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A Student Experience in the Research University (SERU)
Project Research Paper[1]

TWO CULTURES:
Undergraduate Academic Engagement

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Steven Brint
Professor of Sociology, University of California Riverside
Allison M. Cantwell
University of California Riverside
Robert A. Hannerman
Professor of Sociology, University of California Riverside

ABSTRACT
Using data on upper-division students in the University of California system, we show that two distinct cultures of engagement exist on campus. The culture of engagement in the arts, humanities and social sciences focuses on interaction, participation, and interest in ideas. The culture of engagement in the natural sciences and engineering focuses on improvement of quantitative skills through collaborative study with an eye to rewards in the labor market. The two cultures of engagement are strongly associated with post-graduate degree plans. The findings raise questions about normative conceptions of good educational practices in so far as they are considered to be equally relevant to students in all higher education institutions and all major fields of study.

Considerable scholarly and policy attention has been directed toward the improvement of undergraduate education for more than two decades (see, e.g., AAC 1985; Chickering and Gamson 1987). Yet interest appears to have peaked in recent years, as indicated

1 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/

by large-scale improvement efforts at many of the country's leading research universities (see, e.g., Rimer 2007).

The most important cause of this heightened interest is the report of the Secretary of Education's Commission on the Future of Higher Education (also known as the Spellings Commission). The Spellings Commission proposed incentives for the adoption of standardized testing for purposes of making higher education accountable to consumers. In the words of the Commission, "We believe that improved accountability is vital to ensuring the success of all the…reforms we propose…" (Secretary of Education's Commission on the Future of Higher Education 2006: 4). The Commission's recommendations represent what may be the first major salvo in a federal government campaign to bring greater accountability to higher education as a condition of accreditation.

The Spellings Commission recommendations build on significant public concerns about the undergraduate experience. Public opinion surveys have shown that concerns about educational quality are common among Americans; nearly half of Americans say that low educational standards are a serious problem in American colleges and universities and support efforts to hold colleges accountable for student learning (ETS 2003). Well-publicized studies have provided evidence that the college experience is failing as a stimulus to the educational motivation and cognitive development of students. Books like Nathan's *My Freshman Year* (2005) and Bok's *Our Underachieving Colleges* (2006) paint pictures of student life as profoundly anti-intellectual and of colleges as failing to pay as much attention to teaching and learning as they do to recruiting students or building state-of-the-art dormitories and recreation centers. Recent learning assessments indicate that American colleges and universities may be failing to accomplish their basic task of preparing an informed and literate citizenry. A recent study of adult literacy, for example, found that only one-third of college graduates could successfully compare viewpoints in two newspaper editorials or interpret a table relating blood pressure, age, and physical activity (NAAL 2006: 15).

Efforts to increase students' academic engagement are widely perceived to be one key to improving the quality of the undergraduate educational experience (see, e.g., Kuh 2003). Previous work on academic engagement has focused on students' exposure to "good educational practices." Our work raises questions about normative conceptions of good educational practices in so far as they are theorized to be equally relevant to student academic engagement across all major fields of study and all types of institutions. In this paper, we show that at the eight large undergraduate campuses of the University of California academic majors shape divergent forms of academic engagement. We also show that these divergent forms of engagement are more closely aligned to students' graduate degree aspirations than are cross-institutional measures of good educational practices.

Research on US College Student Engagement

Since the 1980s, the College Student Experiences Questionnaire (CSEQ) and its successor, the National Survey of Student Engagement (NSSE), have been the primary sources for research on U.S. college students' academic engagement.

As conceptualized by NSSE researchers, academic engagement includes five dimensions: (1) active/collaborative learning; (2) student-faculty contact; (3) level of academic challenge; (4) enriching educational experiences; and (5) supportive campus environment (see, e.g., Kuh 2003; Carini, Kuh, and Klein, 2006). (1) *Active/ collaborative learning* focuses on practices that lead students to be more intensely involved in their educations. These practices include: asking questions in class and contributing to class discussion; making class presentations; working with other students on projects during class; working with classmates outside of class to prepare assignments; tutoring or teaching other students; participating in community-based projects outside of class; and discussing ideas from reading outside of class. (2) *Student-faculty interaction* focuses on experiences that allow students to see how subject matter experts think about and solve problems, experiences that can lead teachers to become role models and mentors for students. These experiences include: discussing grades and assignments with instructors; talking about career plans with instructors; discussing ideas from class with instructors; receiving prompt feedback on performance; and working with a faculty member on a research project. (3) *Academic challenge* focuses on experiences that promote high levels of student achievement by emphasizing effort and high expectations. These experiences include: class preparation time; working hard to meet instructors' expectations; amount of reading assigned; writing papers of 20 pages or more; courses that emphasize analysis, synthesis, making judgments about course materials, and applying theories and concepts to practical problems or new situations. (4) *Enriching educational experiences* focus on activities outside of class that contribute to personal and intellectual growth. These activities include: talking with students from different backgrounds, political beliefs, or religious commitments; using electronic technology to discuss or complete assignments; and participating in internships, community service work, study abroad, independent study, learning communities, and senior culminating experiences. (5) *Supportive campus environment* focuses on perceptions of campus resources that contribute to the personal and intellectual growth of students. These perceptions include: satisfaction with student services, academic support services, and quality of relationships with other students, faculty members, and administrative personnel and offices. (Items included in each benchmark are reported in Appendix A.)

NSSE researchers refer to these five measures as "benchmarks," "clusters," or "groupings" of undergraduate academic engagement. We will use the term "benchmark," because it is the term most commonly used by NSSE researchers. NSSE researchers derived the five benchmarks from research-based conceptions of good educational practices in U.S. undergraduate education (Chickering and Gamson 1987; see also Sorincelli 1991). In the view of CSEQ and NSSE researchers, good educational practices, such as providing active learning opportunities and fostering student-faculty contact, are equally relevant to all students, regardless of their institutions or majors.

Studies using CSEQ and NSSE have contributed substantially to understanding of the undergraduate experience. Controlling for a number of academic and socio-demographic covariates, NSSE researchers have demonstrated that experiences of good educational practices are less common among commuting students (Kuh, Gonyea, and Palmer 2001), part-time students (Kuh 2003), first-generation college students (Pike and Kuh 2005), male students (Kuh 2003); native students as opposed to international students (Zhao, Kuh and Carini 2004), and students attending research universities (Kuh and Hu 2001). [1] NSSE researchers have also demonstrated that exposure to and

participation in good educational practices do not vary significantly by membership in sororities or fraternities (Pike 2003), participation in non-revenue producing sports (Umbach et al. 2004), or for students who are highly involved in spiritual activities (Kuh and Gonyea 2004). NSSE researchers have also shown that students' experience of good educational practices is not strongly related to institutional selectivity (Pascarella et al. 2006). NSSE evidence indicates that colleges can expand the number of students who are exposed to good educational practices through the introduction of learning communities, honors colleges, opportunities for diversity experiences, and transition-to-college experiences (Kuh 2003; Umbach and Kuh 2006).

An Alternative Approach

We will highlight two conceptual issues that have led us to develop an alternative approach to the NSSE benchmarks. We wish to emphasize that our approach is not intended as a critique of NSSE or of the reform projects that NSSE has helped to inspire. On the contrary, in our view NSSE and the reform projects inspired by it have made valuable contributions to American higher education. Instead, we intend to take a different look at the issue of academic engagement by starting from the ground up and by focusing on the particular learning environment of the research university.

The first conceptual issue has to do with the normative character of the NSSE benchmarks. NSSE benchmarks do not necessarily reflect existing cultures of engagement anchored in campus social structures. Rather, they present a conception of good educational practices that are assumed to be relevant across all institutions, majors, and student subcultures. In this paper, we will show that the divergent cultures of academic majors are important in shaping patterns of engagement in research universities. We will show further that these cultures of engagement are more consistently and more strongly related to post-graduate degree plans than are scales approximating the NSSE benchmarks.

The second conceptual issue has to do with the relevance of NSSE benchmarks to the research university setting. Results from CSEQ and NSSE show that students enrolled in research universities score lower, on average, on benchmarks of good educational practices and learning productivity measures than students enrolled in other types of institutions (Kuh and Hu 2001), even though many students enrolled in research universities are among the most able in the country (Geiger 2002). Three of the benchmarks – active/collaborative learning, student-faculty contact, and supportive academic environment – appear to reflect more closely the educational circumstances of the liberal arts college experience than those of the research university experience. This leads us to question whether the NSSE benchmarks are well designed to measure academic engagement, as it exists in practice, in the research university setting. This is an important issue, given that nearly two of five four-year college undergraduates are enrolled either in doctoral-extensive or doctoral-intensive institutions, including approximately 70 percent of students majoring in science, engineering and mathematics fields (NCES 2006), fields widely regarded as priority areas for human capital development.

Data and Methods

Our research is based on analysis of the University of California's Undergraduate Experience Survey (UCUES) conducted in winter and spring 2006. The data is drawn from the eight large undergraduate campuses in the UC system. (Because of the small size of the UC-Merced student body, responses from UC-Merced were excluded from the analysis.) The UC system is the largest system of publicly supported research universities in the country.

Students must graduate in the top 12.5 percent of high school students statewide to be eligible for admission into the university. The sample, therefore, constitutes a relatively high-achieving group of students (see Douglass 2007). Nonetheless, high levels of variability exist within the population, both in academic engagement and on all characteristics related to engagement. While mean scores on variables undoubtedly differ between UC undergraduates and the population of all four-year college students, we expect the form of key relationships observed for UC students to generalize to the population of students attending comparable research universities. Our confidence in the generalizability of the findings is heightened by the few net effects of campus in the data, and by the comparability of findings in separate analyses conducted on data from each of the eight campuses.[2]

UCUES has been operating for seven years as a web-based census. Incentives are provided to students for participation in the survey. All participating students complete a set of core items and, in addition, one of five randomly-assigned modules: academic engagement, civic engagement, student development, student services, or a campus-specific survey. Questions vary between the lower-division and upper-division versions of the survey. Data on student backgrounds, high school records, SAT scores, and UC GPA were appended to the data file by UC staff.

In the 2006 survey, response rates of students at the eight campuses ranged from nearly half of all undergraduates to approximately one-third. Validity studies indicate that the completed surveys significantly over-represent high GPA students, but were otherwise broadly representative of the UC student population, both as a whole and on each of the eight large undergraduate campuses. This study concludes that post-weighting is unnecessary to achieve unbiased estimates of parameter effects (Chatman 2006).

Because academic majors are central for understanding student engagement, we will discuss findings for upper-division students only. The sample size for the upper-division academic engagement module is 6215. In reporting results, we mask the identity of campuses using formulations such as "campus A" and "campus B."

In our first analysis, we show that cultures of engagement vary by major. The humanities/social sciences (HUMSOC) culture of engagement prizes participation, interaction, and interest in ideas. It is closely related to the NSSE scale measuring active/collaborative learning. By contrast, the natural sciences/engineering (SCIENG) culture of engagement prizes quantitative skills and collective work on problem-solving as a means to obtain high-paying jobs after graduation. It is not closely related to any of the NSSE benchmarks.

In our second analysis, we show high scores on HUMSOC are strongly related to aspirations for graduate law and doctoral degrees, while high scores on SCIENG are strongly related to aspirations for graduate business and medical degrees. We show further that the two cultures of engagement are more strongly related to degree aspirations than scales approximating four of the five NSSE benchmark scales.

Variables used in our analyses are presented in Table 1.

Table 1
Independent and Dependent Variables

A. Continuous Dependent Variables

	Mean	S.D.	Range	N
Out-of-Class Study Time Weekly	4.11	1.73	0-7	6170
Assigned Reading Completed This Year	7.22	2.37	0-9	5722
Humanities Culture of Engagement Scale[1]	0	1.00	-2.39-+2.32	5084
Sciences Culture of Engagement Scale[2]	0	1.00	-3.67-+3.03	5084

B. Mulitnomial Dependent Variable

	Percent	N
Aspiration: Baccalaureate Degree[3]	22.2	1380
Aspiration: Graduate Business Degree	10.0	619
Aspiration: Graduate Law Degree	8.9	551
Aspiration: Graduate Medical Degree	7.2	448
Aspiration: Doctoral Degree[4]	21.6	1342

B. Continuous Independent Variables

	Mean	S.D.	Range	N
Hours Worked Weekly for Pay	3.31	2.10	0-8	6130
UC Grade Point Average	5.43	1.97	1-8	5948
SAT I Math	629.3	89.3	310-800	4620
SAT I Verbal	591.1	95.3	230-800	4620
Mother's Education	3.30	1.43	1-6	5590
Father's Education	3.64	1.59	1-6	5527
Social Class	2.84	1.00	1-5	5810
Academic Challenge Scale[5]	0	1.00	-3.16-+3.62	5327
Student-Faculty Contact Scale[6]	0	1.00	-2.92-+4.34	5327
# of Study Enhancement Experiences[7]	.849	1.24	1-11	6215
"New Perspectives" Scale[8]	0	1.00	-3.90-+3.39	3839
# of Research Experiences[9]	1.92	1.59	1-8	6215
# of Service Learning Courses Taken	1.42	.885	1-5	6066

C. Categorical Independent Variables

	Percent	N
Campus	Masked	---
First-generation College Student	18.2	1060

Ethnicity: African-American	2.4	150
Ethnicity: Asian-American	40.2	2499
Ethnicity: Euro-American	36.6	2276
Ethnicity: Hispanic/Latino	12.8	798
Ethnicity: Other	3.1	192
Gender: Male	42.0	2604
Arts/Communication Major	7.6	472
Humanities Major	9.3	579
Social Sciences/History Major	28.4	1762
Psychology Major	8.5	527
Business Major	4.7	294
Biological Sciences Major	22.1	1371
Physical Sciences Major	7.1	441
Engineering/Computer Science Major	10.6	660

Notes

[1] For details on scale construction, see Table 2.
[2] For details on scale construction, see Table 2.
[3] Includes students who report aspirations for baccalaureate degrees, teaching credentials, and those who say they do not yet know their educational plans.
[4] Includes students who report aspirations for the Ph.D., the Ed.D., and combined Ph.D./graduate professional degree programs, such as the M.D./Ph.D.
[5] The "academic challenge" scale measures students' willingness to accept academic challenges and includes three items: (1) found a course so interesting that you did more work than required; (2) chose challenging assignments, when possible, even though you might get a lower grade; (3) chose challenging courses, when possible, even though you might lower your GPA.
[6] The "student-faculty contact" scale measures students' communication with faculty and includes four items: (1) communicated with a faculty member by email or in person; (2) talked with an instructor outside of class about course material; (3) took a small research-oriented seminar with faculty; and (4) worked with a faculty member on an activity other than course work.
[7] Number of study enhancement experiences is the sum of ten types of co-curricular experiences student may have completed: (1) UC Study Abroad, (2) Study Abroad through an affiliated program, (3) Study Abroad unaffiliated with UC, (4) UC in Washington DC, (5) UC in Sacramento, (6) an internship with a faculty member, (7) an internship with someone other than a faculty member, (8) participation in an honors program, (9) participation in an honors thesis course, and (10) writing an honors thesis.
[8] The "new perspectives" scale measures students' sense that they have reached new understandings of others' perspectives through conversations with six types of students: (1) those whose religious beliefs were very different; (2) those whose political opinions were very different; (3) those of different nationalities; (4) those of a different race or ethnicity; (5) those whose sexual preferences were different; and (6) those of a different social class background.
[9] Number of research experiences is the sum of seven types of research experiences students may have completed: (1) as part of course work, (2) as part of a student research program, (3) as an independent study, (4) with a faculty member for course credit, (5) with a faculty member for pay, (6) with a faculty member as a volunteer, and (7) a creative project with a faculty member.

Two Cultures of Engagement

Table 2 presents the results of a factor analysis intended to define dimensions of student academic engagement empirically. Fifteen items assessing a wide variety of forms of

student engagement were subjected to a principal components analysis. The results strongly suggested two components (eigenvalues of 4.97 and 2.08) which, together, account for 50.4% of the covariance among the fifteen items. The Scree plot strongly suggests that the third component, with an eigenvalue of 1.165, accounting for 8.3% of the variance, should not be retained. Varimax rotation of the first two components produced two quite distinctive factors, with only one of the fifteen items having a split loading. This item ("over the last year, I have helped classmates understand materials better") loads marginally (.39) on the first factor and strongly on the second (.61).

The first factor identifies a type of engaged student who is familiar to professors in the arts, humanities and social sciences. The students who score high on this factor communicate with faculty members by email, talk to them outside of class, contribute to class discussion, ask questions in lectures, bring up ideas from other courses in class discussion, and sometimes find their courses so interesting that they do more work than required. This is a culture of individual assertion, classroom participation, and interest in ideas. The second factor defines a type of engaged student familiar to professors in the natural sciences and engineering, where competence in quantitative analysis is the primary focus of study. The students who score high on this factor value proficiencies in quantitative and computer skills. They are also collaborative in their study; they tend to work with groups of other students outside of class and to help their classmates solve problems. They want courses in their majors that explain and solve problems, and they indicate a high level of interest in prestigious, high-paying jobs. This is a culture based on working toward quantitative competencies through individual study and collaborative effort. None of the student-faculty interaction or participation items or the intellectual interest items loaded on this second factor.

Table 2
Factor Analysis of the Two Cultures of Academic Engagement
(factor loadings above. 40)

Humanities/Social Sciences Culture		*Sciences/Engineering Culture*	
	Factor Loading		Factor Loading
Communicated w/ faculty by email or in person	.685	Current proficiency: Computer skills	.422
Did more work than Required because course Was so interesting	.690	Looked for courses in major that explain and solve problems	.493
Talked w/ faculty about course materials	.759	Reason for major: Prestige	.537
Interacted w/ faculty during lecture	.854	Reason for major: Leads to high paying job	.588

Contributed to class discussion	.861	Worked with group of students outside of class	.606
Brought up ideas or concepts from different courses	.864	Helped classmate understand material better	.612
Asked an insightful question in class	.871	Current proficiency: quantitative skills	.620
N=5084 Minimum= -2.39 Maximum= 2.32		N=5084 Minimum= -3.67 Maximum= 3.03	

Source: UCUES 2006

We created two academic engagement scales based on these factor scores. We will refer to these two scales the "humanities/social sciences culture of engagement" (or HUMSOC) and the "natural sciences/engineering culture of engagement" (or SCIENG) We interpret these scales as connected to the practices of engaged students in the two disciplinary domains -- and to the behaviors that consequently become indicative of engaged students in different parts of the university.

Our use of the term "cultures of engagement" may require justification. Because HUMSOC focuses on behaviors that are commonly associated with engagement, such as participation in class and interest in ideas, few will object to the use of the term "culture of engagement" to describe high scores on this scale. SCIENG could, by contrast, be interpreted more as a measure of "aspirations and orientations" than as a culture of engagement, because it is anchored, in part, in self-reported competencies and career motivations. A culture can be defined as a generalized pattern of value, belief, and practice that connects a person to a course of social action. Cultures prescribe legitimate courses of action to achieve ends, and the value of ends themselves. From this perspective, SCIENG is as much a culture of engagement as HUMSOC; it prescribes legitimate courses of action (achieving quantitative competencies and learning to solve problems through courses and collaborative study) as means to achieve valued ends (prestigious and high paying careers).

Socio-Demographic and Academic Predictors of the "Two Cultures"

What kinds of students score high and low on these scales? Using regression analysis, we predicted high scores on the two engagement scales using the same set of covariates for each scale. In the regression analysis, we included five control variables: GPA, SAT Verbal, SAT Math, hours of paid employment, and campus. We included six socio-demographic background variables: first-generation college, mother's education, father's education, self-identified social class, ethnicity, and gender. We also included two measures of work effort: time spent on study and proportion of reading completed. And, finally, we included four measures of participation in campus co-curricular and extra-curricular learning opportunities: (1) participation in research experiences, (2) participation in study enhancement activities (such as study abroad), (3) participation in service learning courses, and (4) a scale measuring positive interactions with students of different backgrounds.

Table 3
Predictions of High Scores on Two Cultures of Undergraduate Academic Engagement

	Humanities/ Social Sciences (HUMSOC) (B/St. Err.)	Sciences/ Engineering (SCIENG) (B/St. Err.)
Constant	-1.01***	.69***
	(.17)	(.07)
Controls		
UCGPA	.14***	-----
	(.03)	
SAT Verbal	.001***	-----
	(.00)	
SAT Math	-.001***	-----
	(.00)	
Hours Paid Employment	.04**	-----
	(.01)	
Campus A	-----	-----
Campus B	-----	-----
Campus C	-----	-----
Campus D	REF	REF
Campus E	-----	-----
Campus F	-----	-----
Campus G	-----	.25***
		(.06)
Campus H	-----	.20***
		(.05)
Background		
First Generation College	-----	-.18***
		(.05)
Father's Education	-----	-----
Mother's Education	-----	-----
Social Class (+=higher)	.07***	-----
	(.02)	
African-American	.31**	-----
	(.12)	
Asian-American	-.22***	-----
	(.04)	

Euro-American	-----	-----
Hispanic/Latino	-----	-----
Other Race	REF	REF
Gender (+=male)	.24***	.13***
	(.04)	(.04)
Major		
Arts/Communication	.48***	-----
	(.07)	
Humanities	.55***	-.34***
	(.07)	(.07)
Social Sciences	.34***	-----
	(.04)	
Psychology	REF	REF
Business	-----	.89***
		(.08)
Bio Sciences	-----	.59***
		(.05)
Physical Sciences	-----	.91***
		(.07)
Engineering	-----	1.22***
		(.06)
Work Effort		
Out-of-class study time	.08***	.08***
	(.01)	(.01)
Reading completed	.05***	.02**
	(.01)	(.01)
Learning Opportunities		
# of research experiences	.11***	-----
	(.01)	
# of study enhancement activities	.06***	-----
	(.02)	
# of service learning courses	-----	-----
"New Perspectives" scale	.21***	.16***
	(.02)	(.02)
R^2	.302	.310
SEE	.82	.83

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

Source: UCUES 2006

The results of the analysis confirm that the two cultures of engagement are rooted most clearly in differences between academic majors. Students in the arts, humanities, and social sciences scored higher than students in other majors on the HUMSOC scale. Humanities students also scored much lower on the SCIENG scale, while natural sciences, engineering, and business students scored higher. When we compare the standardized regression coefficients of the focal variables in the model, major showed the largest impact on the SCIENG scale. Together with research experiences and the "new perspectives" scale, major also showed the largest impact on the HUMSOC scale. Cognitive styles and aptitudes explained part of the differences between engaged humanities/social sciences and engaged natural sciences/engineering students; consistent with differences by major. SAT verbal was positively associated with high scores on the HUMSOC culture of engagement, while SAT math was negatively associated with high scores on the scale.

Even though differences by major have not been a focus in research based on CSEQ and NSSE, findings of important differences in cultures of engagement by major are not surprising. Long ago, Snow (1959 [1964]) coined the term "the two cultures," observing that scientists and literary intellectuals "exist as cultures in the anthropological sense…linked by common habits, common assumptions, (and) a common way of life." Snow's observation continues to capture a salient distinction in contemporary academic life, relevant also in the domain of undergraduate education. A significant body of research in higher education studies indicates strong differences by major in recruitment and socialization (Kelly and Hart 1971, Lipset and Ladd 1971), personality type (Holland 1973, 1985), values (Davis 1965), and goals (Smart and McLaughlin 1974) of college students. Recent studies confirming differences in students, teaching styles, and academic goals by major include Braxton and Hargens (1996), Braxton, Olson and Simmons (1998), Brecher (1994), and Smart, Feldman, and Ethington (2000).

Net of other covariates, social background characteristics contributed to the explanation of high scores on both of the scales. Notably, men scored high on both scales, indicating the continuing advantages of the dominant gender group in the capacity to conform to valued academic norms, whether in the humanities or the sciences. Students from upper social class backgrounds scored higher on HUMSOC, while first-generation college students scored lower on SCIENG, indicating the continuing advantages of students from higher socio-economic strata. African-Americans scored high on the HUMSOC scale, presumably indicating exceptional commitment to interaction and participation norms in this highly selected group (representing just 2.5 percent of UCUES respondents). Net of other significant covariates, Asian-Americans scored lower than other ethnic groups on the HUMSOC scale, but, contrary to some stereotypes of Asian student culture, they did not score higher on the SCIENG scale.

One of the striking findings in this analysis has to do with differences in reward for study time in the two cultures. Students in both cultures of engagement said they studied longer hours than other students, but only students scoring high on HUMSOC also received higher grades. They were able to achieve these higher grades while also working longer hours in paid employment than other students. By contrast, students who scored high on the SCIENG culture of engagement did not have higher grade point averages than other students.

These paradoxical findings can be largely explained by differences in grading norms between the disciplines: Among students responding to UCUES 2006, nearly 50 percent of upper-division students in arts and humanities reported GPAs of 3.6 or above, but only one-third of students in physical sciences and engineering reported GPAs at this level. This evidence suggests that good grades are quite a bit more difficult to attain in the sciences and engineering, and even longer hours of study and the help of fellow students will not guarantee them. These findings conform to previous studies of grading patterns across disciplines (Johnson 2003). Some previous studies of academic engagement have used grades as an external validation of engagement measures. Our findings indicate that grades may be a misleading indicator of engaged natural science and engineering students, because high grades are harder to achieve in these fields.

Sources of the Two Cultures

Why have divergent cultures of engagement developed in the academic majors? Kelly and Hart (1971) and Lipset and Ladd (1971) suggested that the influence of academic major on students is a consequence of two underlying processes: recruitment and socialization. We speculate that both factors continue to be important. By the time students have reached the upper-division years, most have determined where their interests and abilities lie. They recruit themselves into disciplines most likely to reward these interests and abilities. Properties of the objects of study matter in these recruitment processes. Because the arts and humanities and at least some of the social sciences are based more on expression and interpretation than causal explanation, engaged students in these disciplines tend to be verbal and to want to share their interpretations with others. By contrast, the sciences are based on quantitative reasoning to arrive at correct understandings of principles of analysis. For this reason, engaged students in the natural sciences and engineering tend to be interested in skill development in key areas of quantitative knowledge (see also Bell 1966: 174-5). Once students have begun to take classes in their majors, they are also socialized into the cultures of the disciplinary domains by classmates and teachers. Through experiences in the major, students come to understand what it takes to gain recognition in the humanistic fields and competence in the scientific fields. Our data suggest that business students are closer in these respects to students in the sciences and engineering than to students in the arts, humanities, and social sciences.

Other researchers have argued that levels of paradigmatic development in major fields affect styles of teaching (Braxton and Hargen 1996; Braxton, Olsen and Simmons 1998). Paradigmatic development refers to the level of consensus among faculty about the accepted theories, methods, and principles of analysis in the field. Faculty in fields with low paradigmatic development (most of the arts, humanities, and social sciences) tend to behave more frequently in ways that encourage student participation than do faculty in high paradigmatic development fields (most of the natural sciences and engineering), which have far more structured and organized subject matter. Styles of teaching could influence student cultures of engagement – either through recruitment of students whose learning styles conform to styles of teaching related to paradigm development or through socialization into the expectations for learning associated with fields at different levels of paradigmatic development.

Cultures of Engagement and Post-Graduate Plans

We consider motivation to pursue graduate degrees an important outcome of engagement and success at the undergraduate level. UCUES data on post-graduate plans indicate that the two cultures of engagement are tied to specific graduate degree aspirations and, therefore, to distinctive destinations in the American occupational structure. High scores on the HUMSOC scale were strongly related to aspirations for graduate law and doctorate degrees. High scores on the SCIENG scale were strongly related to aspirations for graduate business and medical degrees.

In this analysis, we compared HUMSOC and SCIENG to scales approximating NSSE benchmarks for academic challenge, faculty-student interaction, and enhanced educational experiences (cf. Table 1 and Appendix A). We focused on these three, because important features of another NSSE benchmark – active/collaborative learning – are captured by HUMSOC.[3] We did not include a scale measuring the fifth NSSE benchmark -- supportive institutional environment -- because this is an institutional rather than a student behavior scale.

Scales measuring the two cultures of engagement were more consistent – and stronger – predictors of graduate degree aspirations than scales we developed to approximate these three NSSE benchmarks of good educational practices. It is important to emphasize that UCUES items do not exactly mirror items in NSSE. For this reason, a one-to-one comparison between the two is impossible. However, a comparison between the relevant measures in Table 1 and Appendix A show that the scales we have developed closely mirror NSSE benchmarks. We are confident that our scales capture the same underlying dimensions of student behavior as the NSSE benchmarks.

In this analysis, we used multinomial logistic regression to investigate influences on graduate degree aspirations. We used aspirations for the BA degree as the reference category in this analysis. The categories of the dependent variable are: graduate business degree (MBA) degree, graduate law degree (JD/LLB), graduate medical degree (MD), and doctoral degree (PhD/EdD).

In Table 4, we report results for campus, student background variables, majors, SAT Verbal and Math, and UC GPA, in addition to the major-based engagement scales (HUMSOC, SCIENG), and the proxy measures of NSSE benchmark scales. We also report results for a variable measuring number of research experiences, a potentially important form of study enhancement for undergraduates in research universities, albeit one that has not been widely adopted by research university faculty (see NSSE 2005). We use the Wald chi-square statistic as a measure of the strength of the net association between an independent variable and a category of the dependent variable. The Wald statistic can be compared across variables to suggest which variables explain the most variance, net of all others.

Table 4
Prediction of Graduate Degree Aspirations of UC Students 2006

	MBA (B/SE)	JD/LLB	MD	PhD (B/SE)
Intercept	-1.51 (1.04)	-6.39*** (1.13)	-7.90***	-4.63*** (1.28) (.85)
Controls				
UCGPA	-----	1.20*** (.26)	1.12*** (.28)	.80*** (.18)
SAT Verbal	-.004*** (.00)	.003* (.00)	-----	-----
SAT Math	.003** (.00)	-----	-----	-----
Campus A	------	-----	-----	-----
Campus B	------	-----	-----	-----
Campus C	------	-----	-----	-.61* (.26)
Campus D	REF	REF	REF	REF
Campus E	-----	-----	-----	-.61* (.29)
Campus F	-1.04* (.42)	-----	-----	-----
Campus G	-1.18** (.40)	-----	-1.74** (.61)	-1.08*** (.28)
Campus H	------	-----	-----	-----
Background				
First Generation	-----	-----	-----	-----
Father's Education	-----	-----	-----	-----
Mother's Education	-----	-----	-----	-----
Social Class (+ = higher)	-----	-----	-----	-----
African-American	-----	-----	1.78* (.73)	1.24* (.59)
Asian-American	-----	-----	-----	-----
Euro-American/White	-----	-----	-----	-----
Hispanic/Latino	-----	-----	-----	-----
Other Race	REF	REF	REF	REF
Gender (+=male)	-----	-----	-----	-----
Major				

Arts/Comm.	REF	REF	REF	REF
Humanities	-----	-----	1.47**	.90**
			(.57)	(.32)
Social Sciences	-----	1.68***	-----	1.04***
		(.31)		(.27)
Psychology	-----	1.18**	1.91***	2.05***
		(.43)	(.59)	(.33)
Business	1.80***	.94*	-----	-1.57*
	(.39)	(.47)		(.78)
Bio Sciences	-----	-----	3.23***	1.63***
			(.48)	(.28)
Physical Sciences	-----	-----	-----	.91**
				(.34)
Engineering	-----	-----	-----	.94**
				(.34)
Cultures of Engagement				
HUMSOC	.37***	.41***	.24*	.48***
	(.10)	(.11)	(.12)	(.09)
SCIENG	.68***	.32**	.50***	.24**
	(.10)	(.11)	(.12)	(.09)
Academic Challenge	-----	----	-----	.44***
				(.08)
Student-Faculty Contact	-.21*	-----	-----	-----
	(.11)			
# of Study Enhancement Experiences	.32***	.18*	-----	.17**
	(.08)	(.08)		(.07)
"New Perspectives" via Diverse Interactions	-----	-----	-----	-----
# of Research Experiences	-----	-----	.19**	.16**
			(.07)	(.05)
N of Category	260	220	202	520

-2 Log Likelihood=4174.4
Chi-square=1186.9 d.f.=116
Sig.=.000
Cox/Snell Pseudo R^2=.488
McFadden Pseudo R^2=.221

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

Source: UCUES 2006

The results reported in Table 4 show that HUMSOC is a strong predictor of aspirations for law and doctoral degrees, while SCIENG is a strong predictor of aspirations for business and medical degrees. According to the Wald statistic, HUMSOC is the third strongest predictor of aspirations for a legal degree (after GPA and majoring in social science) and also one of the top predictors of aspirations for a doctoral degree. SCIENG is the strongest predictor of aspirations for the MBA and the second strongest predictor (after majoring in biological science) of aspirations for the MD.

Although the strength of associations varies across degree fields, both HUMSOC and SCIENG were significantly associated with aspirations for all four graduate degrees. These findings suggest that conformity with either one of the two cultures of engagement on campus can help students aspire to higher degrees linked to prestigious occupations in American society, while lack of conformity to either of the two cultures can depress students' career aspirations. Those who conform are connected to other students who have higher-level career aspirations, while those who do not conform may feel alienated from peers with these aspirations (for summaries of the research literature, see Astin 1993: chapt. 5; and Pascarella and Terenzini 2005: chapt. 6). The two cultures of engagement are perceptible to and consequential for students because they are encountered daily in the behavior of motivated students in the major fields of study on campus.

In general, HUMSOC and SCIENG were stronger predictors of degree plans than the measures we constructed to reflect NSSE benchmarks. One partial exception is the academic challenge scale. High scores on this scale were a marginally stronger predictor of aspirations for doctoral degrees than HUMSOC and a decidedly stronger predictor than SCIENG. High scores on the academic challenge scale also showed up as a significant predictor of aspirations for the MD degree, though they were not as strong a predictor as high scores on either HUMSOC or SCIENG. Student-faculty contact had, by contrast, no positive impact on students' graduate degree aspirations.

Our analysis suggests that, in the research university setting, the NSSE benchmark of enhanced educational experiences could be disaggregated for purposes of understanding student degree aspirations. The NSSE benchmark includes items related both to study enhancement activities and interaction with students from diverse backgrounds. The UCUES scale measuring students' development of new perspectives through interactions with diverse peers did not emerge as an important predictor of degree aspirations in any of the four graduate degree categories. By contrast, study enhancement activities (such as internships, study abroad, and honors programs) mattered greatly, and particularly for students aspiring to degrees connected to business, law, and academe. Research experiences showed up as an important positive influence on students aspiring to graduate medical degrees and the doctorate.

GPA and majors themselves were also strong predictors of degree aspirations. GPA was strongly associated with aspirations for legal, medical, and doctoral degrees. According to the Wald statistic, GPA was a stronger predictor of aspirations for law degrees than any other variable, except majoring in social science. These results indicate that students, not surprisingly, use their college grades as an important reference point for assessing their likely success in graduate studies. Nor is it surprising that students sort themselves into majors based, in large part, on their graduate degree and career aspirations. Thus, our results show that majoring in business was strongly associated with aspirations for an MBA, majoring in social sciences was strongly associated with aspirations for a legal degree, and majoring in biological sciences or psychology was strongly associated with aspirations for a medical degree.

Net of other covariates in the model, only African-Americans were significantly different from students from other backgrounds; they showed higher than expected aspirations for medical and doctorate degrees. These results indicate that, in the research university setting, the academic structure of grades, majors, and cultures of engagement

supported by majors are more directly tied to graduate degree aspirations than the socio-demographic backgrounds of students. In the selective setting of the University of California, the influence of socio-demographic background variables were indirect -- through their association with students' connection or lack of connection to the two cultures of engagement (see Table 3).

Discussion

This paper makes four contributions to the study of undergraduate academic engagement in the research university setting. First, it demonstrates the importance of academic majors in producing two distinct cultures of engagement in research universities. Second, it shows that high scores on both of these cultures of engagement are influenced by students' socio-demographic characteristics – notably, social class and gender – and, at least in the case of the humanities/social sciences culture, by their tested academic aptitudes. Third, it demonstrates that the two cultures of engagement are strongly connected to students' graduate degree aspirations. Finally, because campus social structures are important in the production of cultures of engagement, the study raises questions about normative conceptions of good educational practices, which are thought to be equally applicable to all students, regardless of major or type of institution attended.

In this section, we will discuss the strengths and weaknesses of the two cultures of engagement and the implications of our study for efforts to reform the undergraduate experience.

The two cultures of undergraduate academic engagement have distinctive strengths. The humanities/social sciences culture generates interaction and discussion and can stimulate alert, insightful contributions. At its best, it is associated with interest in ideas, at least enough to lead students to want to apply ideas in class and to do more than the required work because of their interest in a subject. By contrast, the strength of the natural sciences/engineering culture of engagement is that it can generate hard work, collaborative study, and technically competent performances in demanding fields that do not give out rewards very easily.

The weaknesses of the two cultures are equally evident. At one extreme, the humanities culture of engagement can reward students who are verbally adept but sail along on the surface of their studies without working very hard. At the other extreme, the natural sciences/engineering culture of engagement can reward industrious, but unimaginative students who perform technical tasks competently but express little initiative outside of required activities and little interest in connecting ideas or interacting with their professors. Interaction between students and faculty and participation in class are minimal, and interest in jobs seems to greatly outweigh the inspiration of ideas.[4]

Two approaches are possible for university educators who seek to increase academic engagement among undergraduates. One approach is to build on the existing cultures of engagement in the majors by encouraging institutional and instructor practices that extend their reach. Such efforts would undoubtedly involve expanded opportunities for classroom interaction and participation in the arts, humanities, and social sciences through presentations, debates, discussions, and other means. In the natural sciences, business, and engineering, such efforts would, by contrast, involve encouraging

opportunities for collaborative learning activities and would also take advantage of the propensity of students in the natural sciences, business, and engineering to work hard on their quantitative skills.

The second approach is to foster a model of academic engagement suitable to students in all disciplines. Such an approach is consistent with the good educational practices advocated by NSSE researchers. A powerful argument in support of this position is that existing cultures of engagement may not be sufficient to meet the challenges of creativity and productivity in the 21st century. It may be that scientists and engineers need to develop some of the skills more typical of humanists, and that humanists need to develop some of the skills more typical of scientists and engineers (see AAC&U 2007).

However attractive in the abstract, efforts to disseminate a common set of good educational practices will likely continue to meet resistance in the business, natural sciences, and engineering fields (see also Braxton, Olsen, and Simmons 1998). There are good reasons for such resistance: In the research university setting, ideas about engagement involving active participation in class discussion and intense interest in ideas may be relevant primarily to students in the arts, humanities, and social sciences. The dominant culture of engagement in the natural sciences, engineering and business appears to be based on different principles. Importantly, our study provides no evidence to think that these latter principles are any less effective in generating commitment to studies. The strong connection between high scores on HUMSOC and SCIENG and specific graduate degree aspirations reinforce our sense that normative conceptions of good educational practices may have limited value in the research university setting and particularly in the natural sciences, engineering, and business fields.

Indeed, a good case can be made that the current system works well in generating field-specific cultures of engagement linked to graduate degree aspirations and thereby to remunerative careers. The system works because cultures of engagement in the majors are closely connected to requirements in graduate degree programs related to undergraduate majors. Students choose majors that will help prepare them for these programs, find their interests enhanced if they are able to conform to one of the two cultures of engagement, and use grades to monitor the likelihood of their success in graduate studies. One clear weakness of the current system is the greater hospitability of the existing cultures of engagement to men and to students from socio-economically advantaged backgrounds (see Table 3.). Another weakness may be that grade inflation in the arts, humanities, and social sciences could leave some students without an accurate mechanism for assessing their likely success in graduate studies.

Although it is becoming conventional to lament the low levels of engagement among undergraduate students, it is important to recognize that academically engaged students have always been a minority on campus. According to a leading historian of campus life in the 19th century, "Undergraduates at Harvard condemned with a long list of negatives those students who tried to gain teachers' approval. They labeled such behavior with the terms 'bootlick,' 'coax,' 'fish,' or 'baum'…It was sticking your neck out if you spoke up in class and answered a professor's question to the group as a whole. It was likewise regarded as bad form to do reading for the course above and beyond the assignment and to let that be known" (Horowitz 1987: 35-36). Because student culture has effectively resisted professorial utopias for hundreds of years, educators will be disappointed if they expect wholesale changes now.

Nevertheless, deepening the cultures of engagement that already exist on campus could help to reduce the number of disengaged students. On a campus of 10,000 upper-division students, a hypothetical increase in the proportion of fully engaged students from 10 to 12 percent would require "conversion" of just 200 students during an academic year. Because peer effects are known to be an important cause of academic achievement on campus (Astin 1993; Geiger 2002), the impact of this larger critical mass of engaged students could gradually improve the climate for learning on research university campuses.

Appendix A: NSSE Benchmarks

The NSSE scale labels have remained constant, though items included on the scales have varied over time based on changes in the surveys and factor loadings of items. This appendix reports items in the NSSE benchmarks from a recent study by Carini, Kuh, and Klein (2006).

Items in the *active/ collaborative learning* benchmark include: (1) frequency R asked questions in class or contributed to class discussions; (2) frequency R made class presentations; (3) frequency R worked with other students on projects during class; (4) frequency R tutored or taught other students: (5) frequency R participated in a community-based project as part of a regular course; and (6) frequency R discussed ideas from readings or classes with others outside of class.

Items in the *student-faculty contact* benchmark include: (1) frequency R discussed grades or assignments with an instructor; (2) frequency R talked about career plans with a faculty member or advisor; (3) frequency R discussed ideas from readings or classes with faculty members outside of class; (4) frequency R received prompt feedback from faculty on academic performance; and (5) work on a research project with a faculty member outside class or program requirements.

Items in the *level of academic challenge* benchmark include: (1) number of hours per week R spent preparing for class; (2) frequency R worked harder than expected to meets instructors' standards or expectations during the school year; (3) number of assigned textbooks, books or book-length packs of course readings during the current school year; (4) number of written papers or reports of 20 pages or more during the current school year; (5) number of written papers or reports between 5 and 19 pages during the current school year; (6) extent of course work emphasized analyzing the basic elements of an idea, experience, or theory; (7) extent course work emphasized synthesizing and organizing ideas, information or experiences into new, more complex interpretations and relationships; (8) extent course work emphasized making judgments about the value of information, arguments, or methods; (9) extent course work emphasized applying theories or concepts to practical problems or new situations; and (10) extent the institution emphasized spending significant amounts of time studying and on academic work.

Items in the *enriching educational experiences* benchmark include: (1) frequency R used an electronic medium to discuss or complete an assignment; (2) frequency R had serious conversations with students of a different race or ethnicity; (3) frequency R had serious conversations with students who differed in terms of their religious beliefs, political opinions, or personal values; (4) has R completed or planned a practicum,

internship, field experience, coop experience, or clinical assignment; (5) has R completed or planned to do community service or volunteer work; (6) has R completed or planned to take foreign language course work; (7) has R completed or planned to study abroad; (8) has R completed or planned an independent study or self-designed major; (9) has R completed or planned a culminating senior experience; (10) number of hours R participates in co-curricular activities; and (11) extent to which R's institution emphasizes contact among students from different backgrounds.

Items in the *supportive campus environment* benchmark include: (1) the extent to which R's institution emphasized providing support needed to succeed academically; (2) the extent to which R's institution emphasized helping to cope with non-academic responsibilities; (3) the extent to which R's institution emphasized providing support needed to thrive socially; (4) quality of relationships with other students at R's institution; (5) quality of relationships with faculty members at R's institution; and (6) quality of relationships with administrative personnel and offices at R's institution.

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Notes

[1] NSSE findings on socio-demographic correlates of academic engagement were largely supported by Porter (2006) using a different data set, the Beginning Postsecondary Students Survey, and a measure of engagement focusing on participation in campus activities.

[2] Results from the individual campuses are available on request.

[3] A scale we derived to measure active participation in learning correlated .89 with HUMSOC, indicating a high degree of overlap between the two. In UCUES, collaborative learning items did not factor with active participation items.

[4] The limitations of the two cultures are suggested by Goethe's famous lines, quoted by Weber at the end of *The Protestant Ethic and the Spirit of Capitalism*: "For the last stage of this cultural development, it might well be truly said, 'Specialists without spirit, sensualists without heart…'" (Weber [1904-05] 1958: 182).