Research & Occasional Paper Series: CSHE.10.07

CSHE | Center for Studies in Higher Education

UNIVERSITY OF CALIFORNIA, BERKELEY
http://cshe.berkeley.edu/

A Student Experience in the Research University (SERU)
Project Research Paper[**]

DIFFERENT PATTERNS OF STUDENT-FACULTY INTERACTION IN RESEARCH UNIVERSITIES: An Analysis by Student Gender, Race, SES, and First-Generation Status

August, 2007

Young K. Kim
Cerritos College

Linda J. Sax
University of California, Los Angeles

ABSTRACT

This study examined the conditional effects of student-faculty interaction in a large research university system, based on various student characteristics including gender, race, and socio-economic and first-generation status. The study utilized data from the 2006 University of California Undergraduate Experience Survey (UCUES), a longitudinal survey of UC undergraduate students based at the Center for Studies in Higher Education at UC Berkeley. Cross-tabulations with Chi-square statistics and blocked separate regression analyses were employed as analytical methods. The study found that the impact of student-faculty interactions on student outcomes vary by student gender and race whereas it does not by student socio-economic or first-generation status. The positive relationship between research experiences and GPA, for example, is significantly stronger for African American students relative to other students. These and other conditional effects suggest avenues for future research for better understanding whether the nature of the faculty-student interaction differs in certain ways by race or gender, thus producing dissimilar outcomes for different groups.

[**] The SERU Project is a collaborative study based at the Center for Studies in Higher Education at UC Berkeley and focused on developing new types of data and innovative policy relevant scholarly analyses on the academic and civic experience of students at major research universities, One of the main products of the SERU Project has been the development and administration of the University of California Undergraduate Experience Survey (UCUES). For further information on the project, see http://cshe.berkeley.edu/research/seru/

Background and Literature Review

Interacting with faculty—whether in the classroom, the laboratory, office hours, or other venues—is one of the key college experiences associated with student development. Positive and close interactions between undergraduates and their professors precipitate students' favorable educational experiences as well as their greater academic and personal development (Lau, 2003; Pascarella & Terenzini, 1991). College impact research has continually demonstrated a positive relationship between student-faculty interaction and a broad range of student educational outcomes, including academic achievement, educational aspirations, intellectual growth, and academic satisfaction (Astin, 1977, 1993; Endo & Harpel, 1982; Kuh & Hu, 2001; Pascarella, 1980; Pascarella & Terenzini, 1991; Thompson, 2001; Volkwein, King, & Terenzini, 1986). Research also shows that the positive benefits of the interaction are not limited to classroom performance. Such interaction has a positive effect on students' self-concept, persistence, and satisfaction with non-academic life (Astin, 1993; Campbell & Campbell, 1997; Kuh, 1995; Pascarella, 1985; Pascarella & Terenzini, 1976; Tinto, 1975).

Until the 1990s, the majority of research documenting the positive association between faculty contact and educational outcomes utilized aggregate student samples (i.e., not disaggregated by race, gender, or other factors). However, a number of recent studies highlight that the effect of student-faculty interaction may be "conditional." Specifically, contrary to a "general" college effect, a "conditional" effect assumes that the same intervention or experience might not have the same impact for all kinds of students (Pascarella, 2006). Some studies demonstrate that the impact of student-faculty interaction may differ by student gender (Colbeck, Cabrera, & Terenzini, 2001; Kezar & Moriarty, 2000), and others reveal differences by race (Cole, 2004; Mayo, Murguía, & Padilla, 1995). Sax, Bryant, and Harper (2005) found that, compared to female students, male students experienced greater gains in political engagement, social activism, and liberalism resulting from their interactions with faculty. By contrast, the positive effects of student-faculty interaction on the students' sense of physical, emotional, and academic well-being were more evident among females. A study by Lundberg and Schreiner (2004) suggests that the effects of student-faculty contact may vary by student race. Although African American and Native American students worked hardest to meet faculty expectations, due in part to faculty feedback, these interactions had little significant impact on learning for either group. Lundberg and Schreiner argue that African American and Native American students receive fewer benefits from their interaction with faculty, despite more frequent contact than other racial groups.

These results suggest that the estimation of general effects using combined student samples cannot fully explain the relationship between student-faculty interaction and student educational outcomes. Furthermore, the existence of gender- or race- based conditional effects in student-faculty interaction raises the question about other conditional effects in the college experience. Indeed, Pascarella (2006) argues that broadening our notion of diversity regarding the college student populations beyond racial diversity (e.g., diversity of social class, value, or religious views) may improve the college impact research.

Another factor which may influence the role played by student-faculty interaction is the type of college attended by students. Undergraduates in small, liberal arts colleges benefit from more frequent interactions with faculty—both in and out of class—while those attending large research universities may have more difficulty gaining access to

faculty (Boyer Commission, 1998; Kuh & Hu, 2001; Kuh & Vesper, 1997). Students at large research universities encounter at least two potential challenges to faculty access: first is the large student-faculty ratio which inherently limits opportunity for direct interaction with faculty, and second is an emphasis on research which can focus faculty attention on graduate students at the expense of undergraduates (Astin & Chang, 1995). However, an emphasis on research need not come at the expense of undergraduates, as it provides a potentially powerful opportunity for undergraduate learning and engagement.

The current study improves our knowledge base of the conditional effects of student-faculty interaction by examining different patterns of student-faculty interaction for various types of student subgroups within a large research university system. Specifically, it seeks to answer the questions:

1) How does the level of student-faculty interaction vary by student gender, race, SES (socio-economic status), and first-generation status[1]?
2) How does the relationship between student-faculty interaction and student educational outcomes vary by these student characteristics?

Research Framework

The relationship between student-faculty interaction and student educational outcomes is well explained by various theoretical frameworks (see Astin, 1984; Bronfenbrenner, 1979; Pascarella, 1985; Tinto, 1987, 1993; Weidman, 1989). However, Astin's involvement theory (1984) and I-E-O (Inputs-Environments-Outcomes) framework (1991) are especially relevant, in both a conceptual and a methodological sense, to the current study. Astin's involvement theory stresses "behavioral mechanisms or processes that facilitate student development" (Astin, 1984, p.301). He suggests that students are more likely to learn and develop when they invest more time and energy in meaningful college experiences. Since his involvement concept is clearly operationalized, and also mirrors the "time-on-task" construct, it can be easily and reliably measured by quantitative survey items. Moreover, Astin's I-E-O framework accounts for characteristics that vary both *within* institutions (e.g., student background characteristics and college experiences) and *between* institutions (e.g., college environments). This framework allows researchers to estimate the unique predictive power of student-faculty interaction on outcome measures, controlling for an extensive set of within- and between-institutional confounding variables.

Methods

Data Source and Sample

The present project uses data from the 2006 University of California Undergraduate Experience Survey (UCUES), which is a longitudinal survey of UC undergraduate students administered by the UC Berkeley Office of Student Research and managed by the University of California Office of the President. Included in this study are items from the UCUES Core and the Academic Engagement Module. The Core Items target all UC undergraduates, and gather information on student background characteristics,

[1] In this study, first-generation college students refer to those whose parents have not attended college (Billson & Terry, 1982).

academic and personal development, academic engagement, satisfaction, and evaluation of the major. The Academic Engagement Module targets a randomly selected 20% of the students, and collects data on students' college experiences and their perceptions of the university.

The sample for this study consisted of 30,566 UC undergraduate students who completed both UCUES Core Items and the Academic Engagement Module. The sample included more female students (58.3%) than male students (41.5%). Students were mainly from middle-class (59.6%) and upper-class (29.1%) families, with fewer from lower-class families (11.3%)[2]. Of the total sample, 19.0% of students were first-generation college students. The racial composition was as follows: 36.6% White, 2.4% African American, 38.3% Asian Americans, 12.5% Latinos, and 10.3% other race. We used listwise deletion for missing values. Along with multiple imputation, listwise deletion is considered one of the best approaches to missing data (Allison, 2002)[3]. Thus, the sample sizes decreased in the regression analyses, including only students who responded to all items in the regression models.

Variables

Overall, this study utilized five student outcome measures, three student-faculty interaction measures, and 36 control variables for the analyses.

Student Outcome Measures

Since research has demonstrated that student-faculty interaction is linked to a variety of student educational outcomes (Astin, 1977, 1993; Pascarella, 1980; Pascarella & Terenzini, 1991; Sax, Bryant, & Harper, 2005), this project employed multiple outcome measures: college GPA (grade point average), degree aspiration, integration, and two self-reported gains in skills (critical thinking and social awareness). Table 1 details specific survey items for each outcome measure. All outcome measures were collected on the 2006 UCUES Core. College GPA and degree aspiration were measured by, respectively, students' self-reported undergraduate GPA and their highest degree planned in Spring 2006. Integration is a composite measure constructed using two items concerning students' perception of belonging at their campus (Cronbach's alpha = .83). The last two outcomes were assessed using two pre-developed composite measures by the Center for Studies in Higher Education (CSHE), UC Berkeley. Gains in Critical Thinking and Communication reflects self-reported gains since entering college in a variety of skills, including critical thinking, communication, leadership, library skills, among others. Gains in Cultural Appreciation and Social Awareness reflects self-reported gains since entering college in students' appreciation of diversity, the fine arts, and social responsibility.

[2] The SES variable was created recoding social class variable originally measured by five-point scale from 1 = "low income or poor" to 5 = "wealthy" into three-point scale from 1 = "lower-class" to 3 = "upper-class."
[3] If data are missing completely at random, listwise deletion produces a random subsample of the original sample, since it generates little or no bias for all missing values (Allison, 2002).

Table 1. Outcome Measures

Outcome Measures	Survey Items
College GPA	UC GPA
Degree Aspiration	Highest degree planned
Integration	Factor
	Feeing that I belong at this campus
	Intention to still choose to enroll at this campus
Gains in Critical Thinking and Communication	Factor*
	Analytical and critical thinking skills
	Ability to be clear and effective when writing
	Ability to read and comprehend academic material
	Understanding of a specific field of study
	Ability to speak clearly and effectively in English
	Understanding international perspectives
	Leadership skills
	Computer skills
	Internet skills
	Library search skills
	Other research skills
	Ability to prepare and make a presentation
	Interpersonal kills
Gains in Cultural Appreciation and Social Awareness	Factor*
	Ability to appreciate, tolerate, and understand racial and ethnic diversity
	Ability to appreciate the fine arts
	Ability to appreciate cultural and global diversity
	Understanding the importance of personal social responsibility
	Self awareness and understanding

*Factor scales developed by the Center for Studies in Higher Education, UC Berkeley.

Independent Variables
Drawn from both the Core Items and Academic Engagement Module, five blocks of independent variables include the following:

1) Student demographic characteristics,
2) Initial freshman year experiences,
3) Institutional characteristics,
4) Major field climate, and
5) College Experiences (refer to Appendix A for a complete list of variable definitions and coding schemes).

The fifth independent block includes three student-faculty interaction measures such as:

1) raising standards for acceptable effort due to high standards of a faculty member,
2) assisting faculty in research with course credit, and
3) assisting faculty in research as a volunteer.

The first measure was rated on a six-point scale ranging from 1 = never to 6 = very often, and the other two items were measured by dichotomous scale.

Analyses
First, cross-tabulations were conducted to compare the levels of student-faculty interaction among different student subgroups. Moreover, Chi-square statistics were also computed to detect whether the differences observed are statistically significant. Furthermore, blocked stepwise regression analyses were conducted separately for each student subgroup to examine conditional effects of student-faculty interaction by the following student characteristics: gender, race, SES, and first-generation status. Since each conditional effect was examined independently, five sets of separate regression models were developed. For example, to see gender differences, initial exploratory separate regressions were run for male and female students, using “forward entry,” such that only variables that were significant at $p < .01$ would enter the regression equation. From these analyses, we could isolate variables that entered the regression for either males or females. These variables were then “force-entered” identically in separate regressions for each gender. The same approach was repeated for the other student characteristics. To determine whether the effects of student-faculty interaction are significantly different between student subgroups, *t*-tests were also conducted.

Results

Different Levels of Student-Faculty Interaction by Student Characteristics
We first tested how the levels of student-faculty interaction vary by student gender, race, SES, and first-generation status. Compiling the results from four sets of cross-tabulations, Table 2 displays the level of three different types of faculty interaction experienced by various kinds of student subgroups. The pattern of differences in the interaction based on each student characteristic was rather heterogeneous depending on the types of interaction.

Table 2. Student-Faculty Interaction by Student Gender, Race, SES, and First-Generation Status

Type of Interaction	Gender		
	Female	Male	Chi-Square
Students frequently[a] raised standard for acceptable effort due to the high standards of a faculty member	34.3	31.1	126.713**
Students assisted faculty in research with course credit	20.4	18.8	12.849*
Students assisted faculty in research as a volunteer	15.5	17.1	13.968*

Type of Interaction	Race				
	African American	Latino	Asian American	White	Chi-Square
Students frequently[a] raised standard for acceptable effort due to the high standards of a faculty member	35.0	39.2	30.6	32.7	200.866**
Students assisted faculty in research with course credit	16.8	18.9	20.9	18.8	30.349**
Students assisted faculty in research as a volunteer	12.6	15.3	17.4	15.4	46.451**

Type of Interaction	SES			
	Lower-class	Middle-Class	Upper-Class	Chi-Square
Students frequently[a] raised standard for acceptable effort due to the high standards of a faculty member	35.3	32.8	32.6	39.271**
Students assisted faculty in research with course credit	20.0	20.0	23.0	31.895**
Students assisted faculty in research as a volunteer	17.5	16.6	17.8	6.012

Type of Interaction	First-Generation		
	First Generation	Non-First-Generation	Chi-Square
Students frequently[a] raised standard for acceptable effort due to the high standards of a faculty member	34.8	32.4	40.367**
Students assisted faculty in research with course credit	17.7	20.5	20.234**
Students assisted faculty in research as a volunteer	15.5	16.5	2.755

[a]frequently = often, or very often.
*p < .01, **p< .0001.

Gender differences were statistically significant on all types of faculty contact. Female students are more likely than male students to raise their standards for acceptable effort due to the high standards of a faculty member, and to assist faculty in research with course credit. However, males reported higher levels of willingness to assist faculty in research as a volunteer than female students.

The frequency of faculty contact also significantly varies across student racial subgroups. Latino students reported the greatest frequency of raising standards due to the expectations of a faculty member, followed by African Americans, Whites, and Asian Americans. Comparatively, Asian American students reported the highest level of research-related interaction with faculty, followed by Latinos, Whites, and African Americans.

Differences in the level of faculty contact based on student SES and first-generation status were statistically significant on the first two types of interaction only. The results show that students from lower-class families or those whose parents have not attended college tend to raise their standard for acceptable effort due to the high standards of a faculty member more frequently than their counterparts. By contrast, students from upper-income families or those whose parents attended college are more likely than lower-class or first-generation students to assist faculty in research with course credit.

Different Impact of Student-Faculty Interaction by Student Characteristics

In order to comprehensively examine whether the relationship between student-faculty interaction and student educational outcomes varies by student gender, race, SES, and first-generation status, multiple sets of separate regression analyses were conducted. To determine whether the relationships are significantly different for student subgroups, *t*-tests were also conducted. Results of *t*-tests were presented by the bolded regression coefficient and/or the letter that corresponds to the group whose effect is significantly different at the $p < .05$ level from the group compared.

Gender Differences in the Impact of Student-Faculty Interaction

There exist complex dynamics in the relationships between student-faculty interactions and educational outcomes depending on the types of faculty interaction and student outcomes as well as gender subgroups (see Table 3). Students' experience of raising their standard for acceptable effort due to the high standard of faculty significantly and positively predicts their integration (perception of belonging at campus) and gains in cultural appreciation and social awareness for both female and male students, and the effects are not significantly different between the two groups. However, the positive effect of raising one's performance standard on students' critical thinking skills is significantly stronger for female students than male students.

Table 3. Impact of Student-Faculty Interaction by Student Gender

	Female	Male
Student Outcome	Beta	Beta
	Raised standard due to high standard of faculty	
GPA	.02	-.03
Degree aspiration	.00	.01
Integration	.10**	.11**
Gains in critical thinking	**.09****	**.05***
Gains in social awareness	.11**	.09**
	Assisted faculty in research with course credit	
GPA	.09**	.09**
Degree aspiration	**.15****	**.11****
Integration	.03**	.01
Gains in critical thinking	.03*	.03*
Gains in social awareness	**.00**	**-.03***
	Assisted faculty in research as a volunteer	
GPA	**.01**	**.04****
Degree aspiration	.11**	.12**
Integration	.01	-.01
Gains in critical thinking	.01	.02
Gains in social awareness	.00	-.02*

Note: Bolded betas indicate that, according to *t*-test results, the effects are significantly different for the two subgroups.
[a]frequently = often, or very often.
*p < .01, **p< .0001.

For both female and male students, assisting faculty in research for course credit predicts higher college GPAs and larger gains in critical thinking and communication. This faculty contact is also positively related to student degree aspiration for both females and males, but the association is significantly stronger for female students. Some effects of this interaction are exclusively significant for either females or males. For female students, assisting faculty in research for course credit increases the perception of belonging at their campus. Interestingly, for male students only, this type of faculty interaction relates to smaller gains in cultural appreciation and social awareness.

Undergraduate research experience as a volunteer demonstrates a different pattern in its impact on student outcomes. The results show that both female and male students who assisted faculty in research as a volunteer tend to aspire to more advanced degrees. For male students only, this research experience contributes to an enhanced undergraduate GPA, whereas it relates to smaller gains in cultural appreciation and social awareness.

Race Differences in the Impact of Student-Faculty Interaction

As shown in Table 4, differences in the relationships between faculty contact and student outcomes among African American, Latino, Asian American, and White students reveal more mixed findings. Students' experience of raising their standard for acceptable effort due to the high standards of faculty is significantly and positively associated with students' perception of belonging at their campus for all racial groups. The experience

serves to improve students' cultural appreciation and social awareness for Latino, Asian American, and White students, but it does not for African American students. For Asian American and White students only, the experience promotes gains in critical thinking and communication, but the impact is stronger among Asian American students than Whites.

Table 4. Impact of Student-Faculty Interaction by Student Race

	African American [A]	Latino [B]	Asian American [C]	White [D]
Student Outcome	Beta	Beta	Beta	Beta
	Raised standard due to high standard of faculty			
GPA	.05	.03	.01	-.02
Degree aspiration	-.04	-.03	.03	.00
Integration	.19*	.09*	.12**	.09**
Gains in critical thinking	.02	.05	**.10** (D)**	**.06** (C)**
Gains in social awareness	.03	.06*	.12**	.10**
	Assisted faculty in research with course credit			
GPA	**.20** (B,C,D)**	**.07** (A)**	**.09** (A)**	**.10** (A)**
Degree aspiration	.16*	.11**	**.11**(D)**	**.14** (C)**
Integration	-.01	.02	.03*	.03*
Gains in critical thinking	**-.06 (B,D)**	**.04* (A)**	.02	**.04** (A)**
Gains in social awareness	-.09	-.02	-.01	-.01
	Assisted faculty in research as a volunteer			
GPA	**.10* (B)**	**.00 (A)**	.03*	.02
Degree aspiration	.10*	.09**	**.10** (D)**	**.12** (C)**
Integration	-.04	-.03	.01	.01
Gains in critical thinking	.03	.01	.02	.02*
Gains in social awareness	-.02	**-.04* (C)**	**.00 (B)**	-.02

Note: Results of *t*-tests are presented by the bolded beta and the letter corresponding to the group whose effect is significantly different at the .05 level from the group compared.
[a]frequently = often, or very often.
*p < .01, **p< .0001.

Among all racial groups, students who assisted faculty in research with course credit tend to obtain higher college GPA, but the positive effect is more pronounced for African American students than Latino, Asian American, and White students. The research experience leads all racial groups of students to aspire to higher degree attainments, but the impact is stronger for White students than Asian American students. It has significant and positive impact on student integration for Asian American and White students only, and on gains in critical thinking and communication for Latino and White students only.

The effect of voluntary undergraduate research experience on degree aspiration is significant and positive for all racial groups. Comparatively, the experience is related to

higher college GPAs for African American and Asian American students only, and larger gains in critical thinking and communication for White students only. The results indicate that this type of research experience tends to decrease Latino students' gains in cultural appreciation and social awareness. Perhaps in this case the voluntary research experience serves in place of other aspects of campus involvement that may more enhance cultural awareness, such as student clubs and groups.

Socio-Economic Differences in the Impact of Student-Faculty interaction

Patterns in the impact of faculty interaction among lower-, middle-, and upper- class students are rather simple and straightforward (see Table 5). Although the betas slightly vary depending on students' socio-economic status, there is no statistical difference in the effects of student-faculty interaction on educational outcomes across the three student subgroups. Students' experience of raising their standard for acceptable effort due to the high standard of faculty significantly and positively affects students' integration, gains in critical thinking and communication, and gains in cultural appreciation and social awareness for the all students regardless of their socio-economic status.

Table 5. Impact of Student-Faculty Interaction by Student SES

	Lower-class [L]	Middle-Class [M]	Upper-Class [U]
Student Outcome	Beta	Beta	Beta
	Raised standard due to high standard of faculty		
GPA	.03	.00	-.01
Degree aspiration	.04	.01	.00
Integration	.06*	.11**	.10**
Gains in critical thinking	.08*	.08**	.07**
Gains in social awareness	.10**	.10**	.10**
	Assisted faculty in research with course credit		
GPA	.10**	.08**	.11**
Degree aspiration	.13**	.12**	.14**
Integration	.00	.04**	.01
Gains in critical thinking	.02	.02*	.04*
Gains in social awareness	-.02	-.01	-.02
	Assisted faculty in research as a volunteer		
GPA	.01	.02	.03*
Degree aspiration	.12**	.11**	.12**
Integration	-.02	.00	.00
Gains in critical thinking	.02	.01	.02
Gains in social awareness	-.03	-.02*	-.01

[a]frequently = often, or very often.
*p < .01, **p< .0001.

For all socio-economic groups, undergraduate research experience with course credit is significantly related to both higher college GPA and higher degree aspiration. However, the research experience has a significantly positive effect on students' integration for middle-class students only, and on gains in critical thinking and communication for middle- and upper- class students only.

Among all socio-economic groups, students who assisted faculty in research as a volunteer are more likely to aspire to higher degree attainments. The positive relationship between this research experience and college GPA is significant for upper-class students only. We also found that this type of faculty interaction relates to middle-class students' smaller-than-average gains in cultural appreciation and social awareness.

First-Generation Differences in the Impact of Student-Faculty Interaction

Table 6 exhibits different effects of student-faculty interaction on student outcomes for first-generation college students and their counterparts. Similar to the socio-economic differences examined above, there is no statistical difference in the effects of student-faculty interaction on educational outcomes between the two student subgroups. The positive impact of students' experience of raising their standard for acceptable effort due to the high standard of faculty on students' integration, gains in critical thinking and communication, and gains in cultural appreciation and social awareness is equally strong for both first-generation and non-first-generation college students.

Table 6. Impact of Student-Faculty Interaction by First-Generation Status

	First-Generation	Non-First-Generation
Student Outcome	Beta	Beta
	Raised standard due to high standard of faculty	
GPA	.04	.00
Degree aspiration	.02	.00
Integration	.09**	.11**
Gains in critical thinking	.07*	.08**
Gains in social awareness	.06*	.11**
	Assisted faculty in research with course credit	
GPA	.07**	.09**
Degree aspiration	.12**	.13**
Integration	.02	.03*
Gains in critical thinking	.04*	.02*
Gains in social awareness	.02	-.02*
	Assisted faculty in research as a volunteer	
GPA	.04*	.02*
Degree aspiration	.12**	.12**
Integration	-.04*	.00
Gains in critical thinking	.01	.02*
Gains in social awareness	-.02	-.01

[a]frequently = often, or very often.
*p < .01, **p< .0001.

Assisting faculty in research with course credit significantly and positively affects students' college GPA and degree aspiration as well as their gains in critical thinking and communication regardless of students' first-generation status. The research experience has a significantly positive effect on students' integration for non-first-generation students only. The results also show that this type of faculty interaction tends to decrease non-first-generation students' gains in cultural appreciation and social awareness.

Students who assisted faculty in research as a volunteer are more likely to obtain higher college GPAs and plan to pursue more advanced degrees, regardless of their first-generation status. For non-first-generation students only, the research experience as a volunteer contributes to enhance students' gains in critical thinking and communication. Interestingly, this type of interaction has a significantly negative effect on first-generation college students' integration. Similar to the interpretation noted above for Latino students and cultural awareness, perhaps voluntary participation in research detracts from first-generation college student integration whereas other involvement choices may enhance students' sense of belonging on campus.

Summary and Discussion

Set in the context of a large and diverse research university system, this study examines the impact of three types of student-faculty interaction across five student outcomes, and how the effects of such interaction vary by student's race, gender, social class and first-generation status. As noted earlier, research on the role played by student-faculty interactions has been limited due to a reliance on aggregated samples of students, such that general effects are well-documented but conditional effects are relatively unknown. As college campuses become increasingly diverse, especially when it comes to race and socioeconomic status, our understanding of the role played by student involvement with faculty cannot rely solely on prior research. It is possible that aspects of student-faculty interaction may be more or less beneficial for some groups than others, a fact demonstrated by Sax, Bryant and Harper (2005) with respect to gender and Kim (2006) with respect to race.

While the results of this study do suggest *some* conditional effects across *some* outcomes, a *pattern* of conditional effects does not emerge from these data. Characteristics such as gender and race shape the nature of the relationship between student-faculty interactions and developmental outcomes, albeit to a small degree. Some examples include: The relationship between assisting faculty in research for course credit and degree aspirations is significantly stronger for women than men; the positive relationship between research experiences and GPA is significantly stronger for African American students relative to other students; and voluntarily assisting faculty with research is negatively related to gains in social awareness for Latino students only. Given the sporadic nature of the conditional effects detected in this study, the practical implications are not yet clear. Instead, each of these conditional effects suggests avenues for future research so that we can better understand whether the *nature* of the faculty-student interaction differs in certain ways by race or gender, thus producing dissimilar outcomes for different groups. Further, although conditional effects are observed occasionally across categories of gender and race, they are never revealed in terms of class or first-generation status. This suggests that the types of student-faculty interactions measured in this study have the same effect (or no effect) for students regardless of their social class or whether their parents had attended college.

Though this study has placed emphasis on the study of conditional effects, it also reveals numerous general effects of student-faculty interactions (i.e., effects that generally do not vary by race, gender, class or first-generation status). These are listed below, along with notable exceptions in parentheses:

- Raising performance standards due to high faculty standards promotes *integration* for all groups;
- Raising performance standards due to high faculty standards promotes *critical thinking* for all groups (except African Americans and Latinos);
- Raising performance standards due to high faculty standards promotes *social awareness* for all groups (except African Americans);
- Assisting faculty in research for course credit predicts higher *GPAs* and *degree aspirations* for all groups;
- Assisting faculty in research for course credit predicts critical thinking (for all groups except Asians and African Americans); and
- Performing voluntary research with a faculty member promotes degree aspirations for all groups.

We can also learn something from the descriptive analyses presented in this study. Worth noting is that for each measure of student-faculty interaction, there is greater variation across racial group than across any of the other groups (as defined by gender, class, and first-generation status). In particular, Latino and African American students are the most likely to raise their performance standards due to the high standards set by faculty, and African American students are the least likely to assist faculty in research (either voluntarily or for course credit). Asian students are the most likely to have a research experience but the least likely to raise performance standards due to faculty expectations.

What we do not know is the *context* for these differences. For example, are Latino and African American students more likely to raise their own performance standards because they are more likely to have faculty explicitly (and individually) stating their high expectations of these students? Or, are these groups more sensitive than other students to a perception of high standards set by faculty? In other words, are high standards directed more often towards individual African American and Latino students or towards students in general, with these racial/ethnic groups most responsive? Similarly, are African Americans least likely to *seek out* research experiences or least likely to be *invited* to work with faculty on research? Certainly, research opportunities correspond with student's major, a fact that is not accounted for in the present study. Our understanding of the underlying dynamics requires additional collection, and would benefit most from interviews and observations that focus more specifically on the *nature* of the student-faculty relationship across different racial groups.

Though this study is a useful first look into these dynamics in the UC system, the study is limited in several ways. Notably, the study relies only on three measures of student-faculty interaction. Future drafts of this study can include a broader set of student-faculty interaction measures, including communicating with a faculty member by email or in person, talking with an instructor outside of class about issues and concepts derived from a course, and working with a faculty member on an activity other than course work. Further, these unused measures have greater variability than some of the faculty-interaction measures included in the present study (i.e., two of three were dichotomous). Perhaps the greatest limitation in the present study is its lack of reliance on longitudinal data. Ideally, the study would include measures of degree aspirations, critical thinking and other skills *before* students attended college. That way, we could assess, for example, whether and how interactions with faculty make a *difference* in students' degree aspirations, critical thinking, and cultural awareness.

In sum, this study reveals gender and racial differences in the impact of student-faculty interaction across undergraduate student outcomes, though no such differences by class or first-generation status. It justifies the study of conditional effects of student-faculty interaction, though it does not reveal any clear patterns into the nature of these conditional effects. Perhaps such patterns, if they exist, will become more evident as a broader range of student-faculty interaction measures is incorporated into future iterations of this study. Nevertheless, as discussed above, descriptive results do reveal potentially important differences across gender and race in the extent and nature of student faculty interactions.

REFERENCES

Allison, P. D. (2002). *Missing Data*. Thousand Oaks, CA: Sage Publications.

Astin, A. W. (1977). *Four critical years: Effects of college on beliefs, attitudes, and knowledge*. San Francisco: Jossey-Bass.

Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel, 25*(3), 297-308.

Astin, A. W. (1991). *Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education*. New York: American Council on Education/Macmillan Publishing Company.

Astin, A. W. (1993). *What matters in college: Four critical years revisited*. San Francisco: Jossey-Bass.

Astin, A.W., & Chang, M. J. (1995). Colleges that emphasize research and teaching: Can you have your cake and eat it too? *Change, 27*(5), 44-49.

Billson, J. M., & Terry, M. B. (1982). In search of the silken purse: Factors in attrition among first-generation students. *College and University, 58*, 57–75.

Boyer Commission on Educating Undergraduates in the Research University (1998). *Reinventing undergraduate education: A blueprint for America's research universities.* Stony Brook, NY: Carnegie Foundation for the Advancement of Teaching.

Campbell, T. A., & Campbell, D. E. (1997). Faculty/student mentor program: Effects on academic performance and retention. *Research in Higher Education, 38*(6), 727-742.

Colbeck, C. L., Cabrera, A. F., & Terenzini, P. T. (2001). Learning professional confidence: Linking teaching practices, students' self-perception, and gender. *The Review of Higher Education, 24*(2), 173-179.

Cole, D. (2004, November). *Minority students' faculty contact and the impact on their GPA*. Paper presented at the annual meeting of the Association for the Study of Higher Education, Kansas City, MO.

Endo, J., & Harpel, R. (1982). The effect of student-faculty interaction on students' educational outcomes. *Research in Higher Education, 16*(2), 115-138.

Kezar, A., & Moriarty, D. (2000). Expanding our understanding of student leadership development: A study exploring gender and ethnic identity. *Journal of College Student Development, 41*(1), 55-69.

Kim, Y. K. (2006). *Student-faculty interaction in college: Examining its causalities, predictors, and racial differences.* Unpublished doctoral dissertation. University of California, Los Angeles.

Kuh, G. D. (1995). The other curriculum: Out-of-class experiences associated with student learning and personal development. *The Journal of Higher Education, 66*(2), 123-155.

Kuh, G. D. (2001). Assessing what really matters to student learning: Inside the National Survey of Student Engagement. *Change, 33*(3), 10-17.

Kuh, G. D., & Hu, S. (2001). The effects of student-faculty interaction in the 1990s. *The Review of Higher Education, 24*(3), 309-332.

Kuh, G. D., & Vesper, N. (1997). A comparison of student experiences with good practices in undergraduate education between 1990 and 1994. *The Review of Higher Education, 21*(1), 43-61.

Lau, L. K. (2003). Institutional factors affecting student retention. *Education, 124*(1), 126-136.

Lundberg, C. A., & Schreiner, L. A. (2004). Quality and frequency of faculty-student interaction as predictors of learning: An analysis by student race/ethnicity. *Journal of College Student Development, 45*(5), 549-565.

Mayo, J. R., Murguía, E., & Padilla, R. V. (1995). Social integration and academic performance among minority university students. *Journal of College Student Development, 36*(6), 542-552.

Pascarella, E. T. (1980). Student-faculty informal contact and college outcomes. *Review of Educational Research, 50*(4), 545-595.

Pascarella, E. T. (1985). Students' affective development within the college environment. *The Journal of Higher Education, 56*(6), 640-663.

Pascarella, E. T. (2006). How college affects students: Ten directions for future research. *Journal of College Student Development, 47*(5), 508-520.

Pascarella, E. T., & Terenzini, P. T. (1976). Informal interaction with faculty and freshman ratings of academic and nonacademic experience of college. *Journal of Educational Research, 70*, 35-41.

Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty years of research*. San Francisco, CA: Jossey-Bass.

Sax, L. J., Bryant, A. N., & Harper, C. E. (2005). The differential effects of student-faculty interaction on college outcomes for women and men. *Journal of College Student Development, 46*(6), 642-659.

Thompson, M. D. (2001). Informal student-faculty interaction: Its relationship to educational gains in Science and Mathematics among community college students. *Community College Review, 29*(1), 35-57.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*(1), 89-125.

Tinto, V. (1987). *Leaving college: Rethinking the causes and curses of student attrition*. Chicago: University of Chicago Press.

Tinto, V. (1993). *Leaving college: Rethinking the causes and curses of student attrition* (2nd Ed.). Chicago, IL: University of Chicago Press.

Volkwein, J. F., King, M. C., & Terenzini, P. T. (1986). Student-faculty relationships and intellectual growth among transfer students. *The Journal of Higher Education, 57*(4), 413-430.

Weidman, J. (1989). Undergraduate socialization: A conceptual approach. In J. Smart (Ed.), *Higher education: Handbook of theory and research, Volume 5*. New York: Agathon Press.

Appendix A. Definitions and Coding Schemes for Independent Variables

Variables	Coding Schemes
Demographic Characteristics	
Gender	Dichotomous: 0 = no, 1 = yes
Ethnicity	
African American	All dichotomous: 0 = no, 1 = yes
Asian American	
Latino	
White	
Age	Range from 16 to 73
Mother's educational level	Nine-point scale:1 = less than high school, to 9 = doctorate
Father's educational level	Nine-point scale:1 = less than high school, to 9 = doctorate
Total parental annual income	Eleven-point scale: 1 = less than 10,000, to 11 = 200,000 or more
Born or came to US	Sixteen-point scale:1 = born in US, to 16 = came to US 2005 or later
Language heritage (when learn to speak English)	Five-point scale: 1 = native English, to 5 = after turning 16 years old
Initial Freshman Year Experiences	
Transfer status	Dichotomous: 0 = no, 1 = yes
Student level	Four-point scale: 1 = freshman to 4 = senior
Term of entry: Fall	Dichotomous: 0 = no, 1 = yes
Institutional Characteristics	
Current institution	
Berkeley	All dichotomous: 0 = no, 1 = yes
Davis	
Irvine	
Los Angeles	
Merced	
Riverside	
San Diego	
Santa Barbara	
Santa Cruz	

(*table continues*)

Appendix A. (continued)

Variables	Coding Schemes
Major Field Climate	
Major field climate: Open channels of communication b/w faculty and students	Dichotomous: 0 = no, 1 = yes
Major field climate: Students treated equitably and fairly by faculty	Dichotomous: 0 = no, 1 = yes
College Experiences	
Total UC units completed	
Curricular foundations for reasoning	Factor 4b*
Elevated academic effort	Factor 4c*
Collaborative learning	Factor 7a*
Time employed	Factor Ta*
Academic time	Factor Tb*
Library use	Factor Xb*
Enriching coursework	Factor Xe*
Number of service learning courses enrolled	Five-point scale: 1 = 0, to 5 = 4 or more
Raising standard for acceptable effort due to high standards of a faculty member	Six-point scale: 1 = never, to 6 = vary often
Assisting faculty in research with course credit	Dichotomous: 0 = no, 1 = yes
Assisting faculty in research for pay without course credit	Dichotomous: 0 = no, 1 = yes
Assisting faculty in research as a volunteer without course credit	Dichotomous: 0 = no, 1 = yes
Working on creative projects under the direction of faculty	Dichotomous: 0 = no, 1 = yes

*Factor scales developed by the Center for Studies in Higher Education, UC Berkeley.