

**Creating Excellence and
Increasing Ethnic-Minority Leadership in
Science, Engineering, Mathematics, and Technology:**

**A Study of the Meyerhoff Scholars Program
at the University of Maryland–Baltimore County**

Connoisseurial Evaluation Report

2004

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Introduction to the Problem

The issue addressed by this study concerns understanding and reducing problems in student academic development that are associated with the academic underproductivity of certain ethnic-minority populations and the schools that serve them, sometimes referred to as the *academic achievement gaps*. We refer to one of the nation's most critical dilemmas in education: the ubiquitous difference in academic achievement between African-American, Hispanic, and Native American students and their peers who have European-American and Asian-American family backgrounds. These students of color, in addition to some Pacific Islanders, are seriously underrepresented among the students who perform in the top 25th percentile of students in elementary, secondary, and postsecondary education in the United States.

The continuing shortage of African-American, Hispanic, and Native American students who achieve at very high levels academically is the issue that guided the work of the National Task Force on Minority High Achievement, a group organized by the College Board in 1997 and cochaired by Professor Edmund W. Gordon. The 1999 report of the Task Force, titled *Reaching The Top*, concluded that "until many more underrepresented minority students from disadvantaged, middle-class, and upper middle-class circumstances are very successful educationally, it will be virtually impossible to integrate our society's institutions completely, especially at the leadership levels" (p. 2). Equally significant is the report's finding that the pervasiveness of the minority academic achievement problem exists not only among low-income students but also among minority students at all socioeconomic levels. In other words, higher academic achievement and higher social class status are associated with greater differences in academic performance between majority and minority students. This often ignored finding was first reported by Coleman et al. (1966) in *Equality of Educational Opportunity*.

Perhaps the most serious indictment is the finding that achievement indicators such as college admission test scores tend to overpredict the undergraduate-level achievement of students in some ethnic-minority groups. This finding is evidenced by the fact that some minority students who have done very well in high school and/or on college admissions tests often are unable to demonstrate the same high level of academic achievement in college. Combined, these findings suggest pervasive problems in the quality of opportunities to learn and in the reciprocal adaptive behaviors of these students and the institutions that serve them.

The Overprediction Phenomenon

According to Willingham (1985), Duran (1983), and Ramist, Lewis, and McCamley-Jenkins (1994), high standardized test scores (either the SAT or ACT) tend to overpredict the academic performance of some underrepresented minority students. In other words, underrepresented minority students (including African Americans, Hispanics, and Native Americans) tend not to perform as well in their first year of college as their standardized scores would predict (Ramist et al., 1994). This underperformance is particularly acute in first-year science and quantitative courses (Ramist et al., 1994). Although this problem is serious on all levels of the academic achievement distribution, it is perhaps most alarming at the upper end. Bowen and Bok (1998), for example, sampled 28 elite colleges and universities and found the class ranking for black graduates with mean SAT I scores of 1300 and above (the highest category of scores) to be 4

percentile points lower than white graduates whose mean SAT scores were less than 1000 (the lowest category of scores). Thus, these elite institutions did not reduce the performance gaps between blacks and whites even though they may graduate black students at higher rates than other colleges and universities.

This finding is especially disconcerting because these elite institutions recruit the top African-American students in the nation. The data clearly indicate that African Americans, Hispanics, and Native Americans are considerably underrepresented among higher education degree recipients (National Task Force on Minority High Achievement, 1999). For instance, while comprising about 30 percent of the under-18 population in 1995, these minority groups received only 13 percent of the bachelor's degrees, 11 percent of the professional degrees, and 6 percent of the doctoral degrees presented by U.S. colleges and universities. Hence, it is important for these students to sustain their gains, not just on the elementary and secondary level but also on the postsecondary level.

There is considerable speculation about why these gaps persist. Bowen and Bok (1998) suggest that the academic achievement gaps can be partially explained by inadequacies in high school preparation. The seemingly intractable gaps between black and white academic achievement however, cannot be solely explained by students' academic and personal experiences. This variation in academic performance can be attributable to the academic and social isolation that students of color encounter in higher education institutions. Specifically, underrepresented students of color underperform as a result of "lack of support, prejudicial beliefs on the part of faculty and other students, exclusionary social practices on the campus, and other factors that make up a 'chilly' campus climate" (Gandara & Maxwell-Jolly, 1999, p. 44), and the lack of adequate academic integration on campus.

While the overprediction phenomenon is prevalent in all disciplines, it is particularly acute in the sciences, engineering, mathematics, and technology disciplines. Students of color do less well in quantitative and science courses, and are more likely to drop out of these majors and to drop out of school altogether (Ramist et al., 1994) when compared to their Asian-American or European-American counterparts.

The Magnitude of Minority Academic Underachievement

For the majority of African-American, Hispanic, and Native American youth in the United States, the educational system is not fulfilling its promise of developing the talents of all students to their fullest (National Commission on Excellence in Education, 1983; National Task Force on Minority High Achievement, 1999). This result is evidenced by the disparities that appear when the data is disaggregated by race or ethnicity. Assessments of kindergarteners already indicate that African-American and Hispanic children are overrepresented in the lowest quartiles of achievement tests (National Center for Education Statistics, 2000). And as minority children progress through their school years, the differences become clearly entrenched. Indeed, minorities (except for Asians) have scored consistently lower than whites on all National Assessment of Educational Progress (NAEP) tests for the past 30 years. The average NAEP reading scores for 9-year-old African-American and Hispanic students were about 30 points lower than the average scores for white students in 1975. And despite some improvement in the

early 1980s, the gaps increased again in 1996. Specifically, the 1980s represented a period of improvement for 17-year-old students, with gaps in average scores reduced by 40 points for African Americans and more than 20 points for Hispanics; but as indicated, these scores are again falling, although less sharply, according to the American Youth Policy Forum report titled *Raising Minority Academic Achievement* (James, Jurich, & Estes, 2001).

Similarly, while it is correct that more Americans are graduating from high school now than 30 years ago and that the graduation gaps between white and minority students has narrowed significantly, the Hispanic high school graduation rate still lags far behind that of both whites and African Americans. In 1971, 82 percent of whites in their mid-20s had graduated from high school compared to 59 percent of African Americans and 48 percent of Hispanics. In 1999, white and African-American high school graduation rates were much closer at 93 percent and 89 percent respectively. The Hispanic high school graduation rate is only 62 percent (National Center for Education Statistics, 2000).

The same analysis can be made for SAT scores. Although there is an increase in minority academic achievement in recent years, a gap still remains. According to the *College-Bound Seniors National Report* (College Board, 2000), the gap is largest for African-American students, whose mean scores on the math and verbal sections of the SAT are approximately 100 points lower than the mean score for white students. Hispanic and Native American students have less of a gap—between 45 and 75 points lower than the mean score of white students. Meanwhile, Asian-American students outscore white students by 35 points on the math test but have a mean that is about 30 points lower on the verbal test.

SAT data sets also suggest that these differences are often substantial and may be larger among high socioeconomic status (SES) students than among low SES students. For example, in 1993 the gap in average difference in the combined SAT math and verbal scores between white and black test takers who had at least one parent with a graduate degree was 183 points (1024 for whites and 841 for blacks), while it was 137 points (796 for whites and 659 for blacks) between whites and blacks who had no parent with a high school diploma (Miller, 1995). We are especially concerned not only that minorities are grossly underrepresented at the high end of the academic achievement distribution but that the quality of the contribution of this achieving group to the pool of relatively high academic achievers is lower than might otherwise be expected.

For example, African-American, Hispanic, and Native American students made up only 8 percent of the students nationally in 1995 with a combined math and verbal SAT score of 1400 or higher. These minority groups accounted for just 5 percent of the total number of students who scored 1200 or higher on the SAT. However, these minority students totaled 30 percent of all U.S. nationals under age 18. By contrast, Asian Americans accounted for 4 percent of the under-18 population, yet comprised 18 percent of those scoring 1400 or higher (Miller, 1995). We recognize that African-American, Hispanic, and Native American students tend to do less well than students with similar SAT scores, and that the middle-class and professional-class minority students score lower on these tests than do students of Asian and European-American backgrounds.

These within-socioeconomic-group gaps are particularly costly from a high academic achievement standpoint. All racial or ethnic groups in the United States draw a disproportionate number of their highest achieving students from their high SES segments. Indeed, worldwide, high achievers are heavily drawn from high SES students. However, if middle-class non-Asian minority students are not doing nearly as well in relative terms as high-SES European and Asian American groups, it is very difficult to reduce the high achievement gaps that exist. For example, if all Puerto Rican SAT test takers with no parent with a high school diploma had scored as well in 1993 as those with at least one parent with a graduate degree, their average combined SAT math and verbal score would have increased from 686 to 861. Yet, 861 is still 163 points lower than the 1024 average for this segment of high-SES European-American students.

At the elementary and middle school levels, the pervasive shortage of these groups among high-achieving students surfaces “rapidly in the early years of school and changes little thereafter” (College Board, n.d.). For example, minority and majority test score gaps on the federal government’s NAEP reading, math, and science tests in the fourth grade parallel those found on NAEP tests in the 12th grade. Among high school seniors in 1998, blacks, Hispanics, and Native Americans comprised only about one tenth of the students who scored at the highest level on NAEP tests and are represented only by 1 in 20 of the students who had very high scores on the SAT I, “scores typical of individuals admitted to highly selective colleges and universities” (National Task Force on Minority High Achievement, 1999, p. 7).

Educators have known for some time that the existing academic achievement gaps between minority and majority students are related to the alarmingly high percentages of African-American, Hispanic, and Native American students from low-income homes or from families in which the parents have little formal education. Often, these students perform less well in school than students from advantaged families (College Board, n.d).

Although college access for ethnic-minority students has increased in the past 30 years, an achievement gap still remains. Between 1971 and 1999, the percentage of white high school graduates who completed a bachelor’s degree or higher increased 13 percent, from 23.1 percent to 36.1 percent. In this same period, the increase was only 5 percent for African Americans, from 11.5 percent to 16.9 percent, and 4 percent for Hispanics, from 10.5 percent to 14.4 percent (National Center for Education Statistics, 2000).

These incremental increases are alarming in light of the rising proportion of nonwhite students in America’s public schools, who already represent the majority of students in many localities (U.S. Census Bureau, 2001). Between 1972 and 1998, for instance, the proportion of ethnic-minority students in public schools increased from 22 percent to 38 percent. For Hispanics, the proportion more than doubled, from 6 percent to 15 percent. The enrollment rates for minorities in the West and South already constitute 47 percent and 45 percent respectively of the student population. Most of us may not realize or may not even accept that the prosperity of our nation will be increasingly dependent on the knowledge and contributions of young people of color. As educators, policymakers, and parents, we must improve academic learning, socialization, and achievement not only by reducing the gap in test scores but also by providing opportunities to develop and increase language, literacy, and numeracy levels (Gordon, Miller, & Rollock, 1990).

Sources of Achievement Disparities

Attempts at reducing achievement disparities among minority groups, especially as they relate to the near absence of minority high achievers, must acknowledge the range of challenges that disadvantaged children, their families, and the schools that serve them constantly encounter. Family and school instability, for example, rank high among the research-based findings of poverty-related barriers. Indeed, disadvantaged families (1) are more likely to move often, especially in urban areas, and (2) may not be aware that the concomitant school changes interfere on many levels with their children's education. For students who are more settled, learning is disrupted by frequent student turnover and effective teaching is compromised by the presence and high turnover rate of inexperienced and unqualified teachers. Given the reality that blacks and Hispanics now make up a growing number of disadvantaged students, this issue is even more problematic because the effects of poverty on racial and ethnic achievement gaps will continue to be substantial (National Task Force on Minority High Achievement, 1999).

Another concern is the variation in the education levels of minority parents. Unlike parents with less than a high school education, most parents with college degrees understand and emphasize academic achievement by supplementing their children's education with tutors and facilitating access to college preparatory classes. The research indicates that substantial numbers of European-American and Asian-American parents have college degrees—as opposed to black and Latino parents, who are more likely to have completed less than 12 years of schooling.

Racial and ethnic prejudice and discrimination continue to affect minority high achievement in a number of ways. The first is lower academic expectations frequently encountered by African-American, Hispanic, and Native American students. The second is the damaging effect of ingrained stereotypes (which inaccurately posit that minority students are less intelligent than European or Asian students for genetic or cultural reasons) on minority students' confidence and performance in challenging academic situations (National Task Force on Minority High Achievement, 1999). Third, it is not inconceivable that some minority students deliberately minimize their academic efforts out of a belief that success in school is only for white or Asian students (Fordham & Ogbu, 1986; National Task Force on Minority High Achievement, 1999) or a belief that their performance may serve to confirm existing stereotypes (Steele, 1997).

In addition to these ecological sources of academic disparities, the research has identified that both school-related and family/community-related cultural differences contribute to the achievement gaps among ethnic-minority and majority groups (Bhattacharya & Gordon, in press). School-related differences might involve a curriculum that does not effectively tap students' cultural experiences. Similarly, family and community differences speak to the alarming absence of economic and academic resources that both families and their communities can access to facilitate their children's academic and social development. Unlike disadvantaged parents and communities, academically successful parents and communities do draw on their own resources to supply their children with a broad range of activities and peer support (from preschool through postsecondary levels), designed to supplement their children's education. Taken together, these ecological sources of academic disparities continue to impact, on a number of levels, the chronic underrepresentation of minorities among top students.

Current Efforts at Increasing Minority High-Academic Achievement

Despite the extensive attention given to the problem of the academic achievement gaps, the research literature provides little evidence of intervention strategies that are proven to be highly effective in reducing these gaps (James, Jures, & Estes, 2001). We identified a few programs combining rigorous selection criteria with learning environments that are both demanding and supportive. Programs at the elementary level include the Calvert School in Baltimore, Maryland; the KIPP Academy in the Bronx, New York; the General Electric College Bound program (elementary, middle, and secondary schools in Alabama, Kentucky, Massachusetts, New Mexico, New York City, North Carolina, Ohio, and Pennsylvania); Project SAGE (Student Achievement Guarantee in Education) in Wisconsin; and Project STAR (Student/Teacher Achievement Ratio) in Tennessee. At the secondary level, there are whole-school programs (such as Equity 2000, AVID, High School Puente, and Gateway to Higher Education) and special interventions (such as A Better Chance and Prep for Prep). These interventions stress preparation for high academic achievement and facilitate college access for underrepresented students (low-income minority students and students with “average” academic performance but who show potential for higher level academic performance) in postsecondary institutions.

While some of these initiatives are directed at able and gifted minority students who are placed in learning environments after having been identified, most of the extant effort is focused on the mass of students who have not distinguished themselves by their academic prowess but who are, however, considered capable of benefiting from efforts at school reform. This situation has made the search for specific interventions that are effective in reducing the academic achievement gaps more difficult (Borman, Stringfield, & Rachuba, 2000; Gandara & Maxwell-Jolly, 1999).

Nevertheless, it is in institutions of higher education that we find a few comprehensive efforts at specific interventions designed to nurture, enhance, and accelerate the academic development of able and gifted ethnic-minority students. Our work to date leads us to conclude that such interventions are better elaborated at the level of higher education than at the K–12 level (National Task Force on Minority High Achievement, 1999). At the undergraduate level, the early work of professors Uri Treisman and Robert Fullilove at the University of California–Berkeley resulted in the Emerging Scholars Program. For more than 20 years, J. W. Carmichael has labored with this problem at Xavier University in Cincinnati, Ohio. Professor Ana Marie Cauce has engaged this challenge in the Honors College at the University of Washington in Seattle. The most impressive of these efforts, however, may be the Meyerhoff Scholars Program at the University of Maryland–Baltimore County (UMBC). The Meyerhoff Scholars Program was founded in 1988 by Dr. Freeman Hrabowski, currently the president of UMBC.

Thus, our program of research on the correlates of minority high academic achievement (directed at investigating correlates of high academic achievement in minority students) was initiated with a review of exemplary programs in higher education (Gandara & Maxwell-Jolly, 1999) and the selection of two programs (which several experts consider to be exemplary) to document and evaluate: the Meyerhoff Scholars Program at UMBC and the Biomedical Honor Corps at Xavier University. In this report, we provide the context for the above referenced study of exemplary programs and discuss the Meyerhoff Scholars Program in relation to our study objectives and theoretical/research framework.

A Program of Research: The Correlates of Minority High Academic Achievement

Our program of research on the correlates of minority high academic achievement has three emphases. One strand of this work is directed at the identification of those correlates referable to the characteristics and life conditions of individuals who are high academic achievers. The initial study in this segment compares two groups of students of African descent; one group consists of persons who identify themselves as African American, and the second group consists of persons who identify themselves as African/Caribbean American. The second strand is directed at correlates referable to ecological factors, through which we seek to uncover environmental and life conditions associated with high academic achievement. In this segment, extant data sets on preschool and college-age students are being analyzed in search of factors that influence high academic achievement. And the third strand (under which the current study is nested) includes identification, documentation, evaluation, and interpretation of program characteristics of educational interventions and the particular contexts that are associated with high levels of academic achievement in ethnic-minority students.

Our study of the Meyerhoff Scholars Program combines conceptions of connoissuerial evaluation (see Eisner, 1976, 1983, 1991), the ethnographic analysis of resilience phenomena, the meta-evaluation of evaluation data referable to similar interventions, and a survey of the feasibility and incidence of exemplary practices. The goal is to document the best of this work with a particular view to understanding the implications for intervention at the middle and secondary schools levels. From our prior investigations, it is clear that while some of the specific interventions that appear to be effective have been developed on a few college campuses, the actual strategies are by no means college-campus or age-group limited. For example, features such as personalization, community building, curricular integration, student/faculty research, and *in loco parentis* emerge as being appropriate to several levels of intervention. The objectives of this study are thus fourfold:

1. Document and evaluate the components of exemplary programs and their contexts.
2. Better understand the conditions and mechanisms of such interventions.
3. Conduct a meta-evaluation of efforts at evaluating exemplary programs.
4. Determine the extent to which such interventions are considered feasible and/or are actually included in achievement gap initiatives in middle and high schools.

With regards to objectives 1 and 2, we sought to codify and describe (through ethnographic analyses) conditions and factors that are peculiar to persons, institutions, and programs that show potential for enabling high levels of academic achievement in populations that traditionally are underrepresented among the pool of academically high-achieving students in the United States. Specifically, we sought to identify and describe (1) key program components, (2) characteristics of students and staff, (3) characteristic relevant behaviors, (4) institutional policies and structural arrangements, (5) institutional resources and climates that appear to be associated with high academic achievement in ethnic-minority populations, and (6) the possible impact of these variables on closing the academic achievement gaps.

Later in 2004, we plan to (1) compare participants who have been exposed to these interventions with comparison or control subjects through quantitative analyses, (2) conduct a meta-evaluation to identify variables that are consistently associated with the effectiveness of similar programs of intervention, and (3) survey a sample of high schools known to be the feeder schools for selective colleges (including UMBC) to determine the extent to which practices identified through our studies are actually utilized or are considered feasible for implementation. The ultimate product of this study will be the codification of intervention strategies that are determined to be effective or show promise of effectiveness in closing the academic achievement gaps for high-achieving students of color.

Theoretical Framework and Research Perspective

Two systems of theory inform this study. One system of thought builds upon the resilience studies of scholars, including Garmezy (1991), Luthar (1991), and Masten and Garmezy (1985), and the defiance studies of Gordon (in press). In this line of work, it is assumed that multiple factors interact to explain the phenomenon of resilience (i.e., overcoming the odds against success). These scholars examine the characteristics of persons, their environments, and the institutional structures that form the contexts of their lives. Chess and Thomas (1999) postulated that it is the goodness of fit between these interacting variables that account for the outcomes. Wang and Gordon (1994) have applied this concept to institutions and programs as well as to persons in a search for the correlates of specific outcomes.

A second system of thought derives from the works of Suchman (1967), Eisner (1967) and Gordon (1995), who argue for the integration of quantitative, qualitative, and hermeneutic data in program evaluation. This integration can be captured in a connoisseurial evaluation. Gordon, Bowman, and Mejia (2003) explain:

A connoisseurial evaluation is intended to help make informed, considered, and wise evaluative judgments concerning the phenomena under study. The connoisseur seeks to use a variety of research data to arrive at such judgments. A connoisseur's evaluation is not restricted to empirically generated data, although such data are used when available. Rather, the connoisseur relies heavily on expert knowledge, broad experience, and extensive exposure to the kinds of interventions being evaluated. Thus the connoisseur is concerned with the full range of evaluation data, but is free to make use of objective and subjective measures as well as both qualitative and quantitative data. In the search for intervention effects, the connoisseur is free to use all available data, screened for meaning and relatedness through a seasoned eye and reflected-upon experience. The connoisseur's judgment is not used to supplant empirically based systematic evaluation, but to supplement, amplify, and explain more traditional evaluation research. (p. 4)

Through evaluation research, one ultimately seeks to determine empirically and judgmentally the extent to which specific actions are associated with the social goals these actions are intended to achieve. Suchman (1967) proposed five categories of criteria by which the success or failure of an intervention may be evaluated. Suchman's categories were adopted and expanded from an earlier iteration by James. The categories, as further elaborated by Gordon (1995), inform our approach to connoisseurial evaluation. The categories of investigative effort are as follows:

- **Effort.** Evaluations in this category have as their criterion of success the quantity and quality of activity. This represents an assessment of input or energy, regardless of output. It is intended to answer the questions “What did you do?” and “How well did you do it?” Gordon (1976) has referred to this aspect of evaluation as the *assessment of implementation* (i.e., where we want to know whether or not a treatment has been delivered, and if so, what was actually delivered to the targeted group). At this level, the investigator probes beyond what is described as intended treatment or done from the perspectives of the staff and participants. Assessment of effort or implementation is especially responsive to a connoisseurial approach to evaluation.
- **Performance.** Performance or effects criteria guide the measurement of the results of effort rather than the effort itself. This work requires a clear statement of objectives. How much is accomplished relative to an immediate goal? Did any change occur? Was the change the one intended? This is, perhaps, the most commonly utilized category of evaluation, where we look for the intervention’s impact on some person, institution, situation, condition, or other measure. Did the student(s) learn anything? Is there a change in the behavior of teachers? Did institutional policy or practice change? Were the results consistent with the objectives of the intervention?
- **Adequacy of Performance.** This criterion of success refers to the degree to which effective performance is adequate to the total amount of need. Thus, a program of intensive psychotherapy for a small group of individuals with mental illness may show highly effective results but, as a public health measure, prove thoroughly inadequate to meet the problem of mental illness in an entire community. Given the current level of student achievement, did the intervention result in a significant reduction in the gap between the targeted group’s mean achievement level and the level specified by the criterion of success? Adequacy is obviously a relative measure, depending upon societal standards and how high one’s goals are.

Gordon and Shipman (1979) have introduced another test of adequacy that addresses the specific needs of the targeted group. In contrast to a concern for equality of treatment in which all are ensured equal access and equal treatment, Gordon and Shipman suggest that social justice requires “appropriateness and sufficiency of service to achieve some common learning or achievement criterion” especially in light of “correcting inadequately developed treatments and insufficiently allocated resources to meet the differential requirements essential to the achievement of an agreed-upon level of competence” (p. 1031) in populations whose baseline characteristics differ. The determination of adequacy too often is ignored in evaluation research yet may be more sensitively approached in the use of a connoisseurial approach to evaluation.

- **Efficiency.** A positive answer to the question “Does it work?” often gives rise to the follow-up question: “Is there any better way to attain the same results?” Econometricians have introduced a concern for cost effectiveness. Is this the most economical way of achieving the results, and are the results obtained worth the cost of the intervention to the recipients, the implementers, and the sponsors?

- **Process.** In the course of evaluating the success or failure of a program, a great deal can be learned about how and why a program works or does not work. An evaluation study may limit its data collection and analysis simply to determining whether or not a program is successful according to the preceding four criteria without examining the whys and wherefores of this success or failure. However, an analysis of process can have both administrative and scientific significance, particularly where the evaluation indicates that a program is not working as expected. Locating the cause of failure may result in modifying the program so that it will work, instead of discarding it as a complete failure. Understanding why the treatment works can enable the separation of ritual from substance.

Data Collection Methods and Sources

Our data collection methods and sources for this study include the following:

- **Bibliographic methods** to review and analyze existing research literature on the interventions and/or treatment factors associated with high levels of academic achievement and their implications for implementation in K–12.
- **Ethnographic methods** to document programs and the experiences of current student and faculty participants.
- **Quantitative methods** to analyze the relationship between the achievement of Meyerhoff scholars and comparable students at UMBC.
- **Hermeneutic methods** to conduct a meta-evaluation of selected evaluations concerning the strengths and weaknesses of the student academic development programs at the higher education level.
- **Survey methods** to study student academic development practices of feeder high schools that send significant numbers of minority students to selective colleges.

The first line of data was printed documents, including program proposals and program descriptions and reports. The second source of data was generated through site visits, observations, and interviews with participants to generate ethnographic analyses of extant practices. These printed documents, observations, site visits, and interviews were examined as the basis for making judgments concerning the effects, strengths, and weakness of the Meyerhoff Scholars Program. In our analysis, we gave attention to the program’s objectives, participants, components, contexts, administrative or organizational support structures, and available evaluations. The third source of data included quantitative indicators of student academic achievement, participation, and academic progress; and qualitative indicators of changes in attitudes and such learner behaviors as time on task, task engagement, resource utilization, persistence, and sense of efficacy referable to participation in collegiate endeavors. A fourth category of data will be derived from an investigation of the processual prerequisites of the treatment under study. These data will be collected from the examination of student records, interviews, surveys, school and home characteristics of students, and observations of interactions

with peers and family members. A fifth category of data will be gleaned from not more than a dozen college-level student academic development programs (which have given reasonable attention to the systematic collection of evaluation data).

In this meta-evaluation, evaluation data from this pool of natural experiments will be evaluated against utility, propriety, accuracy, and feasibility standards. Subsequent findings will be reviewed, summarized, aggregated, and interpreted in the pursuit of insight into the effectiveness and impact of various approaches to the enhanced academic development of minority students. In summary, this line of investigation should enable us to speak with some definitiveness concerning “what works” in this field.

The Meyerhoff Scholars Program

A convergence of factors influenced Dr. Freeman Hrabowski (who was executive vice president of UMBC in 1989 and became its president in 1993) to launch the Meyerhoff Scholars Program with funding from the Robert and Jane Meyerhoff Foundation in 1988. Dr. Hrabowski was met (early in 1987) by a protest from the Black Student Union, which had taken over the administration building on the UMBC campus. When he investigated the incident, he discovered that many of the African-American students were not engaged in the academic activities necessary for academic success. He also discovered that for these students, grades of C and D in courses such as organic chemistry, genetics, and in upper-level engineering courses were the norm, coupled with the practice of large numbers of African Americans routinely being weeded out of disciplines such as mathematics, engineering, and the sciences. Further compounding this problem was the reality that faculty in these disciplines had not been exposed to high academic achievement from underrepresented minority students. The high-achieving black students that faculty did have exposure to were Africans who had experienced strong French or British educational systems.

Dr. Hrabowski responded to the frustration of students and parents by deciding to invest time and money in putting a support infrastructure in place rather than advocating remediation. To that end, he initiated discussions with faculty, administrators, staff, and students concerning the nature of students' academic backgrounds in mathematics, science, and engineering and the level of these students' academic performance. These discussions resulted in extensive data regarding (1) students' perceptions about the referenced disciplines' course content and related supplementary support; (2) students' sense of academic and social isolation; and (3) students' lack of explicit guidelines concerning tutorial support, access to faculty, strong study habits, and peer group study that appear to be necessary for excelling in the sciences and engineering. Dr. Hrabowski and his colleagues discovered that regardless of race, large numbers of UMBC students were not excelling in these disciplines. As a result, students often transferred out of these disciplines and sometimes left the university. The internal evaluation continued with an assessment of admissions criteria concerning the type of candidates who would succeed at UMBC, given the university leaderships' vision of producing a nucleus of high-achieving minority students who would be included among the nation's leading researchers. Evaluation of admissions criteria led to considerations of how (1) existing orientation programs could be improved upon and strengthened, (2) strategies for excelling in the sciences and engineering would be explicitly communicated, (3) students' performance in first-year courses could be improved, and (4) students' academic and social isolation could be reduced.

During this time, Robert Meyerhoff, an engineer educated at the Massachusetts Institute of Technology, had grown dissatisfied with reading newspaper accounts of the plight of black men. He was interested in creating "some good news for a change" (Mercer, 1994). When Meyerhoff and Dr. Hrabowski met through the president of the Abell Foundation in Baltimore, Dr. Hrabowski was focused on increasing the number of African-American males who succeed in the sciences and engineering. Consequently, the goals of the Meyerhoff Scholars Program included (1) increasing the number of underrepresented students who could successfully complete a course of study in the technical fields (sciences, engineering, mathematics, and technology) in which they were historically underrepresented, thus academically and socially

preparing these students to pursue Ph.D. and or M.D./Ph.D. degrees in these fields; (2) increasing the number of minority professionals in these fields and in the university professorate (thus creating much needed role models for minority students of later generations); and (3) reducing the performance gaps between underrepresented and majority students at the right end of the achievement distribution.

These goals continue to be relevant. During 2000–01, African-American students earned only 12,149 bachelor's degrees in social science; 4,851 degrees in biological/life sciences; and 4,324 degrees in engineering, according to the American Council in Education's *Twentieth Annual Status Report on Minorities in Higher Education, 2002–2003* (Harvey, 2003). The figures are even more alarming on the graduate level. With respect to doctoral degrees, African Americans earned only 80 degrees in physical science, 190 degrees in life science, 299 degrees in social science, and 82 degrees in engineering (Harvey, 2003). These figures are cause for concern, given that African-American students represent approximately 11 percent of all students enrolled in higher education (Wilds, 2000). This reality is also of particular concern not just for the gifted and talented African-American students who do not persist and graduate in the sciences but also for higher education and the nation, which increasingly privileges those skills and intellectual competencies required for meaningful participation in an advanced technological society.

Dr. Hrabowski's background (which includes political activism, a master's degree in mathematics, a doctorate in educational psychology and statistics, and significant experience in nurturing academic achievement in African-American and other students), combined with financial and moral support from the Meyerhoff Foundation, enabled Dr. Hrabowski to create a sophisticated student academic development program (with an impressive emphasis on academic excellence, not remediation) for preparing African-American students for graduate study in the sciences and engineering. Accordingly, the acceptance criteria are selective. Students are admitted with a minimum combined SAT score between 1000 and 1050, SAT mathematics score between 500 and 550, and high school grade-point average (GPA) between 3.5 and 3.7. However, the actual mean scores of participants tend to be considerably higher. The academic criteria necessary for acceptance into the Meyerhoff Scholars Program has increased steadily over the years. (For the 1989–91 cohorts, combined SAT scores were 1180 and mean SAT mathematics scores were 635. The 1998 entering cohort of African-American Meyerhoff scholars had mean SAT mathematics scores of 657, mean SAT verbal scores of 623, and a mean high school GPA of 3.77.) Prospective Meyerhoff scholars cannot have received grades lower than a B in any high school science or mathematics course. Many students have completed a year or more of calculus in high school. The program gives preference to students who have taken Advanced Placement courses in mathematics and science, provide strong references from science or math instructors, and have research experience. Additional criteria include a commitment to stay in the sciences and a desire to contribute to the community. The program accepts between 30 and 50 students each year.

The first group of Meyerhoff scholars included 19 young African-American men who enrolled in fall 1989. Now in its 15th year, the Meyerhoff Scholars Program is open to all high-achieving high school seniors who have an interest in pursuing doctoral study in the sciences or engineering and who are interested in the advancement of minorities in the sciences and related fields. The program currently has a total enrollment of 214 students, including 65 new Meyerhoff

freshmen enrolled in fall 2003 (with average SAT scores of 1310). The National Science Foundation has determined that UMBC has one of the largest concentrations of high-achieving African-American students majoring in science anywhere in the United States. In 1996, the Meyerhoff Scholars Program was recognized nationally with the Presidential Award for Excellence in Science, Math, and Engineering Mentoring.

UMBC has a student population of approximately 12,000. More than half of UMBC's undergraduates and 60 percent of the doctoral students pursue engineering and science degrees. UMBC's student population is approximately 15 percent African American and 17 percent Asian; Hispanics and Native American students collectively comprise 3 percent. Dr. Hrabowski recognizes that although UMBC had been successful in producing a number of white and Asian students in engineering and the sciences, few African-American students had succeeded in these disciplines until the creation of the Meyerhoff Scholars Program.

The Meyerhoff Scholars Program achieves its goals through a deceptively simple group of integrated program components that emphasize (1) the careful selection of students, (2) the provision of merit financial support to reduce concerns about finances, (3) a mandatory Summer Bridge Program to acclimate students to the rigors of freshman year, (4) peer study groups for academic and social support, (5) the responsibility of each Meyerhoff student to each other and to community service, (6) the importance of taking advice, (7) meaningful and sustained interaction with faculty and mentors, (8) the importance of continued family involvement, (9) the centrality of academic excellence and scholarship, and (10) the significance of rigorously and systematically documenting and evaluating program outcomes. The Meyerhoff Scholars Program operates on the assumption that every student selected has the ability to excel in engineering and the sciences if he or she is provided with appropriate challenges, resources, and opportunities.

The Structural Components of the Meyerhoff Scholars Program

14 Program Components

The Meyerhoff Scholars Program includes 14 different components, the descriptions of which we have crafted from our nonparticipatory observations; site visits; conversations with university leadership, faculty, program staff and students; and analyses of written materials. What has emerged as we tried to cull accurate descriptions of the components from these various venues is just how complex they actually are. Perhaps this is because the essential elements of the Meyerhoff Program model tend to recombine in very distinct ways depending on a given activity's purpose; the involvement of faculty, program staff, university leadership, and student peers; and their explicit and implicit meanings.

1. Financial Aid. Comprehensive financial support is contingent upon students maintaining a B average in a science, engineering, or mathematics major. In-state Meyerhoff scholars receive full tuition (averaging about \$18,000 annually; students from out-of-state receive an average of \$25,000). These figures represent tuition, fees, room, board, and books. Meyerhoff finalists receive partial tuition in addition to the many support services and activities the program offers. Student test scores are one of the determinants of who gets a full or partial scholarship. For any two consecutive semesters that a student's GPA falls below 3.0, funding is taken away

completely. Students regain their funding when their grades meet Meyerhoff Scholars Program standards. Program staff do not make any exceptions to this rule.

Program staff members collect student data during the spring and use this information to write students' award letters. These letters include a meal plan and residence choices (different resident halls have different prices). Staff also are responsible for posting the funds to student accounts. Technically, student awards are not posted until two weeks after the students arrive at UMBC. The executive director of the program has the final approval of the funds that the program staff posts to student accounts. Program staff members work closely with the Financial Aid office to have the posting done in the Meyerhoff Scholars Program office. They also work with the scholarship portion of Minority Access to Research Careers (MARC) program to post money to student accounts for this grant. A month after the posting of funds, staff members verify whether or not students have been overfunded or underfunded. If students are overfunded, they refund the program.

2. The Minority Access to Research Careers (MARC) Program. The central goal of the Minority Access to Research Careers (MARC) program at UMBC, which began in 1997, is to provide a comprehensive system of educational and financial support to juniors and seniors from historically underrepresented groups to enable their success in achieving terminal degrees and in entering careers in biomedical research and/or mathematics. This program models the successful Meyerhoff Scholars Program. Its requirements include extended undergraduate research with faculty mentors from biological sciences, chemistry, mathematics, psychology, and engineering. A pre-MARC component serves as a recruitment tool while supporting similar research projects of sophomores. Support includes (1) full fall and spring tuition and academic fees; (2) health insurance only for the student (if needed); (3) support for extended research projects at UMBC or off-campus; (4) stipends determined by National Institutes of Health to cover room, board, and twice-yearly \$500 book allowances; (5) lab supplies for research; (6) travel expenses to scientific meetings and conferences; (7) Graduate Record Examination (GRE) test preparation; (8) development courses for pre-MARC students and transfer students (e.g., technical writing); (9) special session tuition if need is demonstrated; and (10) special tutoring as needed.

Admission to this program requires a 3.2 cumulative GPA; a minimum of 60 college credits, an interest in a research career with a major appropriate to biomedical or mathematics graduate study, letters of recommendation from faculty, SAT scores, past research experience, interest in seeking a Ph.D., and an interview with a MARC panel. Recruitment for this program targets the growing pool of academically talented students from underrepresented groups at UMBC in four areas: (1) eligible pre-MARC students, (2) transfer students new to UMBC, (3) UMBC students interested in biomedical or mathematical research careers, and (4) Meyerhoff scholars who are interested in switching to the MARC program due to an interest in biomedical research. Each trainee must maintain a 3.2 cumulative GPA; choose an approved major; and comply with program requirements that include an extended research project, community service, attendance at regular meetings, successful completion of program activities, and an ethics course. Program direction and participant selection are guided by the MARC Steering Committee and administered through the Meyerhoff Scholars Program by a full-time MARC coordinator and additional staff. Annual, comprehensive evaluations ensure that the program remains focused on its goals and objectives.

The MARC administrative coordinator is the primary student advisor of all MARC program participants. He monitors student performance, promotes the MARC Program on and off campus, receives and organizes applications, organizes Steering Committee meetings, travels with students to meetings, coordinates orientations and student program meetings, plans the annual Research Fest, and assists with the publications of materials and preparation of annual grant applications. The MARC program facilitator assists with grant administration, especially the tracking of program expenses, with special emphasis on research supply funds to ensure that funds are spent in accordance with the program's policies. The program facilitator also assists with the sorting of applications that are competitive or otherwise; mediates contacts between students and research mentors when necessary; issues contracts and termination notices to program participants; coordinates the ethics course; and collaborates with the administrative coordinator on program administration, including orientation, applicant interviews, and annual program events.

3. Recruitment. Recruitment is a labor-intensive activity. Program staff share information about the program in high schools and higher education campuses and with various educators, advisors, and counselors. (Program staff view these professional networks as some of their most effective ways of locating potential students.) This initial identification is followed up with recruitment visits, letters, phone calls, and conversations with students and parents. The Meyerhoff Scholars Program currently receives approximately 1,400 nominations and applications each year. The top 100 to 150 applicants and their families are invited to one of two recruitment weekends on the UMBC campus. The first Selections Weekend, scheduled at the end of February, is for in-state students. The second Selections Weekend, held in the first weekend in March, is for out-of state students. These two weekends provide an opportunity for faculty, university leaders, program staff, and current students to meet the applicants under both formal and informal situations. Also, the weekends expose students to the Meyerhoff Scholars Program expectations that its scholars will enroll in Ph.D. programs in the sciences and give incoming students opportunities for interaction with these various stakeholders.

The recruitment process is both selective and competitive. Students have to complete a written test and participate in a personal interview. With respect to the written tests, all students applying to UMBC, including those applying to the Meyerhoff Program, need to take mathematics and English placement exams. These exams are used to plan course registration for the fall. UMBC students take the exams in the summer; those students applying to the Meyerhoff Scholars Program take both the written and mathematics exams during Selections Weekend. Prospective students are collectively interviewed by a selected faculty member from the mathematics, science, or engineering department; a senior Meyerhoff student; and an administrator. This team approach to interviewing provides the Selections Committee with three different but interrelated perspectives concerning a student's academic strengths and weaknesses, a student's willingness to take advice, and the likelihood of a student becoming a part of the Meyerhoff community of high-performance learners.

The program often has to respond to the accusation that its positive outcomes are the result of student self-selection rather than of an actual program effect. That is to say, the students who choose to participate are both well prepared and highly motivated and thus would succeed

without a program. Although the research of Tinto (1993), Fullilove and Treisman (1990), and Treisman (1992) illustrates that students of color (who enter the university with equally strong academic preparation as compared with whites) do not succeed in the sciences, mathematics, and engineering given their academic and social isolation, the issue of self-selection seems to remain a concern. We have observed that the program staff, university leaders, faculty, and current Meyerhoff students take the task of identifying and recruiting potential students very seriously. This attitude is evidenced in the rigor with which they assess and evaluate students' academic and social competencies both during Selections Weekend and in an in-depth analysis of student applications for admission. Faculty and program staff appear to know the general profile of the students who not only will be able to benefit from the program but can also contribute to its effectiveness.

The general profile of the students accepted include those with high SAT mathematics and verbal scores, high cumulative GPA, Advanced Placement courses in mathematics and science, interest in research, and interest in giving back to the community. Advanced Placement courses, however, are not part of the Meyerhoff admissions requirement because not all high schools offer these courses. The Admissions office at UMBC has an extensive database of high schools, their course offerings, and their graduation requirements. The Meyerhoff Selections Committee has access to this information and is aware of the strength of a students' high school academic program. If Advanced Placement courses were not available to the student, the Selections Committee tries to determine how far the student progressed beyond the minimum graduation requirements. For example, did the student take additional mathematics or science courses at the local community college? Students are not penalized for *not* having Advanced Placement courses on their record, but such courses do help their admissions applications.

One of the unusual aspects of the Meyerhoff Scholars Program recruitment process is its recruitment of the students' family, not just the students. Given the significant role that families play in minority students' lives and the university leadership's understanding of the centrality of this role, students' families are engaged and made to feel wanted in the recruitment process. Similarly, the Meyerhoff Scholars Program also understands the community's role for students. Thus, students also are recruited through community churches and their leaders, and through civic and social organizations and clubs. Finally, the creation of a critical mass of like-minded high-achieving minority students enables prospective minority students and their families to perceive an atmosphere that privileges the academic and social integration of students.

4. Summer Bridge Program. Once selected for the program, Meyerhoff students attend a mandatory pre-freshman Summer Bridge Program, and take courses in math, science, African-American studies, and the humanities. They are trained in how to study in peer groups and engage in rigorous and systematic problem solving. Students also are exposed to relevant social and cultural events that enable them to value each other's diversity and commonalities.

A particular strength of the Summer Bridge Program is the committed faculty from different fields who not only work extensively with these high-achieving students but also explicitly prepare students for the new expectations and requirements of rigorous college courses. This component is structured in Dr. Hrabowski's research and experience with directing an Upward Bound program. This program's Summer Bridge Program for students following high school

graduation is intended to prepare students for rigorous college-level courses and faculty expectations, and to provide students with opportunities for peer, staff, and faculty interaction. Thus, the Meyerhoff Scholars Program's mandatory Summer Bridge Program is implemented with the expectations that intensive summer academic work in addition to opportunities for building academic social networks will prepare students for excelling in university-level work. One of the underlying assumptions is that social forces could potentially interfere with these students' academic performance when they enter the university. Academics in the Summer Bridge Program and in the course of students' undergraduate academic career are thus balanced with social opportunities and cultural events that make for interaction with peers, faculty, university leadership, and program staff.

According to our conversations with program staff, the Summer Bridge component is one of the more crucial of the components. One of the staff's guiding principles is Proverbs 22:6: "Train up a child in the way he should go: and when he is old, he will not depart from it."

Program staff regard the six weeks they have with pre-freshman students very seriously because it gives them an opportunity to reduce and/or eliminate the bad habits of writing a paper overnight and studying overnight, for example. According to the Meyerhoff Scholars Program's director, "Aside from molding them and exposing students to the Meyerhoff way, the greatest things they [the program staff] can give students is compassion and empathy." The program staff has "unconditional faith and belief" in the Meyerhoff scholars. It is important to program staff that they know the scholars' strengths and weaknesses, "who they click with," their background, their pet peeves, and their fears. The program obtains this information in the course of the six weeks of the Summer Bridge Program and the daily advising and monitoring they engage in with students.

Old-fashioned socialization also is emphasized. The program director stressed that "Meyerhoffs have to open doors, pull out chairs, not chew gum in public, and dress in a certain way. Girls wear skirts a certain length below their knees." This emphasis is referred to as both "challenging the Meyerhoffs to be better persons and outfitting them to succeed."

Our observations suggest that the program staff genuinely care about how well the Meyerhoff scholars do. Both program staff and students openly admit that the program is intrusive and that that characteristic is perhaps one of the reasons for the program's effectiveness. According to the director, "Males have more trouble with intrusiveness than females" and they [males] "are not open to talking about what's happening to them." Meyerhoff scholars have to check in almost daily with program staff, who look for students whom they have not seen and put out the word that they have not seen them. From the perspective of the program staff, they work "well together with students like a family."

5. Peer Study Groups. Meyerhoff students are expected to engage in peer group study by the university leadership, faculty, and program staff. Peer group study is perceived as an important part of succeeding in the sciences and engineering. The research literature is replete with findings that support the idea that peer study groups create opportunities for academic and social support, which leads to minority high academic achievement (Treisman, 1992). In the Meyerhoff Scholars Program, peer group study starts during the Summer Bridge component and continues

throughout students' undergraduate career in the program. One of the assumptions undergirding this idea is that regular peer group study meetings enable students to better manage their time and improve their study skills. Students are in groups of two to four peers; groups are no larger than four people. During group work, students work with their peers in learning course content and concepts and completing assignments. They talk about each homework problem and in the process may discover a new method or a better way of solving problems.

Each Meyerhoff scholar has to inform the program staff who is in the study group and how often they meet. Students are expected to take ownership and responsibility not only for their own but also for each other's success. This goal is especially important in the first semester of freshman year, when some students become overconfident and do not study as intensively as they should. If students get less than a grade of B in an introductory science, engineering, or mathematics course, they are advised to retake the course. According to program staff, students quickly learn that they have to seek help so that they are enabled to master the conceptual material. When students understand this situation, they begin to get better grades. After freshman year, most students take the initiative to get their study groups together. Students are advised that peer study groups are one of their tools for success. They are expected to continue their study groups for the entire four or more years of their undergraduate career.

6. Program Values. The Meyerhoff Scholars Program demonstrates peer, faculty, university leadership, and program staff support for high academic achievement; help seeking from a variety of sources; peer supportiveness; high academic goals (with emphasis on Ph.D. attainment and the pursuit of research careers); and meaningful community service. The shortage of African-American science Ph.D.s is discussed at the recruitment phase and the importance of achieving a Ph.D. is emphasized during Selections Weekend and throughout the students' undergraduate career in the program. Settling for an M.D. degree is considered a disappointment in this climate, given the program's focus on producing Ph.D.-level researchers.

These consistently ubiquitous values serve to reinforce the Meyerhoff Scholars Program's emphasis on academic and personal excellence. According to program staff, community service is an inherent part of this "value-based program." Indeed, Meyerhoff scholars are consistently reminded that "to whom much is given, much is expected" and that "with great privilege comes great responsibility." With regards to community service, students are grouped into cohorts (each containing approximately 50 students) that commit a certain number of hours and resources to the community. Program staff may make suggestions about where cohorts can contribute their time; but if group members are already committed to an organization, they are encouraged to follow through. For example, in recent years, sophomores in the Meyerhoff Scholars Program adopted an elementary school and decided that they would go in groups of five students to tutor students. While Meyerhoff scholars are expected to provide approximately 10 hours of community service each semester, students' actual time and effort depend on the project or organization with which they are involved.

7. Program Community. Similar to program values, this component is operationalized both implicitly and explicitly. The infrastructure supporting this component is the family-like social and academic support system available for students. All Meyerhoff scholars are explicitly required to live in the same residence hall during their first year and on campus during

subsequent years. Students also are in continual contact with staff members, who are highly accessible and involved in practically all aspects of student life. University leadership, students, and program staff participate in large “family” meetings at the beginning and end of each semester. During these meetings, Dr. Hrabowski is present and interacts with the students. During the course of a family meeting, for example, the president will ask for students who are doing well to identify themselves. “Doing well” means getting an A in physics or biochemistry, for instance. He will then ask the students who are not doing as well to identify themselves. He then asks the students who are doing well, usually upperclassmen, to take responsibility for tutoring their peers. The essence of these meetings is reflected in their dual celebration of student achievements and support for talent development. Male and female Meyerhoff scholars also have separate meetings with the president. Although we were not allowed to observe these meetings, we were told that conversations explore racial, cultural, and diversity issues.

Community, like many other anchoring principles of the Meyerhoff Scholars Program, can be a deceptively simple concept. Human relations and caring appears to be the core of the Meyerhoff Scholars Program community. Students are associated with like-minded peers who can interact around science, mathematics, or engineering—yet also talk about music, sports, or current events. This social support is balanced with the seriousness with which the university leadership, faculty and staff take student intellectual aspirations. Our conversations with students suggest that they also seem to implicitly recognize the Meyerhoff Scholars Program as a place where race and ethnicity are acknowledged as assets rather than immediately politicized. The cultural and social events that are embedded in the program also seem to encourage a sense of community that may be integral to the program’s effectiveness.

It is important to note here that this component is anchored in Dr. Hrabowski’s experiences in the civil rights movement as a child. As a child, Dr. Hrabowski was confronted with not being able to drink from a public water fountain or use a public restroom, having to enter the side door of a restaurant, or being prohibited from attending a school, merely because of the color of his skin. Although it is now four decades later, Dr. Hrabowski is alarmed that most people do not recognize that many young African-American children today still face discrimination and prejudice in more subtle ways. This situation is reflected in segregated schools, particularly in urban areas that are, by far, more poorly underresourced than their suburban counterparts. In those schools that claim to be integrated, however, the reality is that larger numbers of black children are placed in special-education classes, while the few black children in gifted classes usually perceive themselves as the exceptions. Dr. Hrabowski is concerned that African-American success stories are largely about black entertainers and sports figures—while less than 2 percent of the research scientists and engineers, and fewer than 4 percent of the nation’s new social scientists, are African American.

Thus, while on several levels African Americans may have made some progress as a race, the reality is that African-American children are inadequately prepared intellectually and socially to participate in the mainstream education, political, and economic enterprise. Dr. Hrabowski perceives that “unlike in the 1950s and 60s, when [they] were denied [their] rightful access to schools [they] were qualified to attend,” the biggest challenge facing young African Americans today “is to capitalize fully on the opportunities our nation offers.” As such, young African Americans not only need to focus on high academic achievement but also need to become

involved in community service. He says it is through access to and engagement in community service that African-American youth can “positively change the lives of others, learn more about themselves, and appreciate what their parents have been able to do for them.”

Hence, all Meyerhoff students are encouraged to take part in a community service activity, which often involves volunteer work with at-risk Baltimore youth. This component helps to concretize the program value of giving back to the larger community and deliberately encourages students to focus on outreach activities and service to the broader community. For example, Meyerhoff students would sometimes tutor at a Baltimore high school, bringing their knowledge in the sciences and mathematics and firsthand information about college to local students. Other activities include organizing environmental projects, collecting food for homeless shelters, or participating in campus outreach activities to middle schools. This community service role gives students the status and responsibility of representing the university in the community. Although it is the program’s staff’s responsibility to enable community activity, the community itself grows from the human relations and interactions among all the participants: students, former students, graduate students, faculty, program staff, and university leadership. Dr. Hrabowski believes that the community is at its most vital when the students take an active role in shaping their own environment.

8. Personal Advising and Counseling. The program employs full-time academic advisors and other staff members who monitor and advise students on a regular basis. Advising includes the formal task of helping students get scheduled into the appropriate complement of courses. One of the most important advising tasks for incoming freshmen is to help them avoid the pattern of scheduling five solid courses. This means working with students so that they initially register for fewer courses. This strategy enables students to focus more intensively on the solid mastery of the course content. Passing these foundational courses with a grade of C is considered inadequate. Earning a grade of C results in students’ repeating the course to achieve a grade of B or higher since the program designers’ experience suggests that a grade of C does not reflect solid mastery. At the informal level, advising means constantly checking in and connecting students to opportunities (summer programs, graduate school, future career opportunities, and access to faculty) that will benefit students’ academic careers. In addition, program academic advisors meet with freshmen and sophomores to discuss how students manage their time, apply their study skills, and function in study group meetings. Students are advised to talk with their professors during office hours and not just after class and are expected to ask faculty about their professional experiences and their perception of the field/discipline’s future. Thus, students are socialized not only on how to access time with faculty but also on the kinds of conversations that need to occur.

According to program staff, personal advising and counseling is what they do best and most. They regard this component (in addition to the Summer Bridge component, when advising and counseling effectively starts) as an integral part of the program. There are two math courses in the Summer Bridge program: Math 290 focuses on advanced problems of calculus, and Math 150 focuses on precalculus. Students are placed into Math 290 or Math 150 depending on their mathematics placement score. They are not allowed to *not* take a math and science course because they have taken math and science Advanced Placement courses in high school. Freshman students are advised to take one math and one science course in the first semester.

After freshman year, students can negotiate the number of courses they will take. Advisors are not concerned with the number of courses a student plans to take but rather the combination of courses. For example, if the student plans to register for one math course, one science course, and one English course, this combination of courses is viewed as complementing each other. But when a student plans on a combination of rigorous courses in which they may not be able to devote the necessary time and attention to excelling, advisors strongly advise them to reconsider their course load. For students who are willing to take this advice and trust that the advisors have their interest in mind, there is a great probability that the student can get a 4.0 GPA in freshman year. According to the director of the Meyerhoff Scholars Program, freshman year courses are largely review. In freshman calculus, for example, students are generally getting acclimated to the faculty and the course's content, requirements, and expectations.

Program staff note that freshman year GPAs for those students who resist taking advice are usually below 3.5. In the Meyerhoff Scholars Program, having a GPA of less than 3.5 is not doing well by the program's standards. According to the director, students are "advised by respect—not fear or coercion." The director advises the juniors and seniors and the associate director advises the freshmen and sophomores. By junior year, students need to have an advisor in their department to sign off on courses. The Meyerhoff Scholars Program director has the final signoff on courses. He suggests that his method of advising involves asking more questions than he gives answers to (i.e., "Give me a rationale for taking this course. How does it fit in the big picture?"). Thus, advising involves getting a sense of where students see themselves in 5 or 10 years, giving them information about research opportunities and helping them to access these opportunities early and often. Students with very high GPAs also are encouraged to tutor their peers.

Through the implementation of advising and other services, students are constantly reminded of the program's commitment to them. An essential part of the advising is talking candidly with students about how they feel about the Meyerhoff Scholars Program. If the student is floundering, program staff will ask the student how they have failed him or her and how they (the program staff) can change the situation. The director notes that it is difficult for a freshman or sophomore to answer this question. Juniors and seniors are usually more comfortable verbalizing their concerns.

9. Tutoring. Meyerhoff students are responsible not only for their own academic success but for each other's as well. Thus, they are expected and advised to seek out the resources and opportunities that will support them toward this end. On the UMBC campus, tutoring and being tutored are regarded as activities for students who excel and those who aspire to excel. The assumption guiding this component is that students learn by doing; this learning includes being exposed to systematic tutoring and coaching. The Meyerhoff Scholars Program's emphasis on tutoring explicitly holds students to high standards by providing both the resources and support that students need to achieve those standards. The effect of this component is evident in the high expectations that students, program staff, faculty, and the university leadership set for each other and themselves. Thus, tutors are regularly identified from within and outside the program. Program staff are aware of those students who do very well in upper-level courses and usually ask them to volunteer to tutor those students who need assistance. The academic advisors suggest that students usually are open to these requests. UMBC has a campuswide tutorial center that

provides chemistry, physics, mathematics, and English tutorials. Meyerhoff students are expected both to access these tutorials and volunteer as tutors in these tutorial centers.

Meyerhoff Scholars Program's tutoring component is anchored not only in the research but also in the national context of reducing the gaps between minority and majority students. As suggested in our introduction, many underrepresented minority students are not well prepared for the academic demands of universities. Even for those high-achieving minority students with high SAT scores and strong high school GPAs, the research suggests that variables other than intellectual ability and experiences in the K–12 continuum explain low minority persistence, retention, and achievement. These variables include low academic expectations for intellectual competence, cultural isolation, perceived vulnerability in the face of negative stereotypes, and inadequate knowledge and skill development. Thus, it is not a surprise that learning to think, read, write, and compute well are very explicit skills taught and reinforced in tutoring sessions.

10. Summer Research Internships. If students are not graduating, they are required to participate in research internships each summer. These internships are especially important in enabling students to experience the practice of science and engineering while creating venues for mentoring relationships. Program staff emphasize these research internships as opportunities that can be translated as strengths on students' resume. Students are advised that the research and publications that can result from summer research internships do set them apart.

The Meyerhoff Scholars Program has an internship coordinator, who accesses research internship information for students and helps students to complete relevant applications for these internships. The coordinator is meticulous about seeking out summer mentors, who are not usually the students' Meyerhoff mentors. She currently has two binders containing approximately 160 current research opportunities in which students can participate. Most of these internships are renewable, but some do end as a result of limited funding. The Meyerhoff Scholars Program has special relationships with companies, certain researchers, and universities where they select students to participate. For example, at least eight to 10 students have completed internships with Dr. Thomas Cech, the Nobel Laureate and president of the Howard Hughes Medical Institute. The Meyerhoff Scholars Program also has an agreement with Lancaster University in England and personally selects students for this particular internship. Staff members have approximately 20 internships that they regard as high profile, and they are proud of the ongoing relationships they have with these contacts. Some students start their research during their summer research internships and continue throughout the school year.

The coordinator also assists graduating seniors with the graduate application process. She conducts a professional development seminar series in which she discusses topics ranging from proper etiquette to providing guidance on how to write personal statements, create a resume, and request recommendations from faculty. Juniors who will be graduating the following year receive a graduate application booklet that has information on writing a personal statement, choosing the right graduate program and school, and contacting organizations for more information. She also assists students in narrowing their focus from 30 schools to one, solidifying their personal statement, learning how to read Graduate Record Examination (GRE) scores, and deciding when to take the GREs. The coordinator meets with graduating seniors twice a month during the fall. In these meetings, there is a bidirectional flow of information (i.e.,

the coordinator is updated concerning where students are in the application and interview process, and students are coached with respect to the referenced processes). The coordinator meets with graduating students once a month during the spring semester. Students usually obtain their results from graduate schools in the middle of April or by May 1.

11. Faculty Involvement and Commitment. Freshman students in the Meyerhoff Scholars Program and in the university at large are taught by full-time, tenure-track faculty. This unusual reality, however, has not always been the case. Dr. Hrabowski's highly effective approach of cultivating genuine faculty involvement and commitment has emerged after systematic and deliberate faculty involvement in conversations with university leadership, various departments, and other administrators concerning grades (grades of all students, not just minorities), persistence, and retention in their freshman year. These discussions were not conducted in to embarrass those involved but rather to distill a critical understanding of how students perform by course, section, and faculty member so that the necessary resources and supports can be harnessed for student academic improvement.

These conversations revealed that in the chemistry department, for example, almost half of the students were struggling with below-C averages in the first-semester course. Some faculty suggested that the reasons for these students' underachievement included students working too many hours on the outside, students not having the necessary preparation for doing well in the introductory course, and students not being serious about mastering the concepts and doing well. However, discussions with students revealed that (1) students clearly needed more constructive feedback in the form of graded homework, quizzes, and tutoring earlier rather than later in the semester; (2) students were preparing for exams by themselves rather than studying in groups; (3) the amount of study time necessary to excel in rigorous science courses had not been made explicit to students; (4) most students did not use the department's Tutorial Center because they perceived it as a place that failing students go for remediation; and (5) students were not always aware of the relationship between their homework, graded quizzes, exams, and lectures. Consequently, both majority and minority students were doing poorly.

Given this data and students' perspectives, the chemistry department's faculty has since collaborated in improving student performance and retention in its freshman-year chemistry courses by using a team-teaching approach and by relating the course content to their faculty's research. Students are now assigned theoretical and practical problems to solve as groups. The chemistry Tutorial Center has been destigmatized into a place where those students who excel go for tutoring. The department, via orientation sessions and their classes, make the relationship between time on task and excelling in difficult courses very explicit.

Discussions between university leadership, faculty, departments, and administrators also resulted in a science-education faculty member observing and assessing a biology instructor's course and helping him to create strategies to enable more substantive interaction with his students. This feedback allowed for more accurate gauging of student learning and more tailored use of technology to increase certain learning outcomes.

Also emerging from these discussions are erroneous assumptions that both students and faculty may conclude about the students' academic performance in the classroom. In one instance, both

faculty and students began the semester with the mistaken assumption that a minority student was doing well if he or she earned a C in organic chemistry. In this example and others, continued discussions emphasize that minority students tend to excel when they are exposed to faculty who consistently motivate them, are aware of their strengths and weaknesses, and encourage them to be involved in initiatives related to their majors. Faculty members also convey strong positive messages when they choose minority students to work with them on research projects.

These several changes are among the many that UMBC has put in place for all students, not just minority students. Dr. Hrabowski believes that to the extent that the leadership, faculty, and staff are improving the learning environment for all students, they also are increasing the probability that minority students also will excel. He perceives the success of minority students not simply as a minority issue but rather as an institutional priority. As such, he has focused on creating an environment that attracts high-achieving minority students, sets high expectations of them, and provides the resources and support to enable them to excel.

Now in its 15th year, the Meyerhoff Scholar Program's success has influenced UMBC's faculty to think and talk about minority high achievement. The students working in their research laboratories have opportunities to relate theory and praxis and engage in the research in increasingly sophisticated ways. These successes are the result of visionary leadership and continuous collaboration among faculty, administration, staff, and students.

12. Administrative Involvement and Public Support. The Meyerhoff Scholars Program is supported at all levels of the university, including dedicated support from the president. During the year, the program has generated a substantial amount of public recognition and support. The program's overarching administrative structure maintains an academic and socially nurturing environment for students and reflects a widely acknowledged finding in the research literature on student retention: The more complex and the higher the number of relationships that students have in the university environment—that is, the more people they care about and who care about them, the more likely they are to remain and to succeed at the university (Astin, 1993; Tinto, 1993). The Meyerhoff Scholars Program administrators have primary responsibility for building community and for student advising. By all accounts, they seem to understand their students' needs and appear to be knowledgeable about and connected to the broader campus community. Program administrators have formal responsibility for recruiting, advising, and registering students. They also are charged with monitoring students and making sure that students are not derailed by issues such as financial aid, housing, or personal concerns. Together, the university leadership, program staff, and faculty serve as a safety net that prevents problems and identifies and provides resources not only to students having academic or personal difficulties but also to those who excel.

One gets a full sense of UMBC's commitment to minority high academic achievement and social integration by the level of resources committed to this effort, the quality of faculty teaching the courses, and the systematicity with which faculty are continually assessing their own expectations and instructional practices. This infrastructure enables students to handle the rigor and difficulty of science, engineering, and mathematics coursework. It also influences their attitudes about their major, their willingness to take advice, their involvement in supplementary

education, and the nature and level of their motivation to excel. This full complement of institutional commitment is central to students in general but crucial for minority students in particular.

UMBC's commitment also is reflected in professional development opportunities for Meyerhoff Scholars Program staff. These activities emphasize how to help freshman students set and maintain high expectations throughout their undergraduate career in the Meyerhoff Scholars Program and how to enable students to become comfortable with their differences *and* skilled at addressing tensions that inevitably arise when those from different ethnic, cultural, and racial backgrounds are learning to coexist. Thus, in their formal capacities as admissions counselors, academic advisors, and student-activities coordinators, for example, and in informal yet deliberate interactions with students on a personal level, program staff support students by taking a holistic approach to students' academic progress, cocurricular and career interests, and general well-being.

13. Mentors. Meyerhoff students are paired with mentors who are professional role models (Ph.D., M.D., M.D./Ph.D.) in the sciences, engineering, and mathematics. Mentors are recruited from a variety of settings, including universities, private laboratories, government facilities, and corporations within the science disciplines. Meyerhoff Scholars Program matches students with mentors in their fields of study. These assignments last throughout students' undergraduate careers. Program staff advise Meyerhoff mentors to consult with students on educational and career issues, as well as topics ranging from class scheduling, internship experiences, graduate school placements, career choices, and personal concerns. Mentor and mentee relationships are expressed formally by lab visits, lectures, business meetings, and a Mentors Reception held annually by the Meyerhoff Scholars Program on UMBC's campus. The program staff, the Meyerhoff Parents Association, and the Meyerhoff students coordinate the Mentors Reception jointly. During the Mentors Reception, students present an award to the mentor of the year and are addressed by various mentors at the top of their field. The relationship also expresses itself informally through social outings, letter writing, and recreational activities. These facets of the Meyerhoff mentoring component facilitate educational and professional growth before and after graduation.

The Meyerhoff Scholars Program takes an active role in recruiting mentors for the program in several ways: Meyerhoff staff members visit other organizations and collect the names of potential mentors. Meyerhoff students, through internships and other experiences, come in contact with people who are interested in becoming mentors. The president's office is a primary source of names of potential mentors. Program publicity provides information about the Meyerhoff Scholars Program through various means, and some recipients express an interest in becoming involved with the program. Current mentors often will submit the name of their friends and colleagues as potential mentors. Potential mentors are provided with a Potential Mentor Packet, which includes a letter requesting them to be a mentor, information about the Meyerhoff Scholars Program, and a request for the mentor's demographic information with an addressed return envelope. Currently, 169 mentors support the students and contribute to the program in other ways.

14. Family Involvement. Parents of students in the Meyerhoff Scholars Program are included in social events and kept advised of their child's progress. All of the parents are asked to become part of the Meyerhoff Parents Association. For the active classes, approximately 85 percent to 100 percent of the parents participate. Parents from each active cohort are represented in their association. Currently, the active cohorts include Meyerhoff students enrolled in program years 11 to 15. Some alumni parents have remained with the association and assist with different functions.

The Parents Association plans and implements two major events in the academic year: the family reception and the reception for graduating seniors. They also are involved with raising money for a scholarship fund. (This fundraising is done through dues, donations from other parents, matching funds from employers, and other means.) The Parents Association is also involved in both selections weekends and assists in opening and closing the summer bridge program. During selections weekend, for instance, there is a meeting Saturday evening between existing parents and potential parents. This meeting is informal and none of the program staff are present. The program staff can count on the Meyerhoff Scholars Program to reassure both prospective parents and students.

The Parents Association meets once a month. Program staff believe the Parents Association is effective even though it is a small, independent organization. The president of the university is aware of the activities in which the Parents Association is involved. By all accounts, the perception is that parents are vested in and supportive of the Meyerhoff Scholars Program. Program staff, however, cannot discuss students' grades with parents unless the student gives permission.

It is unusual for a higher education intervention to advocate continued parental involvement. However, Dr. Hrabowski and his faculty and program staff colleagues recognize that the most prevalent components of successful parenting do not end when the child leaves for college. In studies such as *Beating the Odds* (Hrabowski, Maton, & Greif, 1998) and *Overcoming the Odds* (Hrabowski, Maton, Greene, & Greif, 2002), Hrabowski and his colleagues have examined the components of raising academically successful African-American young women and men. Hrabowski (1999) summarizes these components:

- (1) child-focused, self-sacrificing love, including a deep and enduring commitment to education;
- (2) strong limit-setting and discipline by parents, especially in relation to the children's social life;
- (3) consistently high expectations, with the emphasis on the sons and daughters achieving their fullest potential, always striving to achieve and never being satisfied with low grades;
- (4) open, consistent, and strong communication between parents and children, so that the children felt comfortable bringing issues to their parents;
- (5) positive gender and racial identity focus, so that the young black men and women felt positive about themselves; and
- (6) parents' reliance on community resources, most notably churches and extracurricular activities (e.g., academically oriented summer camps).

In *Beating the Odds* and *Overcoming the Odds*, Hrabowski and his colleagues also discovered that regardless of the parents' own education or their economic or marital status, these parents

provided an emphasis on education and academic success, coupled with a focus on hard work and on overcoming adversity. Hrabowski (1999) summarizes the parental factors that contributed to the academic success of the young men and women in these studies:

(1) the importance of reading, beginning with parents reading to their daughters and sons at a young age; (2) the parents' view that education is both necessary and extremely valuable; (3) parents' active encouragement toward academic success; (4) close interaction between parents and their children's teachers; (5) strong parental interest in homework; (6) frequent verbal praise; and (7) parents having calm and thoughtful conversations with their sons and daughters to help them understand that even when they face prejudice or racism, they cannot afford to see themselves as victims and still succeed.

These studies thus support Dr. Hrabowski's perception that parents should not cease to play their role as advocates for their children (not just in school but also in the community). He also believes that parents should never cease to study their children, spend time with them, listen to them, and learn about their lives (schoolwork, friends, interests, and hobbies). Thus, the Meyerhoff Parents Association is a venue for parents to talk with other parents and generate suggestions and insights from parental peers about children's difficulties and related strategies that may improve their children's performance.

Core Categories in Which the Components Converge

As we have detailed, students are provided with virtually every kind of program component that can be found in the literature: full or partial scholarships; mentors; tutors; academic advising; special Summer Bridge classes in mathematics, chemistry, and humanities; family involvement activities; and shared living space with other participants. As suggested earlier, these components do not operate in isolation but rather converge in significant ways to form the core of the program: (1) academic and social integration, (2) knowledge and skill development, (3) support and motivation, and (4) monitoring and advising (Hrabowski, Maton, Greene, & Grief, 2002, pp. 162–163). The program director suggests that “academics are the easy part; it's the other things that are involved with being a young intellectual growing up that requires their [UMBC leadership, program staff and faculty's] time and attention.”

Academic and Social Integration. Of the four categories in which the components fall, academic and social integration probably represents the program's nucleus. Like the myriad facets of the program, it is based on sound theory, research, and practice. The research findings of Professor Uri Treisman (Asera & Treisman, 1995; Fullilove & Treisman, 1990; Treisman, 1992), for example, were a major influence in the continuous drive to academically and socially integrate the Meyerhoff scholars not only on the UMBC campus but also within the students' respective disciplines.

These three research studies examined why African-American students and other students of color were not doing as well as their Asian and European-American counterparts in calculus courses. From 1975 to 1976, Treisman examined the academic and social lives of selected African-American and Chinese-American student populations at University of California—

Berkeley. The population of Chinese-American students was chosen because faculty members and graduate student instructors often had observed that large numbers of Chinese-American students do extremely well in calculus. found that the source of African-American students' poor grades in calculus *was not* the result of the absence of family support, poor motivation or poor academic preparation (as widely assumed). Rather, the crux of the problem was the social and academic isolation that African-American students experienced on a predominantly white campus.

In comparison with the integration of Chinese-American students' social and academic lives, the African-American students' isolation was rather striking. Specifically, the three studies (Asera & Treisman, 1995; Fullilove & Treisman, 1990; Treisman, 1992) found that African-American students studied alone and socialized with a different group of friends from those at college. The Chinese-American students, however, studied first by themselves before gathering in groups to collectively review their work. These group meetings often included food, music, and sometimes people outside the study group—students' brothers, sisters, cousins, and friends. Steinberg, Dornbusch, and Brown (1992) also observed this tendency in Asian cultures for groups to work and study collaboratively.

Using these three studies (Asera & Treisman, 1995; Fullilove & Treisman, 1990; Treisman, 1992) as well as the research of Tinto (1993), Allen (1993), and others, Dr. Hrabowski created a program model that recognized and increased students' strengths, counteracted the pervasive isolation that many of them would otherwise experience, and cultivated these students' academic success. This body of research provided the conceptual bases to support the Meyerhoff Scholars Program strategy of genuinely knowing who their students are and celebrating their social and academic development as well as their successes.

The Meyerhoff Scholars Program promotes student academic and social integration through a committed and involved program staff, who we have observed to be remarkably supportive in every aspect of program implementation. As minority and other students adjust to their new environment during the Summer Bridge orientation process, for example, program staff work tirelessly to help students become academically focused and socially and emotionally comfortable. This strategy is particularly important given the impact of academic confidence and identification with the university in minority student retention (Smedley, Myers, & Harrell, 1993).

The orientation process and continuous interaction between program staff and students is essential as minority students manage the social and academic challenges that may emerge in daily interactions with faculty and students of other races. In the process, students learn how to take responsibility for their own behavior, exercise self-regulation, manage their time effectively, and cope with change and related stresses (Ting & Robinson, 1998).

In both formal and informal interactions with students, program staff members emphasize their expectations concerning respectful behaviors that respect the different ways in which UMBC honors student diversity. During this process, program staff monitor students' social, and academic interactions. Program staff effectiveness in helping students to develop a sense of belonging, to bond with students from different ethnic groups, and to perceive themselves as

valuable members of the campus community is reflected in the Meyerhoff Scholars Program's retention rate of 95 percent.

Knowledge and Skill Development. Treisman (1992) suggests that the practice of teaching and learning cannot be examined in isolation of the specific content area in which they occur. Thus, it is important that faculty, teaching assistants, and tutors make explicit those mathematical concepts, for instance, that students need to understand and internalize in order to achieve mastery. This approach is especially important if students have not had previous intensive exposure to mathematics and other technical fields.

In designing the Meyerhoff Scholars Program, Dr. Hrabowski's observation that underrepresented students needed a stronger foundation in mathematics and science influenced his establishment of a first-year algebra minicourse designed to strengthen students' mathematics skills. He also collaborated with faculty to reconceptualize the content and relevancy of physics, chemistry, biology, and engineering courses. In chemistry, for instance, students are introduced to the faculty's research interests. This approach relates the concepts to real-world concerns. In an engineering course, students' participation in a project for the homeless enabled them to gain a realistic perspective concerning how engineers connect with social problems. Students' courses also include a lesson in which the standards and requirements are made explicit and students are required to plot the number of hours needed for study in order to get an A in a class.

The expectation that students participate in faculty research and the requirement that students study in groups are other strategies for students to internalize and use the language of their field in ways that increase conceptual understanding. In peer study groups, for example, gaps in students' mathematical preparation are addressed *in situ*; that is, the fundamental concepts in algebra or trigonometry are reviewed and mastered within the context of working on demanding calculus problems. This strategy has proved more effective mathematically and psychologically than the alternative strategy of routing students to remedial programs. Emphasizing success at the highest levels, Dr. Hrabowski incorporated exemplary upperclassmen to function as teaching assistants and to counsel new students on what is required for academic excellence. On yet another level, the Meyerhoff scholars have set up a test bank, where they share prior exams and notes to help each other succeed. This emphasis on addressing students' gaps in ongoing work with faculty and peer study groups is a robust characteristic of the Meyerhoff Scholars Program model.

Over the life of the Meyerhoff Scholars Program, it has become evident that peer study groups serve more than the purpose of helping students master the concepts in their fields. Such groups also enable students to regard themselves as part of an academic community. Peer study groups promote conversations in which participants have to both articulate their own ideas and listen to the ideas of others. Peer study group interactions also ensure that students make their work and thinking public; students are thus exposed to different perspectives and the knowledge fund of their peers. As a result, students are disabused of the notion that their ability is based on sheer talent. The peer study group setting exposes students to peers who also struggle with various ideas and subject content as well. The result is that students learn quickly that excelling in a subject does not mean being able to solve problems quickly and easily but rather working very hard and persevering.

This shared process of working in peer study groups seems to also reduce what social psychologist Claude Steele (1997) has described as *stereotype threat*. Steele and Aronson's (1995) work demonstrates that African-American students' scores in mathematics can decline when they are aware that others may judge their performance in terms of their racial background, rather than in terms of their individual background. Thus, Meyerhoff Scholars Program student participation in peer study groups, where it is expected that everyone must work hard to succeed, reduces the potential stereotype threat.

Support and Motivation. The explicit support and motivation provided by the Meyerhoff Scholars Program is designed to reduce the disparities related to inadequate access to financial and other forms of education-related capital (Bourdieu, 1986) and low motivation associated with low levels of academic success. Clearly, ethnic-minority students often lack adequate access to financial, human, and social capital (Miller, 1995). This lack is evidenced in the finding that African Americans, Hispanics, and Native Americans regard the lack of financial capital as one of the major barriers affecting their educational and career goals. In addition, many of these students do not have access to others who are experienced and knowledgeable with respect to academic development. These same populations traditionally have been denied access to and membership in the social networks that are known to facilitate successful movement through academic channels.

The support provided by Meyerhoff Scholars Program to its students reflects UMBC's awareness of the importance of cultural sensitivity and context. It also is a reflection of strong institutional involvement and commitment at many levels. Support is operationalized through Meyerhoff Scholars Program's student study groups, its sense of community and program values, and the leadership of its president. The research demonstrates that student participation in peer study groups outside the class or laboratory leads not only to better academic performance but also to valuable social support and productive interaction. First-year college students usually have had little experience with studying in groups and typically perceive collaborating with others as a hindrance. Students often complain that the group begins studying but ends up talking about other matters and not getting the work done. The Meyerhoff Scholars Program teaches students the rules of how to set up and work effectively in groups. These rules emphasize that students need to prepare for group sessions by studying the work in advance, determining what they do and do not understand about the concepts, and presenting thoughtful questions on aspects of the concepts with which they are struggling. Other basic rules include ensuring that only the task at hand is introduced during the group study time and setting time limits for addressing the selected concept, with clear understandings about break periods.

With regards to community and program values, the Meyerhoff Scholars Program provides a family-like social and academic support system for its students. This structure includes opportunities for older students to be supportive of first-year students and for each freshman to have a designated mentor, who may be a faculty or staff member and who may or may not be different from the student's academic advisor. The Meyerhoff Scholars Program also fully expects that its students will support each other both academically and personally, seek support from a variety of sources, set clear and attainable academic goals, and examine possible careers related to their intended major. These expectations are made explicit and emphasized as early as Selections Weekend. They usually are internalized by the time students are sophomores and

juniors. One of the outcomes of the Meyerhoff Scholars Program's sense of community and collective efficacy is reflected in the return of its graduates to assist and inspire freshman students.

The Meyerhoff Scholars Program's expectation that its students value community service is reflected in students' work with children in the inner cities, children with disabilities, and senior citizens. For instance, students are engaged in tutoring and mentoring, serve as role models, and focus on special projects such as Habitat for Humanity. Community service helps students them to put their studies and their potential for contributing to the larger world in perspective. Students often characterize their commitment to community service in the following way: "From those to whom much is given, much is expected."

Students' sense of community also is reflected in their participation in the arts, cocurricular activities, and cultural activities. Some Meyerhoff Scholars Program minority students, for example, participate in ethnically oriented student clubs and choirs and go to church with Dr. Hrabowski. These cultural activities contribute to students' sense of belonging and enable a goodness of fit between the students and the campus environment. Implicit in the referenced discussion is the level and quality of interaction among students from different racial and ethnic groups. Given that these groups sometimes remain by themselves, program staff and faculty deliberately create opportunities for all students to interact with people from diverse backgrounds.

Finally, the president communicates his unwavering support through the allocation of adequate resources to increase freshman persistence, achievement, and retention; promotion of those practices that are proven to develop successful minority enrollments (including K-12 and college-level initiatives); collaboration with faculty in increasing the faculty's teaching effectiveness with minority students; collaboration with faculty in increasing minority student participation in substantive research experiences and cocurricular initiatives; and constant conversations with both minority and majority faculty and staff concerning related minority issues. UMBC's leadership is committed to recruiting and supporting faculty and administrators of color. The president believes that all students can learn from faculty and professionals with racial and cultural perspectives different from their own.

Monitoring and Advising. Meyerhoff Scholars Program's monitoring and advising of students is reflected in the manner some of the components combine to increase student motivation; faculty expectations for ethnic-minority student success, student access to academically supportive friendship networks, student contact with faculty, and student awareness of the need for strong study habits and access to tutoring. The consistency of the Meyerhoff Scholars Program's monitoring and advisement enables students to make wise academic decisions in selecting coursework, position themselves for the next level of study, and avert or limit the influence of emerging academic or personal problems. Thus, program staff and faculty play many roles in students' lives.

Faculty have collaborated with university leadership and departments to reconceptualize the number and type of courses for which first-semester freshmen may register. This approach increases the probability of success for these students. Science majors now are limited to the

number of mathematics, science, and engineering courses they may take during their first semester or two. The president acknowledges that this approach is somewhat controversial because most colleges require students majoring in science or engineering to take three courses in these disciplines in their first semester, in addition to other courses. Data collected on student achievement in the technical fields and collective experience anchor the Meyerhoff Scholars Program rationale for limiting the number of courses freshman students take. This rationale suggests that (1) students need time to adjust to college-level teaching and testing; and (2) student focus on a smaller number of science or technical courses, in combination with other courses being taken, can build a stronger foundation and contribute to higher grades the first semester, which subsequently helps to increase the new student's self-confidence. The Meyerhoff Scholars Program staff are keenly aware that academic success in the sciences or other disciplines may require students to be in college more than four years; thus students are advised that they should be careful at least in their first-year course selection, and that it is more advantageous to gradually develop a strong foundation and confidence than to rush through without developing either.

Program staff and faculty carefully monitor the level of courses that students take relative to their prior coursework and level of performance. This strategy is especially important in the case of freshmen because studies show that high school GPA is the most significant first-year predictor of success (Ting & Robinson, 1998). It is not unusual for first-year students to be unrealistic in signing up for courses simply because the courses sound interesting, even though they may not have taken the appropriate prerequisites. In addition, first-year students who earn poor grades in one course yet enroll in the next level course fail to understand the distinct relationship between first- and second-level courses. Meyerhoff students who are earning Cs in first-year courses (e.g., in physics, engineering, and chemistry) are advised to retake those courses in order to develop a stronger background and foundation. This practice is especially significant given that UMBC's degree programs are built on a sequence of courses. Faculty and staff can thus monitor whether students' performance reflect adequate preparation for the next level course in the sequence. Dr. Hrabowski's experience and research suggests that unless there is a technology system or person in place to monitor the situation, students will find themselves in courses that are over their heads and for which they are not well prepared.

Finally, Dr. Hrabowski's conversations with Meyerhoff scholars reveal students' dreams and anxieties related to career and life choices. He has observed that the challenges may be even greater for minority students given issues related to race, gender, and culture. In his continual interactions with students, he emphasizes that the skills, values, and habits that students acquire and practice before and during college are the same ones they need to lead effective professional and personal lives. He reminds students of the importance of reading, knowing where to seek answers, problem solving, and asking questions. Another of his refrains include students' ethical and moral responsibility not only to work hard but also work to be the best, set high standards, follow through, be dependable, and understand how to work well with others. Similarly, he emphasizes to students that given the importance of technology and communication skills in the dominant culture, they need to learn how to use technology and to speak and write with clarity and confidence in standard English. Students are reminded that these skills and abilities are necessary in the classroom and eventually in their professional lives. On yet another level,

students are coached on the importance of not isolating themselves from interacting, working, and coexisting effectively with diverse people and remaining open to new experiences.

Minority students who not only function at the top of their classes but also compete against students from around the world are both encouraged and expected to (1) have a vision for themselves; (2) interact with a support group of peers with common aspirations, study habits, and values; (3) take advantage of peer group study sessions; (4) access tutoring services to not only pass but excel in courses; (5) sit in the front of class rooms—not the back—and ask questions of faculty; (6) proactively seek out supportive faculty members during office hours; (7) acquire strong test-taking skills for admittance to college and graduate study; (8) learn how to listen and assess the advice of others; (9) become aware of their strengths and develop plans for improving weak areas; (10) identify strategies for motivating themselves to continue working hard; and (11) actively participate in community service to help those less fortunate. The president often closes his conversations with groups of students by asking them to repeat with him the Langston Hughes poem titled “Dreams” (see Hughes, 1994). We have observed this closing a number of times, and the president’s message to the students about never losing sight of their work and dreams is particularly impressive.

Research Supporting the Meyerhoff Scholars Program’s Conceptual Model of Teaching, Learning, and Assessment

Teaching and Learning for High Achievement. The Meyerhoff Scholars Program’s emphasis on actively developing students’ analytic problem-solving capacity, strong study habits, and motivation to access available university and department resources (Atwater & Alick, 1990; Gandara & Maxwell-Jolly, 1999; Hilton et al., 1989), for example, reflects current research on the context and conditions of how people learn. According to *How People Learn: Brain, Mind, Experience, and School* (Bransford, Brown, & Cocking, 2000), students come to the classroom with preconceptions; if students’ initial understanding is not engaged, they may fail to grasp new concepts presented in the classroom, or they may learn the concepts for purposes of test taking but revert to their preconceptions outside the classroom. Preexisting understandings in students at all levels can impede students’ ability to learn contradictory ideas unless they are given the chance to explore the erroneousness of their initial beliefs. Thus the Meyerhoff Scholars Program’s faculty are expected to (1) draw out their students’ existing knowledge through the creation of classroom tasks and conditions that reveal students’ thinking; (2) use students’ existing knowledge to further student understanding of the subject matter; and (3) use frequent formative assessments to determine why and how students are understanding. Formative assessments are thus more useful in promoting learning with understanding than are tests measuring students’ ability to repeat facts or demonstrate isolated skills.

In the disciplines (mathematics, engineering, sciences, and technology) in which the Meyerhoff students are involved, they are exposed to mentors and faculty at the top of their fields. Mentors and faculty assist students in developing competencies in their area of inquiry, provide students with a foundation of factual knowledge, enable students to understand facts and ideas in the context of a conceptual framework, and help students to develop the ability to organize specific knowledge in ways that enable retrieval and application.

This strategy is reflected in current research comparing the performance of novices and experts, in addition to research on learning and transfer, demonstrating that experts are smart people who also draw on a richly structured information base. Accessing factual information, however, is not enough. The key to expertise is the mastery of concepts that allows for specialized learning and enables the transformation of a set of facts into usable knowledge. Experts use a conceptual framework to organize information into meaningful patterns that facilitate eventual retrieval for problem solving. And unlike simple acquisition of factual knowledge, thoroughly understanding concepts facilitates the transfer of learning to new problems. This finding suggests that in the classroom and peer study groups, in-depth coverage of fewer topics that enable comprehension of key concepts is preferable to the superficial coverage of all topics related to the subject. Faculty, consequently, need substantial knowledge bases in a variety of subjects: familiarity with the process of inquiry, an understanding of the relationship between information and the concepts that help organize it in a discipline, and a grasp of the processes in students' conceptual development. Similarly, assessment tools must be systematically developed that measure both deep conceptual understanding and factual knowledge and that are aligned with the approaches to teaching indicated in this paper.

Although we were not able to assess whether strategies were taught that allowed students to monitor their understanding and progress in problem solving, the performance of experts demonstrate that they monitor their understanding carefully by (1) making note of what additional information is needed; (2) deciding whether new information is consistent with what they already know; and (3) determining appropriate analogies, if any, so that they advance their understanding (Bransford, Brown & Cocking, 2000). This metacognitive approach functions as an internal dialogue as these individuals consider alternative solutions to problems and whether the one chosen will lead to the desired end. The strategies involved in such deliberate monitoring are part of a culture of inquiry, and they can be successfully taught in the context of various subject areas. In teaching these strategies, faculty members need to model both the monitoring questions and observations and to facilitate classroom discussion with the ultimate goal of fostering independent monitoring and learning in their students. This finding requires that faculty (1) integrate instruction in metacognitive skills into the curriculum in a variety of subject areas; and (2) explicitly emphasize the internal inquiry process in order to enhance students' ability to learn independently.

Environments Associated With High Academic Achievement. The Meyerhoff Scholars Program has effectively aligned its environment to focus on students, their knowledge acquisition, formative assessments, and the community. This strategy is supported by Cohen, McLaughlin and Talbert's (1993) findings that today's students need to understand the current state of their knowledge and to build on it, improve it, and make decisions in the face of uncertainty. Accordingly, the Meyerhoff Scholars Program is producing graduates with adaptive expertise who can identify and solve problems and make contributions to society throughout their lifetimes. These outcomes are not by accident but rather stem from the university leadership and faculty's reconceptualization of the sequence of courses in the disciplines offered for study and how related course content is taught and assessed.

- ***Learner-Centered Environments.*** In environments that are learner centered, faculty pay close attention to the knowledge, skills, and attitudes that students bring into the

classroom. This strategy focuses on distilling students' preconceptions about various subjects while simultaneously promoting a better understanding of students. Faculty become aware that:

- Cultural differences can affect students' comfort level in working collaboratively instead of individually. These differences also are reflected in the background knowledge that students bring to a new learning situation (Moll, Tapia, & Whitmore, 1993).
- Students' conceptions of intelligence can affect their performance. Students who think that intelligence is a fixed entity are more likely to be performance oriented as opposed to learning oriented; they want to look good rather than risk making mistakes while learning. These students are especially likely to give up when tasks become difficult. In contrast, students who think that intelligence is malleable are more willing to struggle with challenging tasks and are more comfortable with risk (Dweck, 1989; Dweck & Legget, 1988).

Hence, faculty in learner-centered classrooms are attentive to each student's individual progress and develop appropriate tasks that facilitate a more sophisticated understanding of the material. For instance, faculty present students with challenging material that they can manage; that is, the difficulties are demanding enough to maintain engagement but not so difficult as to lead to discouragement. Taken together, this approach demonstrates the faculty's understanding of their students' knowledge, skill levels, and interests (Duckworth, 1987).

- ***Knowledge-Centered Environments.*** Knowledge-centered environments emphasize attention to what is taught (i.e., course content), why it is taught (to enable understanding and eventual application), and what competence or mastery looks like. Expertise involves well-organized knowledge that supports understanding. Learning with understanding is important for the development of expertise because it makes new learning easier (by supporting transfer). Learning with understanding is often harder and more time-consuming to accomplish than simply memorizing. Many curricula fail to support learning with understanding because they present an array of disconnected facts in a short period of time. Similarly, tests often reinforce memorizing rather than understanding. A knowledge-centered environment, however, provides the necessary depth of study and assesses student understanding rather than mere knowledge of disconnected facts. In addition, it incorporates the teaching of metacognitive strategies that facilitate future learning.

Although student interest or engagement in a task is important, it does not guarantee that the student will acquire the variables of knowledge that will support new learning. On the other hand, knowledge-centered environments consider other factors besides engagement as the primary index of successful teaching (Prawaf, Remillard, Putnam, & Heaton, 1992). These environments also recognize that "there are important differences between tasks and projects that encourage hands-on doing and those that encourage doing with

understanding” (Bransford, Brown, & Cocking, 2000, p. 24). According to Greeno (1991), the knowledge-centered environment emphasizes the latter.

Continuous Formative Assessments Designed to Make Students’ Thinking Visible to Both Teachers and Students. Formative assessments help both faculty and students monitor progress. Equally important, they permit faculty to (1) grasp their students’ preconceptions, (2) understand where the students are along the continuum from informal to formal thinking, and (3) design curriculum and instruction accordingly. Another important characteristic of formative assessments is their learner-friendliness. Rather than requiring students to quickly memorize information for a quiz resulting in a grade that ranks them with respect to their classmates, formative assessments provide students with opportunities to revise and improve their thinking (Vye, Schwartz, Bransford, Barron, Zech, & Cognition and Technology Group at Vanderbilt, 1998), help them see their own progress over the course of weeks or months, and assist faculty in identifying potential problems in students’ critical literacy and comprehension that may need to be addressed.

The Community Context. Because learning is influenced in fundamental ways by its context, promoting student achievement through their community requires the development of norms for the classroom, schools, and the community that both support and inform core learning values. In some schools, the norms may require that students build their own information base; other norms may encourage academic risk taking and provide opportunities for students to make mistakes, obtain feedback, and revise their thinking. School norms also must support students’ comfort in revealing their preconceptions about a subject, their questions, and their progress toward understanding new conceptual constructs related to the subject. UMBC faculty at design classroom activities and promote students’ intellectual camaraderie and attitudes toward learning that build a sense of community. These activities may take the form of students solving problems together by building on each other’s knowledge, asking questions to clarify explanations, and suggesting differing solutions (Brown & Campione, 1994). Thus, cooperation and argumentation in problem solving enhances cognitive development (Evans, 1989; Goldman, 1994; Habermas, 1990; Kuhn, 1991; Moshman, 1995a; 1995b; Newstead & Evans, 1995; Salmon & Zeitz, 1995; Youniss & Damon, 1992) and is a factor in enabling student achievement.

Lave and Wegner (1991) found that a community-centered approach also supports faculty in establishing a community of learners among themselves. Such a community fosters comfort with questioning—not just with knowing the answer—and is a model for creating new ideas that build on the contributions of individual members. Community membership also can promote in faculty a sense of ownership of new ideas that they can transfer to their classroom. Ultimately, the Meyerhoff Scholars Program, as a community-centered program, has developed new ways to link classroom learning to other aspects of students’ lives. This link is reflected in students’ active participation in community service.

Studies Concerning the Effectiveness of the Meyerhoff Scholars Program

Dr. Hrabowski (2003) recently commented on the results of the Meyerhoff Scholars Program:

Since the program's creation in 1988, it has become one of the nation's leading producers of minority graduates, particularly African Americans, who go on to postgraduate study and research careers in science and engineering. In 1999, UMBC ranked first nationally in the number of undergraduate biochemistry degrees awarded to African Americans and produced nearly one-third of all undergraduate biochemistry degrees awarded to blacks. It also ranked second in the number of undergraduate biochemistry degrees awarded to minority students and fourth (tied with Yale) in the number of undergraduate biochemistry degrees awarded, in general. Over 500 undergraduates have enrolled in the program since its inception, and since the first group of graduates in 1993, nearly 300 Meyerhoff students have earned degrees in science and engineering, with 85 percent matriculating into graduate and professional programs nationally. (Two hundred are still enrolled at UMBC.) Most important, these graduates are part of a pipeline of minority Ph.D.s, M.D.s, and M.D./Ph.Ds. By 2005, the program will have sent over 450 minority students to medical, science, and engineering postgraduate programs.

In an early study, Hrabowski and Maton (1995) examined the persistence rates of the first four cohorts of Meyerhoff students. They found that between 85 percent and 95 percent of these students remained in the program to completion. Given traditional persistence rates for African-American students in science and engineering, the Meyerhoff scholars' rates were particularly high. In this study, 34 Meyerhoff scholars from the 1989–1991 cohorts were matched with 34 non-Meyerhoff African-American students from a historical sample of students attending UMBC prior to the start of the Meyerhoff Scholars Program. Students were matched on SAT scores, high school GPA, gender, and ethnicity. Analysis of covariance suggested that the students in the Meyerhoff program had higher freshman GPAs and science GPAs, and higher grades in calculus, analytic geometry, and chemistry. For example, the average freshman GPA for the Meyerhoff group was 3.5, compared to a pre-Meyerhoff group mean of just 2.8 (Hrabowski & Maton, 1995).

In addition, the Meyerhoff scholars' average GPAs in both science and nonscience courses were significantly higher than the comparison groups' and ranged between 3.4 and 3.6 (no standard deviations were reported). This finding suggests that on average, the Meyerhoff scholars were achieving at high levels. One of the limitations of this study was the use of a historical comparison group. This methodology does not make it possible to control for differences in a host of experiences that the two groups may have encountered. As a result, Maton, Hrabowski, and Schmitt (2000) conducted another study with current matched samples. They found that Meyerhoff scholars (at this point, still all black) were two to three times more likely to persist to graduation in science, mathematics, engineering, and technology majors than either Asian or Caucasian peers. In addition, the Meyerhoff scholars' GPAs were equal to those of the Asian students with similar preparation and higher than those of the Caucasian students.

By all measures, the program's positive outcomes are striking. Both internal and external evaluations show that Meyerhoff students are nearly twice as likely to persist and graduate in

mathematics, engineering, and the sciences than their peers who declined offers of admission to the program and enrolled at other universities. We are particularly struck with the significant role that evaluation and research have played in the conceptualization, implementation, and institutionalization of the Meyerhoff Scholars Program. It also is significant that the resounding success of the Meyerhoff Scholars Program leads to a graduate Meyerhoff Fellows Program funded primarily by the National Institutes of Health. This Fellows Program is directed by UMBC's Howard Hughes Medical Institute (HHMI) investigator, a biochemist and recipient of the 2000 U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.

Other campus initiatives include a National Science Foundation (NSF) Alliance for Graduate Education and the Professoriate (AGEP) Program and planning for a Network of Researchers. The AGEP program is designed to increase diversity at the graduate level. The Network of Researchers initiative stems from the unevenness in support and mentoring that Meyerhoff graduates receive as they pursue graduate studies in various institutions. Two of the goals of this initiative are (1) to work with program graduates throughout their graduate studies; and (2) to assist them with making career decisions, including identifying potential faculty and/or professional research positions.

These initiatives build on many of the effective strategies of the undergraduate Meyerhoff program. The university's success was recently recognized by the Council of Graduate Schools/Peterson's Award for Innovation in Promoting an Inclusive Graduate Community.

Conclusion

Our analysis of the program descriptions and reports and our actual site visits, observations, and interviews with students, faculty, and program staff demonstrate that the Meyerhoff Scholars Program is based on an explicit program theory. *Program theory*, according to Rossi, Freeman, and Lipsey (1999), is defined as the assumption(s) undergirding a program, its relationship to the social benefits it is expected to produce, and the implementation strategies included to achieve its goals and objectives. Within program theory, *impact theory* relating to the nature of the change in social conditions brought about by program action can be distinguished from the *process theory*, which illustrates the program's organizational and service utilization plan.

Strategies That Promote Student Success

The Meyerhoff Scholars Program is a strengths-based, theoretically driven model. Its structural practices, with evidentiary proofs extensively culled from the research literature, systematically and deliberately craft the following strategies that promote student success:

1. Creating a critical mass of underrepresented like-minded students of color.
2. Mandating a pre-freshman Summer Bridge Program.
3. Making the curriculum explicit.
4. Assigning the best faculty to teach freshman courses.
5. Providing institutional structural support for cumulative knowledge and skill development.
6. Constructing supportive groups at varying levels for students' academic and social lives.
7. Providing comprehensive financial support.
8. Providing explicit and implicit culturally relevant experiences.
9. Comprehensively monitoring, mentoring, and advising students throughout their undergraduate career, rather than emphasizing only the freshman year.

1. Creating a critical mass of underrepresented like-minded students of color. Being one of a few students of color on a campus or in a program can be psychologically, academically, and socially isolating (Gordon, 1986). The absence of academically and socially supportive peers with whom a student can share his or her self-doubts and/or seek academic help, without fear of reinforcing extant stereotypes about ethnic inferiority, places students at risk of marginalization. Extant evidence suggests that these students are much more likely to underperform academically or leave the university system (Allen, 1993; Astin, 1992; Steele & Aronson, 1995). Alternatively, systematic and deliberate creation of a critical mass of like-minded underrepresented students who have access to and substantive contact with faculty outside of the classroom and mentoring relationships with faculty (including with minority faculty) increases the likelihood of minority student academic achievement.

2. Mandating a pre-freshman Summer Bridge program. The requirement that students attend a pre-freshman Summer Bridge Program can serve as a venue for socializing students to the

explicit and implicit academic and social expectations of the university. As a result, they are enabled to forge positive connections with their peers, program staff, and faculty. This approach increases the requisite motivation and self-efficacy that students require for high levels of academic performance. One of the practical advantages for students includes the establishment of high GPAs in their freshman year.

3. Making the curriculum explicit. The Meyerhoff Scholars Program has, and continues to be, engaged in systematic study of its science, mathematics, engineering, and technology curricula in purposeful attempts to identify (1) its weaknesses, (2) whether and how the curricula should be taught differentially, and (3) what aspects require more time and concentrated study to internalize. In addition, the curriculum is supplemented with peer study groups and tutoring to ensure that difficult concepts are mastered and applied.

4. Assigning the best faculty to teach freshman courses. Given that the greatest attrition of underrepresented minority students occur between the freshman and sophomore years, the Meyerhoff Scholars Program is aware that underrepresented minority students are more sensitive to teaching quality than majority students from more advantaged backgrounds. The university leadership and faculty thus ensure that Meyerhoff students' freshman year is a successful experience both socially and academically by exposing students to faculty who are effective; who interact in substantive ways with students; and who play vitally important roles in (1) engaging and encouraging students, and (2) guiding students in identifying and making use of supportive resources both on the university and department level.

5. Providing institutional structural support for cumulative knowledge and skill development. The Meyerhoff Scholars Program is structured on academic excellence with an emphasis that students are intellectually competent (Gordon, 2001), motivated, and self-confident. However, the Meyerhoff Scholars Program also recognizes that even among these high-performing students, gaps in knowledge or understanding often result from inadequate high school preparation. Thus, the program systematically helps these students to identify where they have gaps in their knowledge and expects its faculty to reinforce fundamental concepts while simultaneously exposing students to rigorous material that is challenging.

6. Constructing supportive groups at varying levels for students' academic and social lives. The institutionalization of rigorous courses, faculty, mentors, upperclassmen, and peers as consistent structural supports is integrated into students' entire undergraduate lives. This strategy is particularly effective in enabling the Meyerhoff Scholars Program to increase minority student grades; persistence in the sciences, engineering, mathematics, and technology; and admission to graduate study in these disciplines.

7. Providing comprehensive financial support. In a deliberate attempt to reduce the negative impact that inadequate finances play on underrepresented students' academic achievement and to increase student retention, achievement, and graduation, Meyerhoff students are provided with full or partial scholarships that are contingent on consistently high GPAs.

8. Providing explicit and implicit culturally relevant experiences. Given the Meyerhoff Scholars Program's emphasis on minority high achievement in the sciences, mathematics,

technology, and engineering, various aspects of their students' cultures are incorporated into the program. For example, students attend church with the president and are active in church choirs. Our conversations with program staff suggest that this approach also serves to socially and academically integrate students. In addition, regular meetings in which students discuss issues such as racism places their experiences, values, and aspirations into perspective.

9. Comprehensively monitoring, mentoring, and advising students throughout their undergraduate career rather than emphasizing only the freshman year. The Meyerhoff Scholars Program does not focus exclusively on the freshman year as the critical point in time to ensure that students make a successful transition to college. Rather, it has institutionalized continuous monitoring and the provision of services to students throughout their undergraduate career. The overarching assumption is that given the referenced support and resources, competitively selected and underrepresented minority students are capable of succeeding in science, engineering, mathematics, and technology disciplines.

Policy Implications

What are the implications of the Meyerhoff Scholars Program's effectiveness from a policy perspective? Clearly, the nurturing and expectations of minority high-academic achievement requires commitment and resources on a number of levels, particularly the institutional level. Commitment and resources include (1) explicitly and consistently conveying unwavering expectations of academic excellence from minority students, 2) creating a supportive environment that is balanced with challenging and progressively rigorous academic coursework, (3) inculcating a concern in students for helping those less fortunate through active community service, and (4) actively reinforcing to the campus community the moral and ethical imperative to promote minority student academic success.

One of the ways that administrators, faculty, and staff can create a culture of academic excellence for their students in general and their minority students in particular includes creatively adapting exemplary models that demonstrate minority students excelling at the highest levels. Institutional awareness and creativity is crucial, given that large numbers of underrepresented minority students are not as well prepared academically for college-level work as their white and Asian American counterparts (partially because of negative stereotyping and low expectations, their own and others), and these students may not feel comfortable in a new setting, whether the student body is predominantly white or minority. Institutions face both a local and national issue when over 85 percent of all African-American undergraduates and a large proportion of other ethnic-minority students attend predominantly white colleges and universities where the composition of leadership or faculty positions does not reflect the diversity of the student population.

Another strategy that institutions can use to increase the proportion of well-prepared college-bound students includes partnerships with K–12 school systems to develop the knowledge, skills, abilities, and character of minority students through appropriate and culturally relevant curriculum, teaching, learning, assessment, and community service.

The Meyerhoff Scholars Program is clearly an exemplary model, not only for higher education but also for school systems and supplementary education services along the Prekindergarten through Grade 12 continuum. The components of the Meyerhoff Scholars Program are transferable, and minority academic excellence is possible. We have the knowledge and exemplar to lead the way to reducing the chronic academic achievement gaps between majority and minority students. What we need is the will to implement this form of social justice.

References

- Allen, W. R. (1992). The color of success: African-American college student outcomes at predominantly white and historically black public colleges and universities. *Harvard Educational Review*, 62(1), 26–44.
- Asera, R., & Treisman, P. U. (1995). Routes to mathematics for African-American, Latino and Native American students in the 1990s: The educational trajectories of Summer Mathematics Institute participants. *CBMS Issues in Mathematics Education*, 5, 127–150.
- Astin, A. W. (1993). *What matters most in college? Four critical years revisited*. San Francisco: Jossey-Bass
- Atwater, M. M., & Alick, B. (1990). Cognitive development and problem solving of Afro-American students in chemistry. *Journal of Research in Science Teaching*, 27, 157–172.
- Bhattacharya, M., & Gordon, E. W. (in press). Community and faith-based support for supplementary education. In E. W. Gordon, A. S. Meroe, & B. L. Bridglall (Eds.), *Supplementary education*. Landham, MD: Rowman and Littlefield.
- Borman, G., Stringfield, S., & Rachuba, L. (2000). *Advancing minority high achievement: National trends and promising programs and practices*. New York: College Board. Retrieved June 18, 2004, from http://www.collegeboard.com/repository/minorityhig_3948.pdf
- Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258) Westport, CT: Greenwood Press.
- Bowen, W. G., & Bok, D. (1998). *The shape of the river: Long-term consequences of considering race in college and university admissions*. Princeton, NJ: Princeton University Press.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school* (Expanded ed.). Washington, DC: National Academy Press. Retrieved June 18, 2004, from <http://www.nap.edu/books/0309070368/html/>
- Brown, A. L., & Campione, J. C. (1994). Guided discovery in a community of learners. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practices* (pp. 229–270). Cambridge, MA: MIT Press.
- Chess, S., & Thomas, A. (1999). *Goodness of fit: Clinical applications from infancy through adult life*. Philadelphia: Brunner Mazel.
- Cohen, D. K., McLaughlin, W., & Talbert, J. E. (Eds.). (1993). *Teaching for understanding: Challenges for policy and practice*. San Francisco: Jossey-Bass.

- Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., et al. (1966). *Equality of educational opportunity*. Washington, DC: U.S. Government Printing Office.
- College Board. (2000). *College-bound seniors national report*. Washington, DC: Author. Retrieved June 18, 2004, from <http://www.collegeboard.com/sat/cbsenior/yr2000/nat/cbs2000.html>
- College Board. (n.d.). *Dimensions of the minority high achievement problem*. Retrieved June 18, 2004, from http://www.collegeboard.com/about/association/academic/taskforce/taskforce_2.html
- Duckworth, E. (1987). *"The having of wonderful ideas" and other essays on teaching and learning*. New York: Teachers College Press.
- Durán, R. (1983). Prediction of Hispanics' college achievements. In M. Olivas (Ed.), *Latino college students* (pp. 241–245). New York: Teachers College Press.
- Dweck, C. S. (1989). Motivation. In A. Lesgold & R. Glaser (Eds.), *Foundation for a psychology of education* (pp. 87–13). Hillsdale, NJ: Erlbaum.
- Dweck, C. S., & Legget, E. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*, 256–273.
- Eisner, E. W. (1967). Educational objective: Help or hindrance? *School Review*, *75*, 250–266.
- Eisner, E. W. (1976). Educational connoisseurship and criticism: Their form and functions in educational evaluation. *Journal of Aesthetic Education*, *3–4*(10), 135–150.
- Eisner, E. W. (1983). Educational connoisseurship and criticism: Their form and functions in educational evaluation. In G. F. Madaus, M. Scriven, & D. L. Stufflebeam (Eds.), *Evaluation Models: Viewpoints on educational and human services evaluation* (pp. 335-347). Boston: Kluwer-Nijhoff.
- Eisner, E. W. (1991). Taking a second look: Educational connoisseurship revisited. In M. W. McLaughlin & D. C. Phillips (Eds.), *Evaluation and education: At quarter century* (Ninetieth Yearbook of the National Society for the Study of Education, Part II, pp. 168–187). Chicago: National Society for the Study of Education.
- Evans, J. St. B.T. (1989). *Bias in human reasoning*. Hillsdale, NJ: Erlbaum.
- Fordham, S., & Ogbu, J. U. (1986). Black students' school success: Coping with the burden of acting white. *The Urban Review*, *18*, 176–206.

- Fullilove, R. E., & Treisman, P. U. (1990). Mathematics achievement among African American undergraduates at the University of California, Berkeley: An evaluation of the Mathematics Workshop Program. *Journal of Negro Education*, 59(3), 463–477.
- Gandara, P., & Maxwell-Jolly, J. (1999). *Priming the pump: A review of programs that aim to increase the achievement of underrepresented minority undergraduates*. NY: College Board. Retrieved June 18, 2004, from http://www.collegeboard.com/repository/primingthep_3949.pdf
- Garnezy, N. (1991). Resilience in children's adaptation to negative life events and stressed environments *Pediatric Annals*, 20(9), 462–466.
- Goldman, A. I. (1994). Argument and social epistemology. *Journal of Philosophy*, 91, 27–49
- Gordon, E. W. (1976). Group differences vs. individual development in educational design. In S. Messick and Associates (Eds.), *Individuality in learning*. San Francisco: Jossey-Bass.
- Gordon, E. W. (1986, Fall/Winter). Designing, implementing, and evaluating programs to facilitate cognitive development. *Special Services in the Schools*, 3(1–2), 171–191.
- Gordon, E. W. (1995). *Evaluation of Pace: A report to the Rockefeller Foundation*. Unpublished manuscript.
- Gordon, E. W. (2001, September). The affirmative development of academic ability. *Pedagogical Inquiry and Praxis*, 2. Retrieved June 18, 2004, from <http://iume.tc.columbia.edu/reports/ip2.pdf>
- Gordon, E. W. (in press). Defiance: A variation on the construct of resilience. In R. Jones (Ed.), *Black psychology* (Revised ed). New York: Rutledge Press.
- Gordon, E. W., Bowman, C. B., & Mejia, B. X. (2003). *Changing the script for youth development: An evaluation of the All Stars Talent Show Network and the Joseph A. Forgiore Development School for Youth*. New York: Institute for Urban and Minority Education. Retrieved June 18, 2004, from http://www.allstars.org/content/06_03_iume_report.pdf
- Gordon, E. W., Miller, F., & Rollock, D. (1990). Coping with communicentric bias in knowledge production in the social sciences. *Educational Researcher*, 19(3), 14–19.
- Gordon, E. W., & Shipman, S. (1979). Human diversity, pedagogy, and educational equity. *American Psychologist*, 34(10), 1030–1036.
- Greeno, J. (1991). Number sense as situated knowing in a conceptual domain. *Journal for Research in Mathematics Education*, 22(3), 170–218.

- Habermas, J. (1990). *Moral consciousness and communicative action*. Cambridge, MA: MIT Press.
- Harvey, W. B. (2003). *Minorities in higher education, 2002–2003: Twentieth annual status report*. Washington, DC: American Council on Education.
- Hilton, T. L., Hsia, J., Solorzano, D. G., & Benton, N. L. (1989). *Persistence in science of high-ability minority students*. Princeton, NJ: Educational Testing Service.
- Hrabowski, F. A., III. (1999, December). Embracing excellence and diversity. *The School Administrator*, 56(11), 38–39. Retrieved June 18, 2004, from http://www.aasa.org/publications/sa/1999_12/hrabowski.htm
- Hrabowski, F. A., III. (2003). Remarks made at the 2003 American Institute of Architects annual leadership and legislative conference. In L. Kiisk (Ed.), *20 on 20/20 vision* (pp. 23-28). Boston: Boston Society of Architects. Retrieved June 18, from <http://www.aia.org/pdf/diversity/hrabowski.pdf>
- Hrabowski, F. A., III., & Maton, K. I. (1999). Enhancing the success of African-American students in the sciences: Freshman year outcomes. *School Success and Mathematics*, 95(1), 19–27.
- Hrabowski, F. A. III., Maton, K. I., & Greif, G. L. (1998). *Beating the odds: Raising academically successful African-American males*. New York: Oxford University Press.
- Hrabowski, F. A., III., Maton, K. I., Greene, M. L., & Greif, G. L. (2002). *Overcoming the odds: Raising academically successful African-American young women*. New York: Oxford University Press.
- Hughes, L. (1994). Dreams. In *Collected poems*. New York: Knopf. Retrieved June 18, 2004, from <http://www.favoritepoem.org/poems/hughes/dreams.html>
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
- James, D. W., Jurich, S., & Estes, S. (2001). *Raising minority academic achievement: A compendium of education programs and practices*. Washington, DC: American Youth Policy Forum.
- Kuhn, D. (1991). *The skills of argument*. Cambridge, England: Cambridge University Press.
- Luthar, S. S. (1991). Vulnerability and resilience: A study of high risk adolescents. *Child Development*, 62, 600–616.

- Masten, A. S., & Garmezy, N. (1985). Risk, vulnerability, and protective factors in developmental psychopathology. In B. B. Lahey and A. E. Kazdin (Eds.), *Advances in Child Clinical Psychology* (pp. 1–52). New York: Plenum.
- Maton, K., Hrabowski, F., & Schmitt, C. (2000). African American college students excelling in the sciences: College and postcollege outcomes in the Meyerhoff Scholars Program, *Journal of Research in Science Teaching*, 37(7), 629–654.
- Mercer, J. (1994, June 22). Guiding black prodigies. *Chronicle of Higher Education*, 40(42), p. A22.
- Miller, L. S. (1995). *An American imperative: Accelerating minority educational advancement*. New Haven, CT: Yale University Press.
- Moll, L. C., Tapia, J., & Whitmore, K. F. (1993). Living knowledge: The social distribution of cultural sources for thinking. In G. Salomon (Ed.), *Distributed cognitions* (pp. 139–163). Cambridge, England: Cambridge University Press.
- Moshman, D. (1995a). The construction of moral rationality. *Human Development*, 38, 265–281.
- Moshman, D. (1995b). Reasoning as self-constrained thinking. *Human Development*, 38, 53–64.
- National Center for Education Statistics. (2000). *Entry and persistence of women and minorities in college science and engineering education*. Washington, DC: U.S. Department of Education. Retrieved June 18, 2004, from <http://nces.ed.gov/pubs2000/2000601.pdf>
- National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington, DC: U.S. Government Printing Office.
- National Task Force on Minority High Achievement. (1999). *Reaching the top*. New York: College Board. Retrieved June 18, 2004, from http://www.collegeboard.com/repository/reachingthe_3952.pdf
- Newstead, S. E., & Evans, J. St. B. T. (Eds.). (1995). *Perspectives on thinking and reasoning: Essays in honour of Peter Wason*. Hillsdale, NJ: Erlbaum.
- Prawaf, R. S., Remillard, J., Putnam, R. T., & Heaton, R. M. (1992). Teaching mathematics for understanding: Case study of four fifth-grade teachers. *Elementary School Journal*, 93, 145–152.
- Ramist, L., Lewis, C., & McCamley-Jenkins, L. (1994). *Student group differences in predicting college grades: Sex, language, and ethnic groups* (College Board Report No. 93-1). New York: College Board.
- Rossi, P. H., Freeman, H. E., & Lipsey, M. W. (1999). *Evaluation: A systematic approach* (6th ed.). Thousand Oaks, CA: Sage.

- Salmon, M. H., & Zeitz, C. M. (1995). Analyzing conversational reasoning. *Informal Logic*, 17, 1–23.
- Smedley, B. D., Myers, H. F., & Harrell, S. P. (1993). Minority-status stresses and the college adjustment of ethnic minority freshmen. *Journal of Higher Education*, 64, 434–452.
- Steele, C. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 5, 613–629.
- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, 69, 797–811.
- Steinberg, L., Dornbusch, S. M., & Brown, B. B. (1992). Ethnic differences in adolescent achievement: An ecological perspective. *American Psychologist*, 47(6), 723–729.
- Suchman, E. A. (1967). *Evaluative research: Principles and practice in public service and social action programs*. New York: Russell Sage Foundation.
- Ting, S.-M. R., Robinson, T. L. (1998). First-year academic success: A prediction combining cognitive and psycho-social variables for Caucasian and African American students. *Journal of College Student Development*, 39(6), 599–610.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: University of Chicago Press.
- Treisman, P. U. (1992). Studying students studying calculus: A look at the lives of minority mathematics students in college. *The College Mathematics Journal*, 23, 362–372.
- U.S. Census Bureau. (2001). *Overview of race and Hispanic origin* (Census 2000 Brief). Washington, DC: U.S. Department of Commerce. Retrieved June 18, 2004, from <http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf>
- Vye, N. J., Schwartz, D. L., Bransford, J. D., Barron, B. J., Zech, L., & Cognition and Technology Group at Vanderbilt. (1998). SMART environments that support monitoring, reflection, and revision. In D. Hacker, J. Dunlosky, & A. Graessner (Eds.), *Metacognition in educational theory and practice*. Mahwah, NJ: Erlbaum.
- Wang, M. C., & Gordon, E. W. (Eds.). (1994). *Educational resilience in inner-city America: Challenges and prospects*. Hillsdale, NJ: Erlbaum.
- Willingham, W. W. (1985). *Success in college: The role of personal qualities and academic ability*. New York: College Board.
- Youniss, J., & Damon, W. (1992). Social construction in Piaget's theory. In H. Berlin & B. Pufal (Eds.), *Piaget's theory: Prospects and possibilities* (pp. 267-286). Hillsdale, NJ: Erlbaum.