Student Aid and Major Choice:
A Study of High-Achieving Students of Color

By

Edward P. St. John
Choong-Geun Chung
Indiana University

Prepared For
Deborah Wilds
Bill & Melinda Gates Foundation

Funding by the Bill & Melinda Gates Foundation for this research project is gratefully acknowledged. The opinions expressed in the paper are the authors' and do not represent official policies or positions of the Foundation.

Student Aid and Major Choice:
A Study of High-Achieving Minority Students

Executive Summary

The Gates Millennium Scholars (GMS) program provides scholarships for high-achieving minority undergraduates and commits financial support through graduate education in selected high-demand fields in which minorities are underrepresented (math/science including computer science, engineering, education, and computer/library science). Using a survey of GMS recipients and qualified non-recipients, this paper examines the impact of student aid (GMS, grant amounts, and debt burden) on choice of major field by freshman and continuing undergraduates who received two years of support from GMS. The principal finding was that debt burden was negatively associated with the choice of majors in math and science by students in samples of both the freshmen and continuing students.

The Gates Millennium Scholars (GMS) Program promises undergraduates that they will receive support through graduate school if they pursue graduate degrees in library/information sciences, engineering, education, mathematics, and science (including computer science). This promise is intended to encourage minorities to go into fields in which they are underrepresented and to which they can make contributions. While the major fields of undergraduate students are not considered in the selection process for potential GMS awardees, receiving the award may influence students to choose a major that is related to one of the fields that receives long-term support. Thus, the GMS Program provides the opportunity to examine how grant subsidies and debt reduction influence major choice.

There are three logical bases for assuming that GMS might influence choices about education programs. First, for many decades the federal government has provided specially directed financial aid for students enrolling in health sciences and other high-demand fields. And while these programs were seldom considered in economic research on student aid, there was evidence that the decline in federal need-based grants was associated with the growing opportunity gap for minorities compared with whites in the U.S. after 1980 (St. John, 2003). Second, debt forgiveness has been used to encourage students to enter teaching or the medical professions, especially if they locate in geographic areas experiencing shortages. However, the influence of targeted debt forgiveness has seldom been evaluated systematically. Recent research on debt forgiveness for public service is not encouraging (Schrag, 2001). It is not clear whether debt forgiveness influences students to enter fields or merely rewards students who would have entered these fields anyway. Third, the idea that student aid might influence major choice gained momentum in the 1980s, when some educational leaders began to speculate about the consequences of growing levels of student debt (Kramer & Van Dusen, 1986**;** Newman,

1985). The initial test of this proposition found that debt burden was not associated with choosing majors with high expected earnings (St. John, 1994), but this issue merits further study.

Not only does GMS provide recipients of grant aid with the opportunity to secure more support for graduate studies, providing a clear incentive for major choice, but it also reduces student debt. So the major choices by students could, in theory at least, be related to the amounts of both debt and grants received. Using a national sample of qualified applicants for GMS (recipients and non-recipients), this paper examines the impact of student aid (GMS and amounts of scholarships and debt). To test whether GMS influenced major choice, we used both versions of our model, one that considered the impact of GMS only and another that considered GMS and the amounts of grants and debt burden, controlling for other forces that could influence major choice. The analyses are restricted to the 2000 freshmen and continuing student samples because these students were enrolled long enough to have declared a major. Often, freshmen (e.g., the 2001 freshman cohort) do not declare majors during their freshman year.

Logical Approach

Logically, we assumed that student background, aspirations, college choice, achievement, and educational experiences influence major choice, along with student aid. Prior studies have established a basis for examining the linkage between debt and choosing majors with higher expected earnings (St. John, 1994). However, this logic does not exactly fit the GMS program, which provides the promise of funding for graduate education in specified fields. Since earnings vary significantly in these major fields, the old logic does not hold. Instead, the incentive for choice of field in GMS is future grant aid, rather than future earnings. GMS would reduce debt, which could make some low-earning fields—like library science and education—appear to be

more attractive options than they would be without the financial inducement. Fortunately, the choice construct provides a more complete basis for conceptualizing the linkages between financial variables and major choice. After discussing below the theoretical foundations for a new major choice model, we describe new model.

The logic of the student choice construct is informed by social theory on attainment, economic theory on human capital and price response, and education research with an explicit focus on the student choice process. The models used in this volume to examine educational choices by high-achieving minority students integrate an understanding of distinct choices informed by the continuity of choice. Specifically, consideration of the situated contexts in which students make educational choices guided the logical development of the analytic models. Each of these elements of the major choice process is examined below.

First, the situated contexts that are crucial in this study are the lived experiences of minority students. The notion that major choices could be constructed differently within different ethnic communities has some roots in educational research. For example, Gail Thomas (1985) found that African Americans were attracted to majors in math and science, but had special developmental needs. A more recent study found that African Americans choosing majors in education, health, and other applied fields were more likely to persist than other African Americans (St. John, Hu, Simmons, Carter, & Weber, in press). However, a similar pattern was not evident for whites.

Ethnic differences in major choice could be related to educational background, aspirations, and/or culture. It also is possible that such differences are related to financial considerations and will change in significance once variables are considered. Thus there is a tension between the social/economic and academic aspects of situated contexts, at least at a

conceptual level. Therefore, to build an understanding of the role and influence of situated contexts in major choice, we need to consider ethnic differences.

Second, social theory of educational attainment periodically needs reinterpretation to contend with the complexities of educational choices by diverse groups. Specifically, in the case of major choice, social attainment theory argues that social class and the professions are linked, that fathers' occupational status influences choices across generations (Blau & Duncan, 1967). This notion of major choice is constraining for groups that have faced historic discrimination in education or the labor market. Accordingly, the role of GMS could be to enable students from disadvantaged backgrounds to overcome these barriers to access.

The concept of racial uplift, a logic that is compatible with attainment theory, has some relevance to the reinterpretation process. There is compelling and growing evidence that the concept of cross-generation uplift remains salient among African Americans (Kaltenbaugh, St. John, & Starkey, 1999; St. John, Musoba, Simmons, & Chung, 2002; Paulsen, St. John, & Carter, 2002). These tensions between cultural reproduction and uplift are manifest in research on major choices, as they are in research on college choice and enrollment.

Third, theory and research on student engagement (Kuh & Love, 2000) and learning communities (Tinto, 2000) can inform the study of major choice as well. It is possible that student engagement with community groups could influence the choices of particular fields, like education, that are socially oriented. It also is possible that engagement with faculty—working on research with faculty or having the opportunity to get to know faculty—might influence the choice of majors in which the individuals' ethnic group is underrepresented. For example, working with faculty on research will illuminate the prospect that scientific research is

interesting, feasible, and worthwhile. Therefore, we examine the influence of variables related to student engagement on major choice.

Fourth, economic theory on human capital assumes that people make educational choices based on consideration of costs and benefits (Becker, 1964). Prior analyses of the role of major choice in persistence indicate important differences between whites and African Americans in this regard (St. John, Hu, Simmons, Carter, & Weber, in press). In theory, debt burden can influence students to choose majors with higher earning potential. By constraining debt in both graduate and undergraduate school, GMS could influence students to choose majors that have lower expected earnings, like education and library science, than business or other fields with high expected earnings.

It is possible that the prospect of long-term support from GMS could influence students to choose all of the majors that are eligible for support through graduate school. While it is possible to enter graduate school in education from almost any undergraduate field, it is more difficult to go on in the sciences and engineering without preparation in these fields. Further, receiving teaching credentials might help students secure admission to graduate school in the field. Therefore, it is reasonable to examine the influence of GMS awards on the choice of majors in math, science (including computer science), engineering, education, and library science/information.

Fifth, continuity of choice also can play a substantial role in major choice (St. John, Asker, & Hu, 2001; St. John, Cabrera, Nora, & Asker, 2000). It is logical that financial reasons for choosing a college also could have an influence on the choice of major. For example, if students were concerned about living at home, they might want a major that enabled them to find a local job. In contrast, choosing a major because of scholarships might open students to broader

horizons academically, since the additional funding brings a new freedom to learn, to pursue new interests, and to discover that which is compelling. Similarly, it is possible that choosing a college because of a strong reputation could be related to choosing majors that are more prestigious, such as science or engineering. Therefore, there is reason to consider whether the financial and educational reasons for choosing a college also have an influence on major choice. Thus, a variation on the financial nexus (Paulsen & St. John, 2002; Paulsen, St. John, & Carter, in review; St. John, Paulsen, & Starkey, 1996) could function as an integral part of the major choice process. It is possible that choosing a college because of low expenses, high scholarships, proximity to home, and reputation are related to aid amounts in the major choice process. These relationships merit exploration.

Based on these considerations, we developed a logical model for the analysis of major choice that considered the influence of: social background (including ethnicity), preferences in college choice, type of college, student engagement, achievement, GMS, and the amounts of financial aid.

Research Approach

The paper uses surveys of two cohorts of GMS recipients and non-recipients to examine the influence of student financial aid on major choices by high-achieving students of color. One cohort consists of freshmen who applied for GMS as high school seniors expecting to enroll in college in 2000. The other cohort is made up of continuing undergraduates—students who already were enrolled in college—and who were qualified to receive awards in fall 2000. This section describes the surveys, model specifications, statistical methods, and limitations of the study.

The NORC Surveys

The National Opinion Research Center at the University of Chicago (NORC) developed surveys of two cohorts of students who applied for GMS in 2000 (freshmen and continuing students). NORC conducted surveys of samples of students who met the academic qualifications and of all recipients in the two cohorts. Students' majors or preferred majors were not a factor considered in their selection for GMS. After it was determined that students met the academic criteria (e.g., the right types of preparatory courses and grade point averages above a 3.3), the students were reviewed by different groups using non-cognitive criteria (Sedlacek, in press) and they were reviewed for financial eligibility. The result was a quasi-random distribution of awards during the first year for qualified students (St. John & Chung, 2003).

Although the survey instruments varied somewhat across the two groups, both the continuing and freshman cohorts were asked about family background, college choices, involvement in college, college majors, and other variables used to examine major choice, consistent with the logical model described above. NORC used a web survey for the study and had reasonable response rates:

- 76.0 % for GMS recipients in the 2000 freshman cohort
- 56.4 % for non-recipients in the 2000 freshman cohort
- 64.2 % for GMS recipients in the 2000 continuing student cohort
- 46.9 % for non-recipients in the 2000 continuing student cohort

In addition, NORC added sample weights for each group, adjusting for the probably of selection. The analyses presented here use the NORC weights.

Model Specifications

The dependent variables compared students choosing majors in math, science (including computer science), engineering, education, and library/information sciences with students making other major choices. The model included independent variables related to:

- GMS (students who received GMS compared with others)
- Student characteristics
    - Male (compared with female)
    - Ethnicity (African Americans, American Indians,[1] and Hispanics were compared with Asian Americans)
- Reasons for choosing a college
    - Choosing a college because of low expense (students rating this as a 5 were compared with others)
    - Choosing a college because of grant/scholarship (students rating this as a 5 were compared with others)
    - Choosing a college close to home (students rating this as a 5 were compared with others)
    - Choosing a college for a strong reputation (students rating this as a 5 were compared with others)
- Family ability to pay (parents contributed to college finances; affirmative responses compared with negative responses)
- Involvement
    - Cultural group (students who participated in events put on by a cultural group were compared with students who did not)

    - Tutoring (students who participated were compared with students who did not)
    - Community service (students who participated in community service were compared with students who did not)
    - Assisted faculty on research (students responding affirmatively were compared with others)
    - Supported by one or more faculty (students responding affirmatively were compared with others)
- Type of institution (students enrolled in private colleges and public two-year colleges were compared with students enrolled in public four-year colleges)
- Finances
    - Loan debt $/1,000 (second step only)
    - Grant/Scholarship $/1,000 (second step only)

Five of these variables were related to student involvement in college. The variables for community service and cultural groups indicate frequent involvement in student social and civic activities. Involvement in faculty research and support by faculty indicate measure of academic involvement. Students who are more involved in the academic life of their campuses are more likely to feel supported by faculty than students who are less involved. The question of faculty support asked whether students perceived that they had the support of one or more faculty. The variable for involvement in tutoring served as an indicator of perceived need for academic support.

[1] American Indians were not considered in the 2000 freshman cohort because of the small number of American Indians in the sample.

A two-step analysis procedure was used as a means of untangling the monetary effects of the GMS program from the effects of other program features (i.e., leadership training, the halo effect of being a GMS recipient, and the criteria used for selection). The first step considered the full model excluding aid amounts; the second step added the amounts of scholarships and debt burden.

Statistical Methods

Logistic regression is an appropriate method for examining educational choices and other qualitative outcomes (Aldrich & Nelson, 1986**;** Peng, So, Stage, & St. John, 2002). Multinomial logistic regression, the statistical method used in this study, is appropriate when multiple choices are being compared, as in the model specified above.

Odds ratios are presented for the independent variables. An odds ratio below one (1) indicates a negative association, while an odds ratio above one (1) indicates a positive association. For dichotomous variables, which are the primary type of independent variable used here, a significant ratio can be interpreted as raising the odds if positive and lowering the odds if negative. For example, an odds ratio of .9 should be interpreted to mean that students with this characteristic have .9 times the odds of the outcome.

For continuous variables (i.e., grant/scholarship amounts and debt burden) the odds ratios can be applied to increments (i.e., 1,000 dollar increments since these variables are divided by 1,000). However, we use a cautious approach in interpreting the effects of continuous variables and, thus, focus on whether the associations are positive (above zero) or negative (below zero) if they are significant.

The analyses present three levels of statistical significance for independent variables. Two levels (.01 and .05) provide indicators of significant difference. The third level (.1)

provides a measure of moderate association that we interpret more cautiously. Since our analyses use a two-step process aimed at understanding the monetary impact of GMS, we considered changes in significance across two steps for each cohort.

Limitations

While this study uses an appropriate logical model and statistical method, the study does have a few limitations that merit consideration by readers.

First, this study represents the initial test of a new logical model for research on major choice. Only a few prior studies have treated major choice as an outcome. The proposed model builds on the logic of this prior research, consistent with the logic of the student choice construct (St. John, Asker, & Hu, 2001). This study tests the logic of the new model on cohorts of lower division and upper division undergraduates, examining the influence of finances on educational choices.

Second, regression analysis does not "prove" causality. Rather, logic should guide the selection of independent variables. When variables are included that should have a logical linkage to the outcome, then it is generally acceptable to interpret significance as having an influence on the outcome. However, caution should be used when assuming causality from a single analysis. By using two cohorts in this study, we can build a better understanding of effects by comparing the analyses for the two cohorts.

While the GMS program was not designed as an experiment, the 2000 award year had quasi-experimental distribution of aid for the qualified group (St. John & Chung, 2003). First, students were selected as eligible based on GPA and non-cognitive variables. Then, students were contacted to see if they met the financial criteria (i.e., Pell eligibility). In addition, some students who were Pell eligible were excluded to ensure racial balance or were not contacted.

Thus, both the award and non-award groups the met the non-cognitive award criteria and there was variation in financial need within both groups. As long as proper statistical controls are used in appropriate statistical models, this was an appropriate database for examining the impact of student aid on major choices by college-qualified students.

2000 Freshmen

Students in the 2000 freshman cohort had been enrolled in college for nearly two years when they responded to the survey, sufficient time to make an initial major choice. The GMS award process did not explicitly consider major preferences. Further, if GMS attracted students predisposed toward specified majors, then all applicants would have a probability of having this predisposition. Therefore, the awards decisions and major choices are appropriately viewed as independent of each other. However, it is possible that the financial commitments for support in graduate school could have induced more GMS recipients to choose high-priority majors than did non-recipients.

Student Characteristics

The distribution of major choices was similar across the two groups (Table 1). There were a few differences in background characteristics. There was a slightly higher percentage of Hispanics in the recipient group and a slightly higher percentage of Asian Americans in the non-recipient group.

The differences in reasons for choosing a college were not substantial for the two groups. Scholarship/grant aid was very important for both groups. However, there were more Pell recipients (low-income students) in the GMS recipient populations. Thus, financial aid was important to most qualified applicants, but the GMS students had lower family incomes.

The patterns of major choice were very similar for the two groups, further indicating major preferences were not a factor in selection. About half of both groups chose other majors (50% of GMS recipients compared with 49% of others). Approximately 28% of both groups chose majors in math and science. The percentage of non-recipients who chose engineering was slightly higher (18%, compared with 15% of GMS recipients), while the percentages of students choosing education and library/information science were nearly equal. Given the modest differences in major choices, we would not expect GMS to have had much influence.

There were differences in student engagement between the two groups. A higher percentage of GMS recipients participated in events conducted by cultural groups (47%, compared with 40%). GMS recipients also were somewhat more likely to participate in tutoring sessions (30%, compared with 24%), a difference that could be attributable to variations in student achievement and preparation[2] (St. John & Chung, 2003). Further, GMS recipients also were more likely to participate in community activities (30%, compared with 24%). However, similar percentages of the two groups had been involved in faculty research.

Impact of GMS

Both gender and ethnicity were associated with major choices (Table 2). Male students were more likely than females to choose majors in math, science, engineering, and library/information sciences. However, females were more likely to choose majors in education. Hispanics were less likely than Asian Americans to choose majors in math, science, and engineering. African Americans also were less likely to choose majors in engineering, but more likely to choose majors in education.

[2] We did not carry forward the measures of achievement in this model, but tutoring could be a proxy for lower achievement (or test scores) before college.

The college choice variables were not associated with the major choices by students in the 2000 freshman cohort, raising the possibility that the two types of choices are not linked.

Student involvement variables were associated with major choice. Students choosing both math and science majors and engineering were more likely to participate in tutoring, possibly because these majors are more demanding academically.[3] Participation in activities organized by cultural groups was positively associated with choosing math and science majors, but negatively associated with choosing engineering majors.

Being involved with faculty on research was positively associated with choosing majors in math and science, but being supported by faculty was negatively associated with this major choice. In combination, these findings indicate a different mode of interaction between faculty and students in math and science than in other fields.

Minority students in private colleges were less likely to choose majors in engineering than students in public four-year colleges. Since private colleges frequently are liberal arts institutions, many do not offer engineering majors, a contextual factor that could explain this finding. In contrast, students in public two-year colleges were substantially more likely to major in library/information sciences.

GMS awards were not significantly associated with major choices for the freshman cohort, at least before aid amounts were considered. This finding was expected, given the major distributions reported above.

These findings raise the possibility that involvement enables students to acquire cultural capital. Specifically, the ability to choose some of the preferred majors was related to student

[3] In previous research, having high grades was associated with choosing higher-earning majors like engineering (St. John, 1994a). Therefore, it is possible that tutoring is a proxy measure of needing to make up for deficiencies in prior preparation, a situation that could relate to the difficulty of some majors as well as the quality of schools attended.

engagement, including the time to work with faculty. Since GMS students were more engaged, it is logical that GMS could influence the process of building cultural capital.

The Impact of Aid Amounts

When the amounts of aid were considered, GMS recipients were less likely to choose engineering majors (Table 3). Scholarship/grant amounts were positively associated with the choice of engineering majors. In combination, it appears that the prospect of receiving the additional financial support GMS provides through graduate school may have influenced some students to choose engineering majors, but these effects were confounded with the effects of GMS (compare Tables 2 and 3).

The confounding relationship between GMS and scholarship is revealing. It is apparent that the positive effects of receiving scholarship dollars through GMS were offset by other program features. From the statistics comparing the two groups, it is evident that more low-income (Pell) students were included in the recipient population. Further, low-income students generally are less likely than middle-income students to aspire to engineering degrees because of differences in cultural capital (i.e., prior educational and cultural experiences associated with high education attainment). Therefore, it is possible that the funding through GMS helps the recipients overcome some of these differences.

Loan amounts were negatively associated with the choices of majors in math and science and in education. Education majors typically earn less than students in other majors, which could explain the influence of debt burden on the choices of education majors. However, the finding on debt and math and science majors is somewhat of a surprise. While math and science majors might earn more, they may have to get a graduate degree to do so. Thus, it is possible that debt burden diminishes the choice of math and science majors among minority students

because of the prospect of long-term debt. It is alarming that the educational choices of minority students have been negatively influenced by debt burden. Ironically, this finding further supports the linkage between grant funding for students and the formation of cultural capital.

In addition to having a positive association with the choice of engineering majors, scholarships had a negative association with the choice of education majors. There are two possible explanations for the findings about education and scholarship aid. Students choosing education majors may not be as likely to be influenced by monetary considerations as students in other fields. Further analyses would be needed to untangle these underlying relationships.

Only one other independent variable (in addition to GMS awards for engineering majors) changed in significance in the analysis of aid amounts. Being enrolled in two-year colleges was no longer significant, but the odds ratio remained high. Students in two-year colleges generally received less grant aid than students enrolled in four-year colleges, partially because of lower tuition. Therefore, it is not surprising that this change in significance was observed.

Continuing Students

Continuing students received GMS awards initially in fall 2000. Most still were enrolled or had graduated when they responded to the survey. The models used to examine major choice by continuing students were identical to those specified above for the 2000 freshman cohort.

Student Characteristics

There were slight differences in the major choices by GMS recipients compared with non-recipients (Table 4). A slightly higher percentage of the non-recipients were in majors outside the select group, while slightly more of the GMS recipients were in majors that would receive long-term funding.

The background characteristics and reasons for choosing college were similar for the two populations. There were more African Americans than other racial and ethnic groups among both recipients and non-recipients. Most students in both groups considered scholarship grant aid to be very important in their college choice.

There were substantial differences in educational engagement between the two groups. More GMS recipients were involved in events organized by cultural groups. Higher percentages of GMS awardees were involved in tutoring sessions and community activities, assisted on research projects, and were supported by one or more faculty. This reinforces the finding that GMS recipients had more opportunities to engage in college life than did non-recipients (Allen, 2003; Hurtado, 2003; Sedlacek, 2003).

The Impact of GMS

GMS awards were positively associated with the choice of education majors, but not with the other majors (Table 5). However, most of the other variables in the model had a more substantial influence on major choices.

Gender and ethnicity were associated with major choice. Males were more likely to choose science and math, engineering, and library/information science majors, consistent with the analyses of the freshman cohort. Once again, African Americans and Hispanics were less likely to choose engineering majors. American Indians and Hispanics, along with African Americans, were more likely to choose education majors.

Students who chose a major because of a scholarship or grant were less likely to choose education majors, providing a further indictor that the choice of education was not related to finances per se. It is entirely possible that the positive effects of GMS on education major choice are attributable to the long-term financial commitment, which enables students to attain their

goals without acquiring high levels of debt. Debt can be problematic for education majors because of their lower expected earnings.

Choosing colleges because they were close to home was negatively associated with being engineering majors. This finding is illuminating when juxtaposed with others in this study. It already is evident that choosing a college close to home was closely related to finances (e.g., St. John & Chung, 2003) and that Hispanics were more likely to have made this choice. Engineering programs are not as widely disbursed across state systems of higher education as are most other education programs, an artifact of the higher costs associated with engineering programs (Halstead, 1974). For the continuing students, GMS awards were made later than for the freshman groups. Awardees were not able to adjust their college choices like some freshman GMS recipients who received awards in the midst of making these decisions. Therefore, the analysis reveals the logical relationship between these choice phenomena.

Choosing a college because of a strong reputation was not associated with major choice in either analysis (i.e., for neither freshmen nor continuing students). Thus, while a sustained link exists between financial choices (i.e., recurrence of the financial nexus phenomena), the academic nexus is not as visible. Students choosing colleges because of their reputations were not more likely to choose higher prestige science or engineering majors.

Parental contributions were positively associated with decisions to pursue majors in math and science. Parents with "high" incomes generally can afford to contribute more. It is possible that the prospects of long-term enrollment and high debt burden are mitigating factors in the choice of science and math majors because of the negative effects of debt (see analyses of aid amounts above and below).

Again, a relationship was seen between tutoring and the selection of majors in both math and science and engineering. The two sets of analyses provide compelling evidence that many minority students who pursue technical majors must seek out additional tutoring support. It is possible that GMS enabled more students to major in these areas as an artifact of the higher percentage of GMS students being involved in tutoring. Apparently, money buys the time needed to find the support necessary to pursue highly demanding courses in math, science, and engineering.

Being involved in community service activities was negatively associated with majoring in engineering by continuing students (Table 5), consistent with the analysis of the 2000 freshman cohort. This could be an artifact of the time required to complete engineering majors or the culture of these majors, a topic that merits further exploration.

Assisting faculty with research was positively associated with choosing majors in math and science and engineering, consistent with the analysis of the 2000 freshman cohort. However, being supported by one or more faculty was negatively associated with majoring in both math and science and engineering, another finding that was consistent across the two cohorts. These patterns may be related to the nature of scholarship in these fields, especially in advanced courses. Nevertheless, these findings merit further exploration by researchers and policymakers interested in encouraging more minority students to enroll in these fields. If the lack of faculty support is an inhibiting factor for minorities, as is abundantly evident here, but not for whites, then faculty support is seriously problematic.

Minority students choosing engineering majors were less likely to be enrolled in private colleges, while students enrolled in public two-year colleges were more likely to choose

education majors.[4] It is entirely possible that this finding is an artifact of the distribution of major programs across different types of institutions.

The Impact of Aid Amounts

The impact of GMS awards was even more substantial after aid amounts were considered. The size of the odds ratio increased and the level of significance increased. Further, the amount of grant/scholarship awards was negatively associated with this major choice. Thus, the effects of GMS awards on the decision to major in education is distinct from the increase in the amount of aid received, a finding consistent for both groups. We explore the meaning of this finding in the conclusion below.

The amount of grant aid awarded was positively associated with choosing majors in math and science and engineering. Thus, finances have a clear link to the education choice process for minority students.

Loan burden was negatively associated with the choice of math and science majors, consistent with the analysis above. It is possible that GMS had an indirect association with the major choice process because it reduced debt burden. However, the fact that debt burden is negatively associated with major choices in both analyses is troubling. It is apparent that debt burden has intruded into the educational choice process for minority students.

Only one variable changed in significance when the amount of aid was considered. Attending private colleges was positively associated with the decision to major in education after the amount of aid was considered. While private colleges are less likely to offer engineering programs, they frequently offer education programs. The reasons why students in private colleges choose education merit exploration in future studies.

[4] In the analysis of the freshman cohort, above, attending two-year colleges was positively associated with choosing a library/information science major. Programs in education and library/information science may be major options

Conclusions

Research on major choice by minority students is scant, and the current study adds substantially to the research base in this area. Three of the findings from this study provide information that confirms the design features of the GMS Program.

First, GMS awards had a direct effect on some educational choices. GMS appeared to enable some recipients in the 2000 freshman cohort to choose majors in engineering. It is reasonable that GMS awards would influence freshmen but not continuing students to major in engineering. The potential for receiving support during college apparently had an influence on this choice. However, continuing students were not as directly responsive because the decision to change to an engineering major often means more years of undergraduate study, given the extensive prerequisites in engineering. The immediate monetary aspect was evident because this variable was significant only after the amount of aid was considered, that is, after the positive effect of the additional aid was considered.

It also is important to recognize that engineering is a highly structured major that is easier to complete if students begin their studies in that field. Therefore, it is not surprising that there was no relationship for continuing students between choosing an engineering major and receiving a GMS. Further, engineering is a field with a high attrition rate, given the demanding nature of the courses. Studies of subsequent surveys of the 2000 freshmen should consider whether GMS mitigates transfer to other fields from engineering. It is possible that the additional time for study afforded by GMS awards could reduce attrition from engineering by low-income minority students.

GMS also had a direct influence on decisions by continuing students to choose majors in education. This effect was not related to the amount of aid provided by GMS because the effect

---

for many community colleges.

size and significance increased after the amounts of aid were added to the model. Rather, it appears that GMS enables students to choose education in spite of the lower earnings associated with this major. It is possible that this is an intrinsic choice – i.e., that GMS students chose education out of personal interests and commitment. It also is possible that they chose the major because of the potential for receiving aid during graduate school. In addition, it is apparent that the decision to choose a major in education is related to the type of college attended. Students in community colleges and private colleges were more likely to choose education than were students in public four-year colleges.

In combination, these findings provide evidence that GMS is achieving at least one of its goals. GMS awards enable students to choose undergraduate majors in fields that are preferred by the program designers and that are thought to be in the public interest. This finding has substantial implications for education policy, some of which are explored below.

Second, the amount of debt burden was negatively associated with some major choices. Evidence from prior research shows that minorities are more likely to choose majors with linkages to employment (St. John, Hu, Simmons, Carter, & Weber, in press). However, this is the first study to provide evidence that debt burden inhibits major choices by high-achieving minority students. It has long been speculated that debt could discourage students from choosing majors for educational reasons (Kramer & Van Dusen, 1986; Newman, 1985), but this hypothesis has not previously been confirmed for either majority or minority students (St. John, 1994).

It is possible that growth in student debt has influenced many low-income minority students to avoid education careers. There is evidence that minorities have more debt than whites because they are from low-income families (Kaltenbaugh et al., 1999; Paulsen, St. John,

& Carter, 2002). High debt is problematic in the field of education because salaries are lower than in business and many other applied fields. Thus, the growth in debt contributes to the problems facing education reform in the U.S., given that debt inhibits students from choosing education as a major and career.

But the problem with debt is not limited to education. Indeed, debt was also negatively associated with majoring in science and math. Advanced degrees are needed to gain opportunity for higher earning in the sciences. Yet, from this study, it is apparent that some minorities lack sufficient support from faculty to go on academically. Debt burden adds to the problem, but it is not the only source of the problem facing minority students who seek opportunities in math and science.

The finding that debt was negatively associated with the choice of majors in math and science is the most important finding on the impact of debt. Not only was this finding evident for both populations, but representation of people of color among the nation's scientists remains an important social and policy issue. Apparently, high levels of debt, coupled with the prospect of long years of study and modest earnings (compared with business, law, and medicine) dissuade some minorities from choosing majors in the sciences.

Third, receiving a GMS award enabled students to become more engaged in college (Allen, 2003; Hurtado, 2003; Sedlacek, 2003) and this engagement was associated with educational choice. Thus, GMS has an indirect effect on education choices by minority students because it provides the opportunity to become engaged in student life and to work more directly with faculty. This serves as a validation of the design concept behind the GMS program.

Thus, there is strong, compelling evidence that the design of the GMS program not only facilitates students' college choices and enables them to persist better (St. John & Chung, 2003),

but that it also encourages students to choose majors fields that need more minority professionals. In the process of investigating the effects of GMS, we also documented fundamental problems with the current system of federal student aid.

Implications

This examination of the impact of financial aid on major choices adds substantially to the knowledge base regarding this issue. For the past two decades, there has been repeated speculation that the overemphasis on federal loans was having an influence on education choices, including the choice of academic majors. To untangle the meaning of these findings for education policy, it is important to situate the results in an understanding of the government role in labor force development.

Before the 1960s, the primary federal role in supporting college students was to fund those who pursued a college education in fields that were in high demand (Finn, 1978; Halstead, 1974). Even after the Higher Education Act (HEA) of 1965 created generally available student aid programs,[5] the specially directed programs were substantially larger than the need-based programs. The impact of specially directed programs in health and other areas seldom was evaluated. Over time, specially directed aid was replaced by generally available aid. Some federal programs targeted labor in specific fields, other programs provided aid to specific groups (e.g., veterans, healthcare workers, children of deceased workers). The movement toward

[5] The National Defense Education Act of 1958 actually created the National Defense Student Loan Program (now called the Federal Perkins Loan Program), the first generally available federal student aid program. The HEA of 1965 reauthorized this program and College Work-Study while creating the first generally available grant program, Educational Opportunity Grants, renamed Supplemental Educational Opportunity Grants in 1972.

generally available aid since 1965[6] made aid more accessible and in this sense was more just, but reductions in grant aid after 1980 caused problems for low-income students (St. John, 2003).

The GMS program has features related to generally available need-based grant aid and features related to the earlier specially directed programs. Our other paper on GMS documents how the need-based features of the program—especially the explicit focus on meeting financial need—enable high-achieving, low-income students to maintain continuous enrollment. It also reveals that the opportunity for high-achieving, low-income minority students to attend four-year colleges has been constrained by finances. Providing GMS awards improves the odds for low-income minority students to enroll in private colleges and attend public four-year colleges. In addition, providing adequate grant aid improves the odds that funded students will persist. In combination, these findings illustrate the inadequacy of federal aid.

This paper examines the specially directed aspect of GMS. The GMS program makes a commitment to provide continued funding through graduate school for students choosing to continue their education in selected high-demand fields in which minorities are underrepresented. This study confirms that this long-term commitment, along with the additional resources provided in the short term, influences students' choice of major in some fields. However, the study also reveals that debt burden is a crucial cause of the shortage of minority representation in education, engineering, and scientific fields. This provides clear evidence that debt burden has entered the domain of education choice in a problematic way.

The reasons why debt constrains students' choices to pursue majors in education and science and math are different, revealing the complex and destructive ways debt invades the educational choice process. Students in math and science were more likely to work with faculty

[6] Before the Higher Education Act, federal student grants were directed to special populations, such as veterans. The HEA provided need-based grants that were "generally available" based on financial need and were not directed

on research and to become engaged in their major fields. The negative influence of debt on choosing majors in science may be related to the prospect of the large levels of debt necessary to attain the advanced degrees needed in these fields. GMS helps mitigate this worry about debt by providing more opportunity for students to work with faculty and gain their support (St. John, in preparation). Through this indirect process, the GMS program is enabling more minority students to follow interests in the fields of science and math.

The education story is different but not less revealing. Education majors were not as likely to be persuaded by scholarship aid. Their major choices apparently were intrinsic, related to interest rather than to the amount of grant aid. However, debt dissuaded potential education majors from following their interests because it may be problematic relative to earnings.

These findings further confirm the inadequacy of the current federal student aid programs. They also show that financial aid provides a mechanism for states to influence labor force development. Two possibilities merit consideration: targeting grant aid to undergraduates in select high-demand fields and forgiving loans for students who pursue education or choose careers in high-demand fields. While loan forgiveness has been tried in the past (e.g., for teacher education), it has seldom been studied and remains a little understood policy instrument. Given the negative effect of debt, it is probable that targeted debt relief would have an influence on labor force development.

---

toward special populations.

Table 1 2000 Freshmen Students: Descriptive Statistics for Variables in the Multinomial Logistic Regression for Choice of Major

Variable	Value	Gates Scholarship			
		Recipient		Non-recipient	
		Count	Col %	Count	Col %
Field of Declared Major	Mathematics and Sciences (including Computer Science)	170	28.9	250	28.2
	Engineering	88	15.0	162	18.2
	Education	29	5.0	36	4.1
	Library and Information Science	5	0.9	6	0.7
	All Other	294	50.1	432	48.7
Gender	Male	176	29.9	296	33.4
	Female	411	70.1	590	66.6
Ethnicity	African Americans	202	34.3	319	36.0
	American Indians	35	5.9	47	5.3
	Hispanic Americans	174	29.5	189	21.4
	Asian/Pacific Islanders	178	30.3	331	37.4
Reason select school low expenses	Very important	258	44.0	409	46.2
	Other	329	56.0	477	53.8
Reason select school scholarship/grant	Very important	515	87.7	653	73.7
	Other	72	12.3	233	26.3
Reason select school can live at home	Very important	45	7.6	82	9.3
	Other	543	92.4	804	90.7
Received Pell Grant from current school	Yes	520	89.3	232	26.4
	No	63	10.7	646	73.6
Parents contributing college finances	Yes	222	37.8	568	64.1
	No	365	62.2	318	35.9
UGrad R part. in events by cultural grp	Very often or often	275	46.8	356	40.1
	Other	312	53.2	531	59.9
UGrad R part. in tutoring sessions	Very often or often	177	30.2	209	23.6
	Other	410	69.8	677	76.4
UGrad R part. in comm. service activity	Very often or often	282	48.1	383	43.2
	Other	305	51.9	504	56.8
Assisted on faculty research project	Yes	129	22.0	195	22.0
	No	458	78.0	691	78.0
UGrad support one or more faculty	A lot	115	19.5	139	15.7
	Other	473	80.5	747	84.3
Institution Type in 2000 Fall	Private	260	44.2	366	41.3
	Public 2-year	8	1.3	25	2.8
	Public, 4-year or above	320	54.5	495	55.9
Total money (in $1,000) borrowed since start school		1,474		1,474	
Amount (in $1,000) of scholarship/grants this year		13.745		8.504	
Valid cases		1,474			
Cases with missing values		355			
Total number of cases with relative weight		1,829			

Table 2 The Impact of GMS on Major Choice for 2000 Freshman Students: Multinomial Logistic Regression Results

Variable		Mathematics and Sciences		Engineering		Education		Library and Infor Science	
		Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.
Gates Scholarship	Recipient	1.0359		0.8289		1.1384		1.3675	
	Non-recipient								
Gender	Male	1.4766	***	4.6898	***	0.4014	**	4.8269	**
	Female								
Ethnicity	African Americans	0.9213		0.7287	*	1.7964	*	1.0721	
	American Indians								
	Hispanic Americans	0.6052	***	0.6569	**	1.6647		0.4259	
	Asian/Pacific Islanders								
Reason select school low expenses	Very important	1.0608		0.9229		1.2144		0.8666	
	Other								
Reason select school scholarship/grant	Very important	0.8169		0.9359		1.4377		4.0155	
	Other								
Reason select school can live at home	Very important	0.9762		0.9202		1.8467		2.3895	
	Other								
Parents contributing college finances	Yes	0.9633		0.9259		0.9640		1.0783	
	No								
UGrad R part. in events by cultural grp	Very often or often	0.8804		0.9395		0.8777		0.9397	
	Other								
UGrad R part. in tutoring sessions	Very often or often	1.7017	***	1.9898	***	0.6157		2.0791	
	Other								
UGrad R part. in comm. service activity	Very often or often	1.4275	***	0.7268	*	1.3539		1.9016	
	Other								
Assisted on faculty research project	Yes	1.5453	***	0.9083		1.0034		0.2320	
	No								
UGrad support one or more faculty	A lot	0.7236	*	0.8237		0.6363		1.8572	
	Other								
Institution Type in 2000 Fall	Private	0.8921		0.6893	**	0.6915		0.3615	
	Public 2-year	1.0011		0.5002		0.7326		6.2555	*

	Public, 4-year or above
Number of cases with relative weight =	1,474
Model X^2 =	229.016
	2,775.96
-2 Log Likelihood =	8
Cox & Snell Pseudo R^2 =	0.144

***<0.01, **<0.05, *<0.1

Table 3 Impact of Aid Amount on Major Choices by 2000 Freshman Students: Multinomial Logistic Regression Results

Variable		Mathematics and Sciences		Engineering		Education		Library and Infor Science	
		Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.
Gates Scholarship	Recipient	0.9636		0.6975	**	1.0728		1.7828	
	Non-recipient								
Gender	Male	1.4608	***	4.5285	***	0.4033	**	5.1016	***
	Female								
Ethnicity	African Americans	0.9009		0.6955	*	1.7418	*	1.2255	
	American Indians								
	Hispanic Americans	0.5994	***	0.6459	**	1.6302		0.4410	
	Asian/Pacific Islanders								
Reason select school low expenses	Very important	1.0494		0.9603		1.1194		0.7474	
	Other								
Reason select school scholarship/grant	Very important	0.8223		0.8484		1.5936		4.8292	
	Other								
Reason select school can live at home	Very important	0.9435		0.9325		1.6561		2.2898	
	Other								
Parents contributing college finances	Yes	0.9544		0.9428		0.9306		0.9904	
	No								
UGrad R part. in events by cultural grp	Very often or often	0.8842		0.9588		0.9041		0.8731	
	Other								
UGrad R part. in tutoring sessions	Very often or often	1.7037	***	1.9867	***	0.6116		1.9614	
	Other								
UGrad R part. in comm. service activity	Very often or often	1.4312	***	0.7220	*	1.3534		2.0099	
	Other								
Assisted on faculty research project	Yes	1.5399	***	0.8740		1.0249		0.2392	
	No								
UGrad support one or more faculty	A lot	0.7185	*	0.8329		0.6242		2.0029	
	Other								
Institution Type in 2000 Fall	Private	0.9583		0.5745	***	1.0393		0.5143	
	Public 2-year	0.9635		0.5258		0.6233		4.5429	
	Public, 4-year or above								

Total money (in $1,000) borrowed since start school	0.9848	**		0.9834		0.9612	*	1.0283
Amount (in $1,000) of scholarship/grants this year	0.9992			1.0228	**	0.9701	*	0.9212
Number of cases with relative weight =	1,474							
Model X^2 =	251.202							
-2 Log Likelihood =	3,232.038							
Cox & Snell Pseudo R^2 =	0.157							

***<0.01, **<0.05, *<0.1

Table 4 2000 Continuing Students: Descriptive Statistics for Variables in the Multinomial Logistic Regression for Choice of Major

Variable	Value	Gates Scholarship			
		Recipient		Non-recipient	
		Count	Col %	Count	Col %
Field of Declared Major	Mathematics and Sciences (including Computer Science)	220	30.1	190	27.8
	Engineering	102	13.9	99	14.5
	Education	70	9.6	48	7.1
	Library and Information Science	15	2.0	7	1.0
	All Other	325	44.4	338	49.5
Gender	Male	234	32.1	185	27.1
	Female	497	67.9	498	72.9
Ethnicity	African Americans	296	40.5	295	43.2
	American Indians	66	9.0	37	5.4
	Hispanic Americans	202	27.6	169	24.7
	Asian/Pacific Islanders	167	22.9	183	26.8
Reason select school low expenses	Very important	384	52.5	345	50.4
	Other	348	47.5	339	49.6
Reason select school scholarship/grant	Very important	644	88.1	538	78.7
	Other	87	11.9	145	21.3
Reason select school can live at home	Very important	169	23.2	129	18.9
	Other	562	76.8	554	81.1
Reason select school strong reputation	Very important	555	75.8	532	77.9
	Other	177	24.2	151	22.1
Received Pell Grant from current school	Yes	551	75.8	168	24.7
	No	176	24.2	512	75.3
Parents contributing college finances	Yes	153	20.9	367	53.6
	No	579	79.1	317	46.4
UGrad R part. in events by cultural grp	Very often or often	329	44.9	234	34.2
	Other	403	55.1	450	65.8
UGrad R part. in tutoring sessions	Very often or often	159	21.8	95	13.9
	Other	572	78.2	589	86.1
UGrad R part. in comm. service activity	Very often or often	370	50.5	283	41.5
	Other	362	49.5	400	58.5
Assisted on faculty research project	Yes	261	35.7	217	31.8
	No	470	64.3	466	68.2
UGrad support one or more faculty	A lot	256	35.0	204	29.9
	Other	476	65.0	479	70.1
Institution Type in 2000 Fall	Private	284	38.8	319	46.7
	Public 2-year	38	5.2	22	3.2
	Public, 4-year or above	409	56.0	342	50.1
Total money (in $1,000) borrowed since start school		7.660		12.300	
Amount (in $1,000) of scholarship/grants this year		11.778		7.698	
Valid cases		1,415			
Cases with missing values		751			
Total number of cases with relative weight		2,166			

Table 5 The Impact of GMS on Major Choice for 2000 Continuing Students: Multinomial Logistic Regression Results

Variable		Mathematics and Sciences		Engineering		Education		Library and Infor Science	
		Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.
Gates Scholarship	Recipient	1.2046		0.8903		1.5429	*	1.7131	
	Non-recipient								
Gender	Male	1.3810	**	4.6644	***	0.7417		3.8044	***
	Female								
Ethnicity	African Americans	0.8115		0.6440	**	2.1954	**	0.8351	
	American Indians	0.8528		0.6280		3.7390	***	1.4901	
	Hispanic Americans	0.7997		0.4957	***	2.1798	**	0.8823	
	Asian/Pacific Islanders								
Reason select school low expenses	Very important	0.9391		0.7745		1.3006		0.7422	
	Other								
Reason select school scholarship/grant	Very important	1.2251		0.9176		0.5316	**	0.9807	
	Other								
Reason select school can live at home	Very important	1.0842		0.5485	**	1.4154		1.1265	
	Other								
Reason select school strong reputation	Very important	0.8931		1.3429		1.2115		0.7578	
	Other								
Parents contributing college finances	Yes	1.2830	*	0.7584		0.9288		1.0169	
	No								
UGrad R part. in events by cultural grp	Very often or often	0.8512		0.8604		0.9577		1.8513	
	Other								
UGrad R part. in tutoring sessions	Very often or often	2.1556	***	2.2107	***	0.8015		1.4522	
	Other								
UGrad R part. in comm. service activity	Very often or often	0.9514		0.5192	***	0.8536		1.6079	
	Other								
Assisted on faculty research project	Yes	1.6892	***	2.0338	***	0.6695		0.5734	
	No								
UGrad support one or more faculty	A lot	0.7814	*	0.6901	*	1.0285		0.5833	
	Other								
Institution Type in 2000 Fall	Private	0.9785		0.4707	***	1.2125		0.6533	
	Public 2-year	1.0461		0.5396		2.1093	*	0.6119	
	Public, 4-year or above								
Number of cases with relative weight =		1,415							
Model X^2 =		277.502							
-2 Log Likelihood =		3,093.843							
Cox & Snell Pseudo R^2 =		0.178							

***<0.01, **<0.05, *<0.1

Table 6 The Impact of Aid Amount on Major Choices by 2000 Continuing Students: Multinomial Logistic Regression Results

Variable		Mathematics and Sciences		Engineering		Education		Library and Infor Science	
		Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.	Odds Ratio	Sig.
Gates Scholarship	Recipient	1.0858		0.7960		1.7346	**	1.9072	
	Non-recipient								
Gender	Male	1.4022	**	4.7365	***	0.7378		3.7527	***
	Female								
Ethnicity	African Americans	0.8244		0.6523	**	2.2264	**	0.8571	
	American Indians	0.8339		0.6130		3.7224	***	1.6104	
	Hispanic Americans	0.7987		0.5017	***	2.1659	**	0.9344	
	Asian/Pacific Islanders								
Reason select school low expenses	Very important	0.9582		0.8026		1.1487		0.7385	
	Other								
Reason select school scholarship/grant	Very important	1.1877		0.8771		0.5545	**	1.0113	
	Other								
Reason select school can live at home	Very important	1.1440		0.5847	**	1.2931		1.1389	
	Other								
Reason select school strong reputation	Very important	0.9111		1.3833		1.2261		0.7299	
	Other								
Parents contributing college finances	Yes	1.2818	*	0.7624		0.8479		1.1029	
	No								
UGrad R part. in events by cultural grp	Very often or often	0.8718		0.8662		0.9942		1.8669	
	Other								
UGrad R part. in tutoring sessions	Very often or often	2.1090	***	2.1588	***	0.7857		1.4933	
	Other								
UGrad R part. in comm. service activity	Very often or often	0.9562		0.5246	***	0.8464		1.5964	
	Other								
Assisted on faculty research project	Yes	1.6453	***	1.9527	***	0.6984		0.5572	
	No								
UGrad support one or more faculty	A lot	0.7731	*	0.6876	*	1.0513		0.5839	
	Other								
Institution Type in 2000 Fall	Private	0.9423		0.4273	***	1.5861	*	0.5621	
	Public 2-year	1.0230		0.5237		2.1362	*	0.6366	
	Public, 4-year or above								
Total money (in $1,000) borrowed since start school		0.9898	*	0.9896		0.9898		1.0153	

Amount (in $1,000) of scholarship/grants this year	1.0133	**	1.0187	**	0.9530	***	1.0011
Number of cases with relative weight =	1,415						
Model X^2 =	308.873						
-2 Log Likelihood =	3,264.567						
Cox & Snell Pseudo R^2 =	0.196						

***<0.01, **<0.05, *<0.1

References

Aldrich, J. H., & Nelson, F. D. (1986). *Linear probability, logit and probit models* (3rd ed.). Beverly Hills, CA: Sage.

Allen, W. (2003). *Who goes to college? High school context, academic preparation, the college choice process, and college attendance.* Prepared for the Bill & Melinda Gates Foundation, Seattle, WA.

Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis with special reference to education*. New York: Columbia University Press.

Blau, P., & Duncan, O. D. (1967). *The American occupational structure.* New York: Wiley.

Finn, C. E., Jr. (1978). *Scholars, dollars and bureaucrats.* Washington, DC: The Brookings Institution.

Halstead, D. K. (1974). *Statewide planning in higher education.* Washington, DC: U.S. Government Printing Office.

Hurtado, S. (2003). *The transition to college for low-income students: The impact of the Gates Millennium Scholars Program.* Prepared for the Bill & Melinda Gates Foundation, Seattle, WA.

Kaltenbaugh, L. S., St. John, E. P., & Starkey, J. B. (1999). What difference does tuition make? An analysis of ethnic differences in persistence. *Journal of Student Financial Aid, 29*(2), 21-32.

Kramer, M. A., & Van Dusen, W. D. (1986). Living on credit. *Change,* May/June, 10-19.

Kuh, G. D., & Love, P. G. (2000). A cultural perspective on student departure. In J. Braxton (Ed.), *Reworking the departure puzzle*. Nashville, TN: Vanderbilt University Press.

Newman, F. 1985. *Higher education and the American resurgence.* A Carnegie Foundation special report. Lawrenceville, NJ: Princeton University Press.

Paulsen, M. B., & St. John, E. P. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *Journal of Higher Education, 73*(2), 189-236.

Paulsen, M. B., St. John, E. P., & Carter, D. F. (2002). Diversity, college costs, and postsecondary opportunity: An examination of the financial nexus between college choice and persistence. *Policy Research Report # 02-1.* Bloomington, IN: Indiana Education Policy Center.

Peng, C. Y. J., So, T. H. S., Stage, F. K., & St. John, E. P. (2002). The use and interpretation of logistic regression in higher education: 1988-1999. *Research in Higher Education, 43,* 259-294.

St. John, E. P. (1994). The influence of debt on choice of major. *Journal of Student Financial Aid, 24*(1), 5-12.

St. John, E. P. (2003). *Refinancing the college dream: Access, equal opportunity, and justice for taxpayers*. Baltimore: Johns Hopkins University Press.

St. John, E. P. (in preparation). *Diverse pathways.* A report being prepared for the Bill & Melinda Gates Foundation, Seattle, WA.

St. John, E. P., Asker, E. H., & Hu, S. (2001). College choice and student persistence behavior: The role of financial policies. In M. B. Paulsen & J. C. Smart (Eds.), *The finance of higher education: Theory, research, policy & practice* (pp. 419-436). New York: Agathon.

St. John, E. P., Cabrera, A. F., Nora, A., & Asker, E. H. (2000). Economic influences on persistence reconsidered: How can finance research inform the reconceptualization of persistence models? In J. M. Braxton (Ed.), *Rethinking the departure puzzle: New theory and research on college student retention* (pp. 29-47). Nashville: Vanderbilt University Press.

St. John, E. P., & Chung, C. G. (2003). The Impact of GMS on Financial Access: Analyses of the 2000 Freshman Cohort, Prepared for the Bill and Melinda Gates Foundation, Seattle, WA.

St. John, E. P., Hu, S., Simmons, A. B., Carter, D. F., & Weber, J. (in press). *What difference does a major make? The influence of college major field on persistence by African American and white students.* Review of Higher Education.

St. John, E. P., Musoba, G. D., Simmons, A. B., & Chung, C. G. (2002). *Meeting the access challenge: Indiana's Twenty-first Century Scholars Program.* New Agenda Series, vol. 4, no. 4. Indianapolis: Lumina Foundation for Education.

St. John, E. P., Paulsen, M. B., &. Starkey, J. B. (1996). The nexus between college choice and persistence. *Research in Higher Education, 37*(2), 175-220.

Schrag, P. G. (2002). *Repay as you earn: The flawed government program to help students have public service careers.* Westport, CT: Greenwood Publishing Group.

Sedlacek, W. E. (2003). *Correlates of Leadership Activities of Gates Millennium Scholars.* Prepared for the Bill & Melinda Gates Foundation, Seattle, WA.

Sedlacek, W. E. (in press). *Measurement and evaluation in counseling and development*. San Francisco: Jossey-Bass.

Thomas, G. E. (1985). College major and career inequality: Implications for Black students. *Journal of Negro Education, 54*, 537-547.

Tinto, V. (2000). Linking leaving and learning: Exploring the role of the college classroom in student departure. In J. M. Braxton (Ed.), *Reworking the departure puzzle* (pp. 81-94). Nashville, TN: Vanderbilt University Press.

Edward P. St. John is professor of educational leadership and policy studies at Indiana University. His research focuses on the impact of public finance, student aid, and school reforms on college access and other educational outcomes.