into their value and importance. Additionally, such research may offer suggestions as to how best to structure informal mentorships between faculty and students so as to maximize the associated benefits. Moreover, while the study found no significant differences across many racial/ethnic groups and gender in their attainment of faculty mentorship, the study does not tease out whether these students received mentorship from STEM faculty, specifically. Future research should address this issue

given the importance for persistence and success in STEM that students receive mentorship from STEM faculty along their educational trajectories. Generalizations that all STEM students, regardless of race/ethnicity and gender, are receiving equal amounts of faculty support in STEM must be taken with caution as some groups may search for and receive mentorship from faculty outside of STEM disciplines more often than others due to insurmountable barriers experienced in their attempt to receive mentorship from faculty in STEM. Future research also needs to consider the role of mentorship in longer-term outcomes using multiple time points of data. By following students beyond their undergraduate years, scholars can offer a more thorough understanding of the ways in which having a faculty mentor as an undergraduate student affects STEM students' career and educational decisions after college.

Faculty's mentorship of undergraduate STEM students represents one of many tools we can use to address the racial disparities in undergraduate and graduate STEM education. By connecting with students in a way that helps them to become socialized into their undergraduate STEM majors, faculty mentors can provide the guidance and support necessary for students to successfully navigate their educational and career trajectories. Although mentorship represents a two-way relationship between faculty and students, faculty must realize the role they have in reaching out to students and providing the space for students to reach out to them, as selecting only the most assertive, well-prepared students merely harvests STEM talent rather than develops students' potential for STEM careers. Additionally, this problematic practice may lead to disproportionate access to critical networks, relationships, and resources for certain groups which can further disparities along STEM pathways. Working to develop, support, and nurture students STEM talent and potential may go a long way in improving undergraduate STEM completion rates and graduate STEM enrollment rates for all students.

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Appendix
Table of Measures

Variable	Coding
Dependent Variable	
Faculty Mentorship	Factor composed of seven variables: faculty providing help in achieving professional goals (0.81), advice and guidance about your educational program (0.80), emotional support and encouragement (0.74), encouragement to pursue graduate or professional study (0.72), feedback about your academic work (outside of class; 0.69), a letter of recommendation (0.66), and an opportunity to work on a research project with faculty (0.63), (alpha= 0.88)
Student-Level Background and Pre-College Variables	
Sex: Female	0=male, 1= female
Race: Asian American	0=no, 1=yes (referent White)
Race: Black	0=no, 1=yes (referent White)
Race: Native American	0=no, 1=yes (referent White)
Race: Latino	0=no, 1=yes (referent White)
Socioeconomic status	Factor composed of: Father's education (0.82), Mother's education (0.76), and Parental Income (0.56), (alpha= 0.71)
High school GPA	1=D to 8=A or A+
SAT composite score	Continuous
Pre-college activity: Bored in class	1=not at all to 3=frequently
Pre-college activity: Studied with other students	1=not at all to 3=frequently
Pre-college activity: Asked a teacher for advice after class	1=not at all to 3=frequently
Hours per week: Talking with high school teachers outside class	1= none to 8=over 20 hours
Chose this institution based on advice from private counselor	1=not important to 3=very important
Chose this institution because grads gain admission to top graduate/professional schools	1=not important to 3=very important

Enrolled in college to prepare for graduate/professional school	1= not important to 3=very important
Goal: To be well-off financially	1=Not Important to 4=essential
Concerns about financing college	1=none to 3=major
STEM identity	Factor composed of four variables relating to the goals of: obtaining recognition from colleagues (0.75), making a theoretical contribution to science (0.61), becoming and authority in my own field (0.64), and working to find a cure for a health problem (0.43), (alpha = 0.69)
2004 Degree aspiration: MD	0=no, 1=yes
2004 Degree aspiration: Ph.D. or Ed.D.	0=no, 1=yes
Student-Level College Variables	
Career goal: Discovery/enhancement of knowledge	1=Not Important to 4=essential
Failed one or more courses	0=no, 1=yes
Participated in a program to prepare for graduate school	0=no, 1=yes
Joined a club or organization related to major	0=no, 1=yes
Presented research at a conference	0=no, 1=yes
College academic engagement construct	Factor composed of six variables: Came late to class, fell asleep in class, failed to complete homework on time, skipped class, turned in course assignments that did not reflect best work, and missed class for other reasons.
Frequency: Worked on independent study projects	1=not at all to 3=frequently
Frequency: Have been a guest in a professor's home	1=not at all to 3=frequently
Frequency: Tutored another college student	1=not at all to 3=frequently
Frequency: Met with an advisor/counselor about career plans	1=not at all to 3=frequently
Frequency: Asked a professor for advice outside of class	1=not at all to 3=frequently
Frequency: Challenged a professor's ideas in class	1=not at all to 3=frequently
Frequency: Felt intimidated by professors	1=not at all to 3=frequently
Frequency: Felt isolated from campus life	1=not at all to 3=frequently
Hours per week: Talked with faculty outside of class/office hours	1= none to 8=over 20 hours

College positive cross-racial interaction construct	A factor with seven variables assessing how often students have experienced the following with students from a different racial/ethnic group from their own: socialized, dined/shared a meal, had meaningful and honest discussions about race/ethnicity, shared personal feelings and problems, had intellectual discussions outside of clas, studied or prepared for class, socialized or partied.
Opinion: Faculty here are interested in students' personal problems	1=strongly disagree to 4=strongly agree
Opinion: Faculty here are interested in students' academic problems	1=strongly disagree to 4=strongly agree
Satisfaction: Racial/ethnic diversity of the student body	1=Very dissatisfied to 5=Very satisfied
Institutional Contexts (Level 2)	
Institutional control: Private	0=no, 1=yes
Selectivity	Continuous; range 400-1600, rescaled to 4-16
HBCU	0=no, 1=yes
Institution offers a medical degree	0=no, 1=yes
Proportion of STEM undergraduate majors	Continuous
Proportion of undergraduate White students	Continuous
Student peer mean: Faculty here are interested in students' personal problems	Average of this opinion variable (level-1) for each institution
Faculty hours per week spent advising/counseling students	1=none to 9= 45+
Faculty frequency: Mentoring new faculty	1= Not at all to 3= To a great extent
Faculty opinion: Faculty here are strongly interested in undergraduates' academic problems	Average of this opinion variable (level-1) for each institution

Table 1
Descriptive Statistics of Variables in the Model

Table 2
Factor Loadings for the Factors Included in the Analysis

	Cronbach's Alpha	Factor Loading
Faculty Mentorship	0.88	
Help in achieving your professional goals		0.81
Advice and guidance about your educational program		0.80
Emotional support and encouragement		0.74
Encouragement to pursue graduate/professional study		0.72
Feedback about your academic work (outside of grades)		0.69
A letter of recommendation		0.66
An opportunity to work on a research project		0.63
Socioeconomic Status	0.71	
Father's education		0.82
Mother's education		0.76
Parental income		0.56
STEM Identity	0.69	
Obtain recognition from colleagues		0.75
Become an authority in my own field		0.64
Make a theoretical contribution to science		0.61
Work to find a cure to a health problem		0.43

Table 3
Hierarchical Linear Model Results Predicting Students' Receipt of Faculty Mentorship

	Model 1			Model 2		
	Coef.	S.E.	Sig.	Coef.	S.E.	Sig
Student-Level Background and Pre-College Variables						
Sex: Female	0.01	0.05		0.06	0.03	
Race: Asian American	-0.19	0.06	**	-0.06	0.05	
Race: Black	-0.01	0.08		-0.04	0.06	
Race: Native American	-0.14	0.10		-0.16	0.08	*
Race: Latino	-0.09	0.06		-0.08	0.05	
Socioeconomic status	0.04	0.02		0.02	0.02	
High school GPA	0.04	0.02		-0.02	0.02	
SAT composite score	0.06	0.02	**	0.00	0.00	
Pre-college activity: Bored in class	-0.12	0.04	**	-0.04	0.03	
Pre-college activity: Studied with other students	0.04	0.04		-0.01	0.03	
Pre-college activity: Asked a teacher for advice after class	0.11	0.04	**	0.01	0.03	
Hours per week: Talking with high school teachers outside class	0.07	0.03	**	0.01	0.02	
Chose this institution based on advice from private counselor	0.07	0.06		0.02	0.05	
Chose this institution because grades gain admission to top graduate/professional schools	0.10	0.03	**	0.01	0.03	
Enrolled in college to prepare for graduate/professional school	0.14	0.06	**	0.10	0.04	**
Goal: To be well-off financially	-0.09	0.03	***	-0.04	0.02	*
Concerns about financing college	-0.10	0.04	**	-0.03	0.03	
STEM identity	0.08	0.03	**	0.00	0.02	
2004 Degree aspiration: MD	-0.07	0.06		-0.07	0.05	
2004 Degree aspiration: Ph.D. or Ed.D.	-0.05	0.07		-0.07	0.04	
Student-Level College Variables						
Career goal: Discovery/enhancement of knowledge				0.13	0.02	***
Failed one or more courses				-0.17	0.04	***
Participated in a program to prepare for graduate school				0.10	0.04	*

Joined a club or organization related to major	0.09	0.03	**
Presented research at a conference	0.19	0.04	***
College academic engagement construct	-0.01	0.00	***
Frequency: Worked on independent study projects	0.12	0.02	***
Frequency: Have been a guest in a professor's home	0.17	0.03	***
Frequency: Tutored another college student	0.06	0.03	*
Frequency: Met with an advisor/counselor about career plans	0.18	0.03	***
Frequency: Asked a professor for advice outside of class	0.17	0.03	***
Frequency: Challenged a professor's ideas in class	0.07	0.03	**
Frequency: Felt intimidated by professors	-0.08	0.03	**
Frequency: Felt isolated from campus life	-0.06	0.02	**
Hours per week: Talked with faculty outside of class/office hours	0.13	0.01	***
College positive cross-racial interaction construct	0.01	0.00	*
Opinion: Faculty here are interested in students' personal problems	0.20	0.03	***
Opinion: Faculty here are interested in students' academic problems	0.22	0.03	***
Satisfaction: Racial/ethnic diversity of the student body	0.06	0.02	**
Institution-Level Variables			
Intercept	-0.69	0.15	***
Institutional control: Private	0.14	0.04	***
Selectivity	0.06	0.02	**
HBCU	0.22	0.10	*
Institution offers a medical degree	0.05	0.04	
Proportion of STEM undergraduate majors	-0.21	0.10	*
Proportion of undergraduate White students	0.34	0.11	**
Student peer mean: Faculty here are interested in students' personal problems	0.36	0.07	***
Faculty hours per week spent advising/counseling students	0.16	0.08	*
Faculty frequency: Mentoring new faculty	0.11	0.07	
Faculty opinion: Faculty here are strongly interested in undergraduates' academic problems	-0.10	0.08	

Model Statistics		
Variance component - Level-1	0.81	0.44
Variance component - Level-2	0.08	0.01
Explained variance at level-1	0.07	0.50
Explained variance at level-2	0.31	0.95
Overall explained variance	0.10	0.55