Racial and Ethnic Diversity in the Classroom: Does It Promote Student Learning?

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## Does It Promote Student Learning?

Since passage of the Civil Rights Act of 1964 and the Higher Education Act of 1965, America's colleges and universities have struggled to increase the racial and ethnic diversity of their students and faculty members, and "affirmative action" has become the policy-of-choice to achieve that heterogeneity. These policies, however, are now at the center of an intense national debate. The current legal foundation for affirmative action policies rests on the 1978 *Regents of the University of California v. Bakke* case, in which Justice William Powell argued that race could be considered among the factors on which admissions decisions were based. More recently, however, the U.S. Court of Appeals for the Fifth Circuit, in the 1996 *Hopwood v. State of Texas* case, found Powell's argument wanting. Court decisions turning affirmative action policies aside have been accompanied by state referenda, legislation, and related actions banning or sharply reducing race-sensitive admissions or hiring in California, Florida, Louisiana, Maine, Massachusetts, Michigan, Mississippi, New Hampshire, Rhode Island, and Puerto Rico (Healy, 1998a, 1998b, 1999).

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In response, educators and others have advanced educational arguments supporting affirmative action, claiming that a diverse student body is more educationally effective than a more homogeneous one. Harvard University President Neil Rudenstine claims that the "fundamental rationale for student diversity in higher education [is] its educational value" (Rudenstine, 1999, p. 1). Lee Bollinger, Rudenstine's counterpart at the University of Michigan, has asserted, "A classroom that does not have a significant representation from members of different races produces an impoverished discussion" (Schmidt, 1998, p. A32). These two presidents are not alone in their beliefs. A statement published by the Association of American Universities and endorsed by the presidents of 62 research universities stated: "We speak first and foremost as educators. We believe that our students benefit significantly from education that takes place within a diverse setting" ("On the Importance of diversity in University Admissions," *The New York Times*, April 24, 1997, p. A27).

Studies of the impact of diversity on student educational outcomes tend to approach the ways students encounter "diversity" in any of three ways. A small group of studies treat students' contacts with "diversity" largely as a function of the numerical or proportional racial/ethnic or gender mix of students on a campus (e.g., Chang, 1996, 1999a; Kanter, 1977; Sax, 1996). Gurin (1999) and Hurtado, Milem, Clayton-Pedersen, and Allen (1999) refer to this numerical or proportional "mix" of students as "structural diversity." Whether such diversity is a *sufficient* condition to promote student educational outcomes, however, is far from clear.

A second, considerably larger set of studies take some modicum of structural diversity as a given and operationalize students' encounters with diversity using the frequency or nature of their reported interactions with peers who are racially/ethnically different from themselves. In these studies, which might be labeled "*in situ* diversity studies," encountering diversity is viewed as part of the normal processes and functioning of campus life or of a campus's racial/ethnic and gender climate (e.g., Antonio, 1998; Astin, 1993; Cabrera, Nora, Terenzini, Pascarella, & Hagedorn, 1999; Davis, 1994; Gurin, 1999; Pascarella, Edison, Nora, Hagedorn, & Terenzini, 1996; Whitt, Edison, Pascarella, Nora, & Terenzini, 1999).

A third set of studies examines institutionally structured and purposeful programmatic efforts to help students engage racial/ethnic and/or gender "diversity" in the form of both ideas and people. This category includes studies of the influences of coursework and the curriculum (e.g., Astin, 1993; Chang, 1999b; Cohen, 1994; Cohen, Bianchini, Cossey, Holthuis, Morphew, & Whitcomb, 1997; Hurtado, 1999; MacPhee, Kreutzer, & Fritz, 1994; Palmer, 1999), and participation in

racial or multicultural awareness workshops (e.g., Antony, 1993; Astin, 1993; Springer, Palmer, Terenzini, Pascarella, & Nora, 1996; Vilalpando, 1994), as well as various other forms of institutional programming intended to enhance the diversity of a campus or the educational consequences of engaging "diversity" in one form or another (see Musil, Garcia, Moses, & Smith, 1995; Rendon & Hope, 1996; Sedlacek, 1995). Appel, Cartwright, Smith, and Wolf (1996), Smith (1989), and Hurtado et al. (1999) provide useful reviews of this literature.

These various approaches have been used to examine the effects of diversity on a broad array of student educational outcomes. The evidence is almost uniformly consistent in indicating that students in a racial/ethnically or gender-diverse community, or engaged in a diversity-related activity, reap a wide array of positive educational benefits. "Diversity" in its various forms has been linked to such outcomes as higher minority student retention (e.g., Bowen & Bok, 1998; Chang, 1996, 1999a), greater cognitive development (e.g., Adams & Zhou-McGovern, 1994; Cohen, 1994; Cohen, et al., 1997; Hurtado, 1999; MacPhee et al., 1994; Sax, 1996), and positive gains on a wide-range of measures of interpersonal and psychosocial developmental changes, including increased openness to diversity and challenge (Pascarella, et al., 1996), greater racial/cultural knowledge and understanding and commitment to social justice (Antonio, 1998; Astin, 1993; Chang, 1999b; Milem, 1994; Palmer, 1999; Springer, et al., 1996), more positive academic and social self-concepts (Astin, 1993; Chang, 1996; Sax, 1996), more complex civic-related attitudes and values, and greater involvement in civic and community-service behaviors (Astin, 1993; Milem, 1994; Hurtado, 1999). (Chang [1998] and Milem [1999] provide excellent reviews of this literature.)

As noted above, however, only a relative handful of studies (e.g., Chang, 1996, 1999a; Sax, 1996) have specifically examined whether *the racial/ethnic or gender composition* of the students on a campus, in an academic major, or in a classroom (i.e., structural diversity) has the educational benefits claimed by Rudenstine, Bollinger, and others. Sax found that the proportion of women in an academic major field had no impact on students' cognitive or affective development. Chang's analyses reveal a good bit of the complexity of the relation between structural diversity, student interactions and experiences, and educational outcomes. He found that a campus's racial heterogeneity had an effect on learning outcomes through its influence on students' diversity-related experiences, specifically, socializing with peers from different racial/ethnic backgrounds and discussing racial/ethnic issues. Whether the degree of racial diversity of a campus or classroom has a *direct* effect

on learning outcomes, however, remains an open question. The scarcity of information on the educational benefits of the structural diversity on a campus or in its classrooms is regrettable because it is the sort of evidence the courts appear to be requiring if they are to support race-sensitive admissions policies.

In addition to the shortage of information on the role of structural diversity, most studies examine diversity's influence on various dimensions of students' psychosocial development, including (but not limited to) racial/ethnic attitudes and values, academic and social self-concepts, civic behaviors, and racial/ethnic awareness and knowledge. Far fewer studies (e.g., Cohen, 1994; Cohen, et al., 1997; MacPhee et al., 1994; Slavin, 1995) explore the influence of diversity in the classroom or in other small groups on students' development of academic or intellectual knowledge and skills.

This study attempted to contribute to the knowledge base by exploring the influence of structural diversity in the classroom on students' development of academic and intellectual skills. The study put to an empirical test Bollinger's claim that racially/ethnically homogeneous classrooms produce "an impoverished" educational experience (Schmidt, 1998, p. A32). The study was designed to evaluate whether and to what extent (if any) the racial/ethnic diversity of the students in a classroom is related to student learning, specifically, to gains in students' problem-solving skills and their abilities to work in groups. In addition, this study sought to extend Chang's (1996, 1999a) work indicating that structural diversity was associated with more frequent, diversity-related experiences which, in turn, were related to educational outcomes. This study examines both the direct effect of classroom diversity on academic/intellectual outcomes and whether any effects of classroom diversity may be moderated by the extent to which active and collaborative instructional approaches are used in the course.

## *Methods*

### *Conceptual Underpinnings*

In this study, we assume that the development of students' course-related skills are shaped by students' precourse characteristics, the instructional practices encountered in the classroom, and the racial/ethnic diversity of the classroom. Students' precourse characteristics are assumed to be temporally prior to both classroom diversity and instructional methods in their effects on learning outcomes. Our primary focus is on the influence of varying levels of classroom diversity on students' learning outcome *above and beyond the effects of other variables that may*

*also influence learning* (e.g., students' precourse characteristics and the pedagogical methods adopted by instructors).

*Sample and Data Collection*

This study was part of an evaluation of the National Science Foundation-funded Engineering Coalition of Schools for Excellence in Education and Leadership (ECSEL). ECSEL comprises seven colleges of engineering: City College of New York, Howard University, the Massachusetts Institute of Technology, Morgan State University, Pennsylvania State University, the University of Maryland, and the University of Washington. Among other goals, ECSEL seeks to promote the use of design groups, or engineering teams, throughout the undergraduate curriculum in helping students learn to solve unstructured engineering problems. The original data collection was intended to evaluate the extent to which the active and collaborative learning activities inherent in group-based engineering design promoted student learning when compared with more traditional approaches to teaching (e.g., lecture and discussion).

The base sample consists of 1,258 engineering students enrolled at all 7 ECSEL institutions who completed the Classroom Activities and Outcomes Survey (described below). Participating courses and students were not randomly selected. The local ECSEL evaluator on each campus was asked to identify as many "ECSEL" courses (in which design was being taught using active and collaborative learning techniques) as feasible, as well as (for comparative purposes) several "non-ECSEL" courses with educational goals similar to those of the ECSEL courses. In the non-ECSEL courses, traditional lecture and discussion techniques were the primary mode of instruction.

Survey forms were administered in 49 classrooms. Of these, 29 were ECSEL classes, and 20 were non-ECSEL classes. Of the 1,258 students, 936 (74%) were enrolled in an ECSEL course while 322 (26%) were in non-ECSEL courses. Because of the nonrandom nature of the data collection, 46% of the students were enrolled at the University of Maryland, 21% at the University of Washington, and 13% at The Pennsylvania State University. The remaining 20% were distributed approximately evenly across the City College of New York, Howard University, Morgan State University, and MIT. The analyses reported here are based on the responses of 680 white students (58% of the sample) and 488 students of color. In the overall sample, 180 respondents (15.4%) were African Americans, 234 (20.0%) were Asian Americans, 64 (5.5%) were Latino/as, and 10 (0.9%) were Native Americans. Students were approximately evenly distributed across class years, with 57% in lower-divi-

sion courses and 43% in upper-division courses. No significant differences in this distribution were identified between ECSEL and non-ECSEL course students. While the total database for this study contained the original 1,258 students, the *n*'s for the several analyses described below varied between 962 and 1,194 because of missing data. Because of the relatively large number of cases with missing data on some variables, it was decided to drop those cases from analyses rather than use mean replacement.

### *Instrument and Variables*

The data for this study come from the Classroom Activities and Outcomes Survey, a pencil-and-paper, multiple-choice questionnaire completed at the end of a course. The instrument has three sections. The first gathers information on students' personal and academic backgrounds and demographic characteristics. The second section asks about the characteristics and activities of the course in which the students were enrolled when completing the questionnaire. The final section asks students about the extent to which they believe they have made progress in various learning and skill development areas *as a result of taking that particular course*. (A copy of the Classroom Activities and Outcomes Survey is available from the first author at <ptt2@psu.edu>.)

*Control variables*. Background characteristics controlled in this study included gender (coded: 1 = male, 0 = female), race/ethnicity (coded: 1 = nonminority, 0 = minority; group *n*'s did not permit disaggregation of race/ethnicity into more discrete categories), and high school academic achievement (combined SAT scores).

*Independent variables*. The second section of The Classroom Activities and Outcomes Survey asks students to report how often during the course they or their instructor engaged in each of 26 classroom activities. Respondents use a 4-point scale, where 1 = never, 2 = occasionally, 3 = often, and 4 = very often/almost always. The items comprising this section were drawn from the research literature on effective instructional practices and activities.

A principal components factor analysis of these 26 items (with varimax rotation) produced 5 factors. This solution, accounting for 62.2% of the variance in the correlation matrix, is shown in Table 1. Three of the five factors related to specific instructional practices. Collaborative Learning consists of 7 practices that reflect the interdependence among students required by working in groups. The Instructor Interaction and Feedback factor included 5 practices that fostered frequent, supportive communication between faculty and students. The 3-item Clarity and Organization factor reflects instructors' use of clear explanations and an

integrated course structure. The fourth and fifth factors contained 2 and 4 items, respectively, reflecting students' perceptions of fairness in the treatment of minorities and women in the classroom by the faculty member (the Faculty Climate scale) and by other students (the Peer Climate scale). As can be seen at the bottom of the table, the internal consistency reliabilities (Cronbach's alpha) for these scales were generally high, ranging from 0.77 to 0.89. The classroom climate measures were excluded from the set of independent variables to provide a more precise estimation of the effects of classroom diversity on learning unconfounded by students' perceptions of racial or gender dynamics in the classroom, which might, in themselves, affect learning. In affirmative action cases, moreover, the courts' interest has been specifically in the educational contributions (if any) of the racial/ethnic composition of the learning setting.

TABLE 1

Factor Structures for Classroom Practice Items

| | Factor Loadings | | | | |
|---|---|---|---|---|---|
| Items | Collaborative Learning | Instructor Interaction & Feedback | Clarity & Organization | Faculty Climate | Peer Climate |
| Discuss ideas with classmates | 0.822 | | | | |
| Work cooperatively with students | 0.739 | | | | |
| Opportunities to work in groups | 0.753 | | | | |
| Get feedback from classmates | 0.753 | | | | |
| Students teach & learn from one another | 0.679 | | | | |
| Interact with classmates outside of class | 0.650 | | | | |
| Require participation in class | 0.589 | | | | |
| Interact with instructor as part of the course | | 0.780 | | | |
| Interact with instructor outside of class | | 0.741 | | | |
| Instructor gives *detailed* feedback | | 0.713 | | | |
| Instructor gives *frequent* feedback | | 0.689 | | | |
| Guided student learning versus lecturing | | 0.578 | | | |
| Assignments/activities clearly explained | | | 0.767 | | |
| Assignments/presentations clearly related | | | 0.722 | | |
| Instructor makes clear expectations for activities | | | 0.677 | | |
| Instructor treats minorities the same as whites | | | | 0.913 | |
| Instructor treats women the same as men | | | | 0.901 | |
| In groups, some males treat women differently | | | | | 0.876 |
| Some male students treat women differently | | | | | 0.869 |
| Some white students treat minorities differently | | | | | 0.865 |
| In groups, some whites treat minorities differently | | | | | 0.809 |
| Internal Consistency Reliability (Alpha) | 0.88 | 0.83 | 0.77 | 0.86 | 0.89 |

Classroom diversity, the independent variable of principal interest in this study, was operationalized using a "diversity index" created by dividing the number of students who reported their racial/ethnic identity to be non-white by the total number of students in the class. Because two ECSEL institutions are Historically Black Universities, the diversity index was calculated so that classrooms with a diversity "mix" approaching 50% were considered the most diverse. Classrooms with a percentage of students of color lower than 50% (or, in the case of HBCU classrooms, greater than 50%) were considered to be less diverse. For example, a classroom in which all students were white *or* all were students of color was considered to have no diversity.

A preliminary examination indicated that the distribution of the diversity index was curvilinear (i.e., as classroom diversity increased, the nature of the effect on reported learning gains changed). In order to examine the nature and effects of this nonlinear relation more easily, the diversity index was used to develop five categories of "classroom diversity." Table 2 shows the five categories, the ranges of the classroom diversity levels within each category, and the number and percentage of students who were in classes falling within each category. For example, about 40% of the students were in courses characterized as "medium" diversity classrooms. This category contains students in predominantly white courses in which 33–38% of the total enrollment were students of color *as well as* students in predominantly minority-student courses in which 33–38% of all the students were white. The categories were formed using natural breaks in the multi-modal frequency distribution. With the exception of the "medium" diversity category, which is the largest group, respondents were distributed relatively evenly across the five categories.

*Dependent variables*. The third part of the Classroom Activities and Outcomes Survey asks students to report the progress they believe they have made in 27 areas *as a result of the course for which they were completing the survey form*. Progress is reported on a 1-to-4 scale, where

TABLE 2

Classroom Diversity Categories, Intervals, and Number and Percentage of Students in Each Group

| Categories | Classroom Diversity Intervals | Students | |
|---|---|---|---|
| | | *n* | % |
| No diversity | 0% or 100% | 142 | 11.3% |
| Low diversity | 6–19% | 184 | 14.7 |
| Medium–low diversity | 22–30 | 185 | 14.7 |
| Medium diversity | 33–38 | 500 | 39.7 |
| High diversity | 40–50 | 247 | 19.6 |
| TOTALS | | 1,258 | 100.0% |

1 = none, 2 = slight, 3 = moderate, and 4 = a great deal. These items were drawn primarily (but not exclusively) from a series of Delphi studies by Jones and her colleagues (Jones, 1994; Jones, et al., 1994) intended to develop consensus among faculty members, research specialists, academic administrators, and employers on definitions and components of "critical thinking" and "problem solving."

A principal components factor analysis (with varimax rotation) of the 27 skill development items yielded three factors: Problem-Solving Skills (12 items), Group Functioning Skills (7 items), and Occupational Awareness (4 items). This three-factor solution explained 64.6% of the total item variance and produced scales with internal consistency reliabilities ranging from 0.81 to 0.93. The composition of these factors is given in Table 3. Because of the interest in this study in students' skill development, the Occupational Awareness scale was excluded from further analyses.

TABLE 3
Factor Structures for Learning Outcome Items

| | Factor Loadings | | |
|---|---|---|---|
| Items | Group Skills | Problem-Solving Skills | Occupational Awareness |
| Developing ways to resolve conflict & reach agreement | 0.779 | | |
| Being aware of feelings of members in group | 0.841 | | |
| Listening to the ideas of others with open mind | 0.829 | | |
| Working on collaborative projects as member of a team | 0.815 | | |
| Organizing information to aid comprehension | 0.679 | | |
| Asking probing questions that clarify facts, concepts | 0.606 | | |
| Developing alternatives that combine best from previous work | 0.618 | | |
| Ability to do design | | 0.578 | |
| Solve an unstructured problem | | 0.697 | |
| Identify knowledge, resources, & people to solve problem | | 0.666 | |
| Evaluate arguments & evidence of competing alternatives | | 0.675 | |
| Apply an abstract concept or idea to a real problem | | 0.735 | |
| Divide problems into manageable components | | 0.744 | |
| Clearly describe a problem orally | | 0.679 | |
| Clearly describe a problem in writing | | 0.667 | |
| Develop several methods to solve unstructured problem | | 0.732 | |
| Identify tasks needed to solve an unstructured problem | | 0.752 | |
| Visualize what the product of a design project would look like | | 0.584 | |
| Weigh the pros/cons of possible solutions to a problem | | 0.623 | |
| Understanding what engineers do | | | 0.754 |
| Understanding language of design | | | 0.721 |
| Understanding engineering has a nontechnical side | | | 0.710 |
| Understanding of the process of design | | | 0.703 |
| Internal Consistency Reliability (Alpha) | 0.926 | 0.943 | 0.813 |

For both the Classroom Activities and Skill Development Outcome factors, scales were created by summing students' responses on a factor's component items and then dividing by the number of items the factor contains.

### *Analytical Methods*

Ordinary least-squares multiple regression analyses were used in a series of hierarchical analyses. First, to determine whether the diversity of the classrooms had *any* association with learning outcomes, each of the two dependent variables (self-reported gains in problem-solving and group skills) was regressed on four of the five levels of classroom diversity (students in courses with no diversity constituted the reference group). Second, reported gains in problem-solving and group skills were again regressed on classroom diversity after controlling for students' race/ethnicity, gender, and academic ability. Third, each learning outcome was regressed hierarchically on: (1) students' race/ethnicity, gender, and ability, (2) the three scales reflecting the instructional methods used in the classroom (collaborative learning, instructor interaction and feedback, and course clarity and organization), and (3) four levels of classroom diversity.

Finally, the influence of classroom diversity may well be contextual, that is, conditional (or dependent) on the degree to which students interact with one another in course-related activities. For example, interpersonal contacts among students in low diversity courses may well have a different effect on learning than similar contacts in medium- or high-diversity classrooms. To evaluate the extent to which classroom diversity's effects may vary depending on the instructional methods used, a set of four cross-product interaction terms was created by cross-multiplying each of the four levels of classroom diversity (low through high) by students' scores on the Collaborative Learning scale. These interaction terms were then entered as a set into an OLS regression (one for each dependent variable) after students' precourse characteristics, instructional methods, and the four diversity levels had been entered as main effects variables.

### *Results*

Table 4 reports the means and standard deviations for each group's reported gains in problem-solving and group skill development, although the relations among (and magnitudes of the differences between) the group means for both outcomes are more easily seen in Figures 1 and 2.

The basic patterns of the relations between classroom diversity and reported learning are the same for both problem-solving and group skill development. As can be seen in both figures, and with students in "no diversity" classrooms as the reference group, the reported gains drop to their lowest among students in "low diversity" classrooms, although those drops are not statistically significant (as indicated by the "n.s." between the data points). The trend line then climbs through the mean for "low-medium" diversity classrooms, peaking among students in "medium" diversity classes, only to fall again for students in "high diversity" courses. The magnitudes of the differences between the various diversity levels are similar and relatively small. Only the differences between medium-level course means and (with one exception) all other group means are statistically significant (based on pair-wise Scheffé *post hoc* comparisons). (The exception is that for the problem-solving outcome, students in medium diversity classrooms report gains at approximately the same level as do students in classrooms with no diversity.)

The results of each of the three phases of the analyses are reported in Table 5. Consistent with the analyses underlying Figures 1 and 2, the first-phase regressions (with levels of classroom diversity as the only predictors) indicate that classroom diversity is, indeed, related to students' self-reported development of both their problem-solving and group skills. While statistically significant ($p < 0.001$), however, the overall relation in both analyses is small (adjusted $R^2$s of 0.02 and 0.05 for the problem-solving and group skill models, respectively). The beta weights indicate that (relative to the reference group: students in classes with no diversity) low classroom diversity is negatively related to students' development of both problem-solving and group skills at statistically significant levels. In the regression on group skills, moreover, both low and medium-low levels of classroom diversity are significantly and negatively related to reported gains. It is worth noting that in the group

TABLE 4

Means and Standard Deviations on Learning Outcomes by Level of Classroom Diversity ($n = 1{,}199$)

| | Problem-Solving Skills | | Group Skills | |
|---|---|---|---|---|
| Classroom Diversity Level | Mean | *SD* | Mean | *SD* |
| No diversity | 2.82 | 0.75 | 2.81 | 0.88 |
| Low diversity | 2.68 | 0.68 | 2.57 | 0.83 |
| Medium–low diversity | 2.77 | 0.63 | 2.71 | 0.81 |
| Medium diversity | 2.96 | 0.64 | 3.05 | 0.64 |
| High diversity | 2.77 | 0.67 | 2.72 | 0.83 |
| TOTALS | 2.84 | 0.67 | 2.84 | 0.78 |

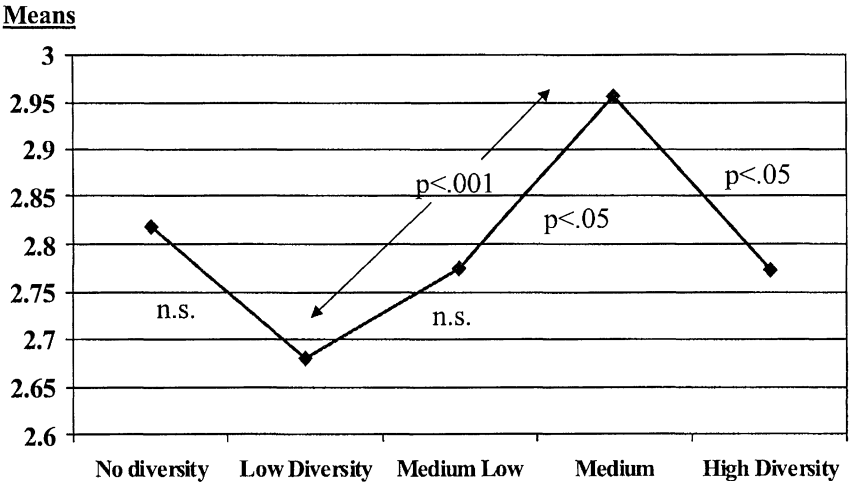


FIG. 1. Differences in Group Means for Gains in Problem-Solving Skills

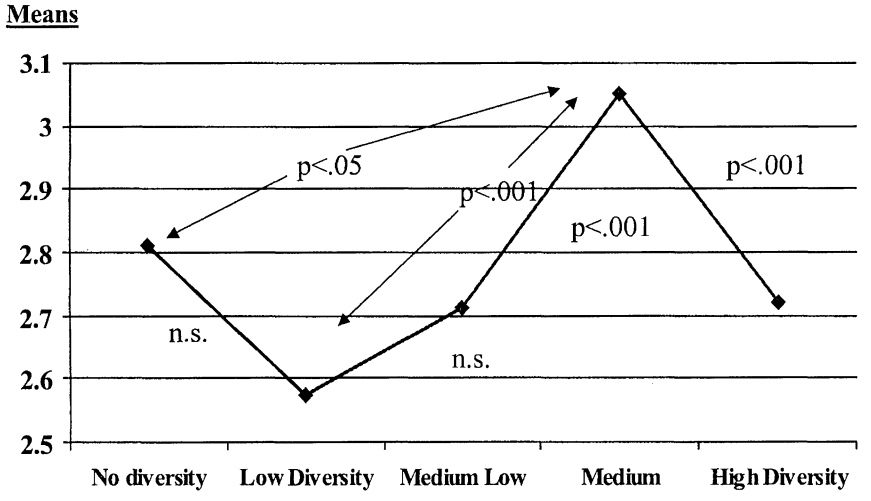


FIG. 2. Differences in Group Means for Gains in Group Skills

skills model, the beta weights for both medium and high levels of diversity (0.07 and –0.09, respectively) approach traditional levels of statistical significance ($p < 0.17$ and $p < 0.07$, respectively), with medium diversity positively related to reported group skill learning gains, while a high level of diversity is negatively related to students' reported gains.

TABLE 5
Results of the Three Phases of Regression Analyses

| Independent Variables | Problem-Solving Skills | | Group Skills | |
|---|---|---|---|---|
| | Adj. $R^2$ | Betas | Adj. $R^2$ | Betas |
| *Classroom Diversity Only* | 0.02*** | | 0.05*** | |
| Low diversity | | –0.12** | | –0.16*** |
| Medium-low diversity | | –0.05 | | –0.09* |
| Medium diversity | | 0.04 | | 0.07 |
| High diversity | | –0.04 | | –0.09 |
| *Precourse Characteristics and Classroom Diversity* | 0.02*** | | 0.05*** | |
| Gender | | 0.03 | | –0.05 |
| Race/ethnicity | | –0.04 | | –0.00 |
| Ability (SATs) | | –0.03 | | –0.02 |
| Low diversity | | –0.13** | | –0.15*** |
| Medium-low diversity | | –0.06 | | –0.08 |
| Medium diversity | | 0.03 | | 0.09 |
| High diversity | | –0.04 | | –0.08 |
| *Precourse Characteristics, Classroom Activities, and Classroom Diversity* | 0.34*** | | 0.34*** | |
| Gender | | 0.04 | | –0.02 |
| Race/ethnicity | | –0.01 | | 0.03 |
| Ability | | –0.07* | | –0.08** |
| Collaborative learning | | 0.28*** | | 0.41*** |
| Instructor interaction | | 0.32*** | | 0.20*** |
| Clarity & organization | | 0.13*** | | 0.08** |
| Low diversity | | 0.00 | | –0.01 |
| Medium-low diversity | | –0.01 | | –0.01 |
| Medium diversity | | 0.06 | | 0.09 |
| High diversity | | 0.04 | | 0.00 |

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

In the second phase analyses (reported in the middle portion of Table 4), despite the addition of controls for students' race/ethnicity, gender, and academic ability, the association between classroom diversity and both learning outcomes persists relatively unchanged. The adjusted $R^2$s remain low and, indeed, are identical (within rounding error) to those in the first-phase models. Again, low levels of classroom diversity (relative to no diversity at all) were negatively related to gains in both problem-solving and group skills at statistically significant levels. The pattern of the signs of the beta weights also remained unchanged, suggesting that medium-low and high levels of classroom diversity may be negatively related to reported learning gains, while medium levels of diversity appear to have a positive effect on learning. None of these weights, however, reached the traditional standard of statistical significance. In the

group skills model, however, the weights for medium-low, medium, and high levels of classroom diversity did approach the traditional criterion of statistical significance ($p < 0.08$, 0.11, and 0.13, respectively). In sum, gender, race/ethnicity, and academic ability appear to have no statistically significant effect on the learning reported by students in this study, while the evidence continues to suggest that classroom diversity may be a factor (possibly both positive and negative).

In the third phase of the analyses, with students' precourse characteristics and the three classroom activity scales included as control variables, the adjusted $R^2$ values climb substantially to 0.34 for both problem-solving and group skills. The sharp rise in the $R^2$ was predictable. Both the research literature and common sense would lead one to expect the addition of three scales reflecting what goes on in a classroom to be powerful predictors of how much students think they have learned. Indeed, one might reasonably expect these close-to-the-action predictors to eliminate what the earlier regressions have suggested is the relatively small contribution of classroom diversity to learning gains. Such expectations were largely—but not completely—borne out. As can be seen in the bottom portion of Table 4, none of the beta weights for the various levels of classroom diversity reached statistical significance. Classroom diversity, as a factor in student learning, however, did not disappear entirely. In the model predicting reported gains in problem-solving skills, the diversity index, when treated as a *continuous* variable (rather than being treated as dichotomous categories), produced a beta weight of 0.045. Although small relative to the weights of the three classroom activity scales, the diversity index weight remained statistically significant ($p < 0.05$). Similarly, in the group skills model, the beta weight for medium levels of diversity (0.09) was statistically significant at $p < 0.067$, only narrowly failing to meet the conventional $p < 0.05$ standard. Thus, these findings indicate that what happens in a classroom (e.g., the degree to which students engage in active and collaborative learning activities, their interactions with instructors and peers, and the level of clarity and organization in the classroom) are clearly more powerful influences on students' reported learning gains than is the level of the classroom's structural diversity. Nonetheless, classroom diversity, *despite* the presence of these more proximal and powerful influences, continued to have a measurable influence on student learning (albeit a small and statistically marginal one by conventional standards).

Finally, entry of the set of four diversity-by-collaborative learning scale interaction terms produced no appreciable increase in the value of $R^2$ for either the problem-solving or group skills models. Thus, the data in this study suggest that the effects of the level of classroom diversity

on students' reported skill-development gains are general rather than conditional (or dependent) on the use of collaborative learning approaches in the course.

*Limitations*

This study has several limitations. First, although the sample is multi-institutional and contains a broad range of engineering schools, the seven institutions that participated in the study were not randomly selected. Thus, to an unknown degree, these institutions may not be representative of the national mix of engineering schools or, indeed, of all four-year universities. Similarly, the classes and students invited to participate in the study were not randomly selected. Although local evaluators were urged to sample ECSEL and non-ECSEL courses from across their institution's college of engineering's class levels, the resulting samples may not be representative of the course or student populations (engineering or otherwise) on each campus. Moreover, the number of classes and students participating vary widely across the participating institutions. Thus, generalizations to other institutions' engineering classes and students must be made cautiously. With regard to sampling, however, the study has two distinct assets when compared to most studies of classroom effects on student learning: its multi-institutional design and its relatively large sample of both courses and students.

Second, the influences of gender and academic ability are probably underestimated in this study due to the relative homogeneity of engineering students on these campuses with respect to these variables. By and large, the participants in this study were male (73%) and academically very able (mean combined SATs of 1,241).

Third, while problem-solving and group skills are basic educational outcomes of most engineering (and general education) programs, they are certainly not the only dimensions along which future engineers (or students in general) develop academically and intellectually during their undergraduate programs. Moreover, alternative conceptualizations and operationalizations of "problem-solving" and "group" skills have been advanced, and the results of this study might have been somewhat different had other conceptualizations and/or measures of each skill been used, or if other, entirely different learning outcomes had been the foci of this study.

Fourth, the measurements of skill development in this study are based on students' self-reports rather than on more objective measures of student learning (e.g., standardized tests). Recent research suggests, however, that self-report measures of learning can be used to appraise gains in cognitive skills. Pike (1995) found self-reported measures of educa-

tional gains to be as valid as objective measures to the extent that the self-report measures reflect the content of the learning outcome under consideration. As noted earlier, the items reflecting the learning outcomes studied in this research came primarily (albeit not exclusively) from a national study of the beliefs of faculty members, researchers, administrators, and employers about what component abilities make up those skills (Jones, 1994; Jones, et al., 1994). Similarly, Anaya (1999), after examining a representative sample of students who took the Graduate Record Examinations in 1989, concluded that self-reported measures of gains in cognitive skills are valid proxies of cognitive skills as measured by the verbal and math components of the GRE. Moreover, while standardized measures have some advantages over self-reports, they also come with limitations of their own for classroom use, including availability, length, cost, and relevance to specific courses. The self-report instrument used in this study was designed specifically to gather course-level information and to be easy and inexpensive to use. One must, nonetheless, acknowledge the trade-offs being made.

Fifth, the study's design and database are cross-sectional. The concept of learning "gains" or skill "development" implies change over time. Moreover, the impact of course- (or campus-) diversity may also vary over time. A longitudinal design would provide a more rigorous test of whether classroom diversity is related to learning. It is worth noting in this regard, however, that the relations identified between classroom diversity and reported learning gains persisted in the presence of controls for selected precourse student characteristics (gender, race/ethnicity, and high-school academic achievement) and remained marginally significant even in the presence of psychometrically sound measures of classroom activities designed to promote learning. These latter measures, as one might expect, were clearly more powerful forces for student learning, but they failed to completely eradicate evidence that classroom diversity may also be involved.

Sixth, for reasons explained earlier relating to the apparent curvilinear effect of classroom diversity on reported learning gains, this study operationalized classroom diversity as four, dummy-coded levels, rather than as a single, continuous variable. Subsequent use of these dummy-coded variables in statistical interaction terms to examine whether classroom diversity might have a different effect depending on the degree of interpersonal contact among students in the course provides a relatively low-power test of the possible, conditional effects of diversity on learning. Future studies should examine more rigorously the possibility of such "contextual" effects. The structural diversity in a classroom (and elsewhere) may, indeed, have a general effect (i.e., one that is about the

same, regardless of classroom activities), rather than "conditional" or "contextual" (i.e., one in which the magnitude of the effect varies depending on the setting), but for theoretical, practical, and policy reasons, that relation should be validated.

Seventh, this study examined the influence of different levels of classroom diversity only in relation to the effect of no classroom diversity at all. Some levels of diversity, independent of the kinds of pedagogies adopted, may be more or less, positively or negatively, related to learning gains. This study shed no light on these questions, and future research on the matter is strongly encouraged.

Finally, students develop their problem-solving and group skills over time and at varying rates. This study is limited by the fact that changes in these skill areas were examined after only one course. The *cumulative* changes in these areas that can be attributed to the racial/ethnic diversity in these and subsequent courses throughout students' academic programs, as well as in their out-of-class encounters with racially and ethnically diverse individuals, may be more extensive than what is reported here. Indeed, one might also hypothesize that the overall institutional climate for diversity is a more powerful force for learning than is the level of diversity in individual classrooms. Chang's (1996, 1999a) work supports this proposition, but it offers no insight into the relative influence of campus- vs. classroom-level diversity. Because this study was unable to control for campus-level diversity climate, the hypothesis that the campus climate is the dominant force remains a plausible alternative to the interpretation of the findings in this study. It is worth noting, however, that the phrasing of the survey items consistently reminded students that they were being asked to describe the activities going on in a specific course and to report learning gains associated specifically with that course. Moreover, Cabrera and Nora (1994) report findings consistent across racial/ethnic groups that students' sense of institutional alienation is shaped more powerfully by their in-class experiences than by their perceptions of the general campus climate.

### *Conclusions and Implications*

Since the passage of the Civil Rights Act of 1964 and the Higher Education Act of 1965, America's colleges and universities have struggled to provide equal access to applicants of all races and ethnicities. Affirmative Action, based on racially and ethnically sensitive admissions decision making, has been the policy of choice in trying to achieve equality of access and racially and ethnically diverse student bodies.

Widely adopted as it has been, however, affirmative action has be-

come increasingly controversial. Reliance on race-sensitive admissions received the support of the U.S. Supreme Court in the 1978 *University of California v. Bakke* decision, when Justice William Powell, writing for the majority, argued that race could be one of the factors on which admissions decisions were based. The *Bakke* decision came under fire, however, in the 1996 *Hopwood v. Texas* case when the U.S. Court of Appeals for the Fifth Circuit rejected arguments supporting the University of Texas' use of race-sensitive admissions to its law school. That ruling was subsequently extended to all admissions activities in Texas' public higher education systems, and it has shaped referenda or legislative actions in a number of other states nationwide.

In response, representatives of colleges and universities have argued that affirmative action is necessary to maintain racially and ethnically diverse student bodies and that the practice is defensible on educational, if not legal, grounds. Diverse student bodies and classrooms, the argument goes, are more educationally effective than are less- or non-diverse ones. Lee Bollinger, president of the University of Michigan, for example, has asserted, "A classroom that does not have a significant representation from members of different races produces an impoverished discussion" (Schmidt, 1998, p. A32).

A growing body of research has lent support to this argument, although the evidence is far from conclusive. A significant segment of this literature focuses on the effects of a campus's racial/ethnic climate on students' racial/ethnic attitudes or learning. These studies are generally consistent in finding that a "warmer" climate is related to students' willingness to socialize and discuss racial issues and to greater tolerance and appreciation for diverse populations. A second segment of the diversity research has examined the effectiveness of specific, programmatic initiatives (e.g., cultural awareness workshops and diversity course requirements) intended to promote greater tolerance and understanding among racially and ethnically diverse students. Like the campus climate research, this body of evidence generally supports the effectiveness of such programmatic interventions.

Few studies, however, specifically examine whether the racial/ethnic composition of a campus or classroom—the so-called "structural diversity" of these settings—has a measurable impact on student learning. This study explored precisely that question with respect to the racial/ethnic composition of individual classrooms, as well as whether the effects of structural diversity might be mediated by the kinds of instructional methods in use in the classroom. The findings of this study hardly constitute a ringing endorsement of Bollinger's claim that "a classroom that does not have a significant representation from members of different

races produces an impoverished discussion" (Schmidt, 1998, p. A32). Portions of the evidence do, however, support claims about the educational benefits of racially or ethnically diverse classrooms. Level of classroom diversity was related at small—but statistically significant—levels to students' reported gains in both their problem-solving and their group skills. Moreover, those relations persisted even in the presence of controls for students' race/ethnicity, gender, and academic ability. In the most rigorous tests applied in this study, both students' precourse characteristics (including ability) and three scales reflecting the instructional practices in use in the course were controlled, the level of classroom diversity *continued* to show a positive, if small, statistically marginal relation to reported learning gains. In a regression on students' reported gains in problem-solving skills, a continuous measure of classroom diversity had a small, but statistically significant, positive effect (beta = 0.045, $p < 0.05$). In a similar regression on students' reported gains in their group skills, being in a "medium diversity" classroom was positively related to reported gains net of other student characteristics, instructional methods, and other levels of classroom diversity. This effect failed, but only narrowly ($p < 0.07$), to meet the conventional standard for statistical significance. These findings indicate quite clearly that what happens in a course is far-and-away a more powerful predictor of learning outcomes than is the level of classroom diversity. Nonetheless, the persistence of diversity's influence *despite* the presence of more powerful predictors is, we believe, substantively noteworthy and relevant to the policy question this study seeks to illuminate.

The evidence also suggests that the relation between the racial/ethnic composition of a classroom and students' learning gains may not be a simple, linear one. The evidence quite consistently indicates that "medium" levels of classroom diversity (i.e., approximately in the 30–40% range) are positively, if not always significantly, related to students' reports of learning gains. At the most rudimentary level of analysis, however, the data also suggest the possibility that low or high levels of classroom diversity *may* be negatively related to learning gains. Analyses examining the effects of only classroom diversity level, or of diversity level while controlling for students' race/ethnicity, gender, and ability, produced some marginal evidence of statistically significant but negative effects among students in classrooms with low or high levels of diversity (compared to no diversity at all). These negative relations, however, were not supported when measures of the instructional practices in use in these classrooms entered the analyses. Entry of a set of interaction terms (reflecting whether the effects of various levels of diversity varied depending on the extent to which collaborative learning

activities were used in the classroom) produced no appreciable increase in the value of the $R^2$ for either model. This finding suggests that any effects of structural diversity appear to be general and not conditional on the instructional methods in use in the classroom. That conclusion, however, warrants further validation. Similarly, future research should examine more precisely than was possible here the levels at which classroom diversity becomes a salient positive or negative force in shaping students' learning.

At best, the findings in this study suggest a small, if statistically significant, link between the level of racial/ethnic diversity in a classroom and students' reports of increases in their problem-solving and group skills. The relatively consistent and positive salience of medium levels of classroom diversity is the most supportive evidence for arguments that classroom diversity has positive, educational effects on student learning. That evidence, however, is far from conclusive.

The findings of this study are all the more suggestive when one considers that the relation between diversity and student learning is at least modestly detectable *in individual classrooms*. One might reasonably speculate that, if the beneficial effects of racial/ethnic diversity are apparent in *individual* classrooms, then those effects may well be substantially magnified in the aggregate, when accumulated across the courses students take and across their out-of-class experiences in racially/ethnically diverse settings.

Should subsequent studies of the effects of the racial/ethnic composition of classrooms and other campus settings bear out the relations suggested in this research, then much of the current cloudiness in the legal and policy worlds concerning the educational effectiveness of diverse settings may be clarified. Arguments for affirmative action and race-sensitive admissions that assert the educational effectiveness of such policies will rest on substantially firmer empirical ground, and campus, state, and federal policies permitting or encouraging race/ethnicity-sensitive admissions will also rest on firmer empirical ground

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