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Supporting High Achievement In Introductory Mathematics Courses: What We Have Learned From 30 Years of the Emerging Scholars Program

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Introduction

This article is aimed toward faculty in mathematics departments who are working to increase the number of high-achieving mathematics students from racial and ethnic minorities and for researchers investigating these endeavors. The Emerging Scholars Program (ESP) is one of the most widespread models for supporting such increases. It is also one of the oldest, so there is a considerable body of research, both quantitative and qualitative, related to its impact. Whether or not one chooses to implement an ESP, this discussion of the history, philosophy, structure, impact, and future of the program will highlight important and emerging themes that any related student support efforts must confront.

Individuals, departments, and colleges are invested in issues related to diversity for a number of reasons. One reason is a belief that all students should have the opportunity to pursue a satisfying career path. While acknowledging that personality plays some role in student academic choices, research and practice point to systemic factors that also affect students' choices (some of which we elaborate in the section below, A Brief Look at the Emerging Scholars Program Model). This implies that institutions themselves have a responsibility to address such factors. Another reason for attention to issues of diversity is the increased health that disciplines experience from drawing on diversity—e.g., a variety of backgrounds, goals, and perspectives. This reason grows ever more important as minorities continue to constitute an increasing proportion of the U.S. population. The effects of diversity in the discipline reach beyond mathematics and researchers in science and engineering fields. In fact, the large majority of mathematics majors go on to jobs in industry and into teaching jobs at the K–12, community college, and university levels. The effectiveness of minority mathematics teachers at these levels has not been definitively researched. However, small-scale qualitative studies have found that

> Students of color tend to have higher academic, personal, and social performance when taught by teachers from their own ethnic groups. (However, this finding does not suggest that culturally competent teachers could not achieve similar gains with students of color from different ethnic groups.) (National Collaborative on Diversity in the Teaching Force, 2004, p. 6)

Moreover, calculus in particular is a significant filter for premedical tracks, so the effects of student success—and particularly the success of minority students—in calculus cascade into the makeup and health of the medical professions.

For all these reasons and many others, many institutions and individuals are taking active responsibility for the high achievement of minority students in mathematics. This paper offers an overview of recent related research, as well as lessons learned during thirty years of work in Emerging Scholars Programs, some of which have been documented in the literature and some of which have been passed on as program folklore. This paper also documents some of the most recent relevant changes in the social and political landscape.

The year 2004 marks the 30th anniversary of the first piece of research directly related to the ESP model. It was an ethnographic study started in 1974 by Treisman (Treisman, 1985, 1992; Fullilove & Treisman, 1990; Treisman & Asera, 1990), who was then a graduate student in mathematics at the University of California at Berkeley. The timely observation, based on an analysis of academic transcripts, that even high-achieving, high-potential minority students were struggling in freshman calculus, led to the question, "what was the overall experience of African-American and Hispanic students in calculus at UC Berkeley?" (Asera, 2001, p. 9). More details about Treisman's study and the resultant ESP model are provided in the next section of this paper, A Brief Look at the ESP Model.

The last thirty years have seen many attempts across the country to adapt ESP to local conditions. These decades have also seen the birth and growth of a variety of programs. Gándara (1999) offers an instructive overview of other program models that have documented systematic analysis of impact. In this study of 20 programs (including ESP), Gándara identified five strategies that such programs typically employ: "mentoring, financial support, academic support, psychosocial support, and professional opportunities" (p. 29). In this scheme, ESP strategies were classified as academic support and psychosocial support. Other programs have used different combinations of strategies and have successfully addressed different needs, goals, and target populations (e.g., graduate students). Throughout the report, Gándara stressed the need for more programs that emphasize excellence (as opposed to non-failure).

There have also been many changes in the social and political landscape since the beginning of ESP. One of the most encouraging changes has been the increase in bachelor's degrees awarded to black and Hispanic students. According to the latest comprehensive surveys performed by the National Science Foundation, there was an impressive increase between 1990 and 2001 in the absolute number of bachelor's degrees earned by underrepresented minorities, both overall and specifically in science and engineering. The proportion of bachelor's degrees earned by blacks and Hispanics has increased noticeably as well (see Table 1). We see slower growth when we focus on mathematics degrees, but there is still an increase in the proportion of mathematics degrees awarded to blacks and Hispanics. However, despite the general improvement in numbers, the proportion of blacks and Hispanics graduating with bachelor's degrees in science and engineering still lags far behind their respective proportions of the population as a whole. Nonetheless, the efforts of individuals, departments, and colleges to increase the success of minorities in mathematics-based fields have made a noticeable difference.

Table 1
Bachelor's degrees earned by Blacks and Hispanics in 1990 and 2001 (National Science Foundation, 2001, 2004; U.S. Census Bureau, 2001b)

	Blacks (1990)	Blacks (2001)	Hispanics (1990)	Hispanics (2001)
Number of Bachelor's Degrees				
All Fields	59,301	106,648	43,864	89,972
Science and Engineering	18,230	33,869	13,918	29,262
Mathematics	720	845	413	668
% of Total Bachelor's Degrees				
All Fields	5.6%	8.5%	4.1%	7.2%
Science and Engineering	5.3%	8.1%	4.0%	7.0%
Mathematics	4.9%	7.2%	2.8%	5.7%
% of Population	11.7%	12.1%	9.0%	12.5%

We must offer one caution. The existing research on minority academic performance is in its first stages. Issues with effect size, replication, and scalability thwart attempts to be absolute about conclusions, despite calls from the mathematics community to be definitive. In short, educational research on minority advancement in higher education is not in a mature state where any definitive results can be claimed.

To complicate matters, any results and recommendations considered from research need to be analyzed and adapted to local history and resources. In fact there is often a practical disconnection between educational research and practice. The reasons for this disconnection are many and well summarized elsewhere (e.g., Burkhardt & Schoenfeld, 2003). Indeed, this disconnect has been the general experience of ESP practitioners and program designers. They are often working at the edge of their time and material resources and cannot hope to be simultaneously immersed in the sprawling mathematics education literature on minority academic performance.

Despite these cautions, educational research can strengthen and refine practice. Excellent research and theory can call attention to hidden structures and subtle phenomena that have practical implications for program design. Research can also reframe one's understanding of the practical terrain in which programs are implemented or bring to mind fruitful and essential questions. As an example of research-informed practice, this paper begins with a brief description of the ESP model and an overview of the documented effects of programs based on this model. We will then discuss three major questions that can be addressed from new research around minority academic performance of the last 15 years. We conclude with a look at future challenges both for program designers and for education researchers hoping to make more practical impact with their work.

A Brief Look at the Emerging Scholars Program Model

The original version of the ESP model, the Professional Development Program

Mathematics Workshop at the University of California at Berkeley, was designed in the 1970s in response to ethnographic research at UC Berkeley that described the contrasting study habits of black students and Chinese students (Fullilove & Treisman, 1990; Treisman, 1985, 1992; Treisman & Asera, 1990). In particular, the black students, who were more likely to fail or barely pass calculus, tended to study in isolation, separating their academic lives from their social lives. In contrast, their Chinese classmates, who were more likely to achieve high grades in calculus, tended to form cohesive support groups that factored heavily in the ability of these students to navigate the system. The first workshops began in Fall 1977, and the program that developed from this research proved to be not only successful, but portable. This section summarizes some of the literature on implementations at public research universities.

The overall goal of a mathematics workshop program is to increase student achievement by creating small diverse communities of learners who work on challenging mathematics in visible and collaborative ways. A key aspect of the program is that it emphasizes honors-level mathematics, not remedial. It is also important to note that across ESPs there is little uniformity of theoretical frameworks around group work and classroom culture (cf. the excellent overview of theoretical perspectives on classroom interaction in this collection by Bowers and Nickerson). This lack of uniformity is a result of the decentralized, spontaneous, and pragmatic spread of the ESP model. Some structural features, however, are much the same from one instantiation to another (Alexander, Burda, & Millar, 1997; Asera, 2001; Moreno, Muller, Asera, Wyatt, & Epperson, 1999; Murphy, Stafford, & McCreary, 1998; Treisman & Asera, 1990). In general, students in calculus at large research universities attend a lecture along with several hundred other students. They also enroll in a recitation section. During traditional recitations, a graduate teaching assistant answers homework questions at the chalkboard. In the ESP model, however, these recitations are replaced with sessions that have come to be known as workshops. Students in these workshops continue to attend the same lectures and take the same exams as the students in the traditional recitations. However, workshops typically are not only smaller than traditional recitations (12–20 students instead of 25–30), but also meet for longer blocks of time (75–120 minutes instead of 50) and more often (2–3 times per week instead of 1–2), a commitment for which students may receive additional credit hours.

For each workshop session, the graduate teaching assistant (GTA) constructs a worksheet, sometimes with the aid of a problem database (Hsu, 1999), composed of challenging problems. Asera (2001) characterized the features of the problems used on ESP worksheets: good problems pull ideas together from across multiple chapters, fill in gaps in student preparation without resorting to remediation, and are challenging enough to incite student collaboration and to teach students to persevere. During the workshop class time, students work individually and collaboratively on these problems (not on homework), while the GTA keeps the conversations moving forward without directly answering students' questions (Alexander, Burda, & Millar, 1997; Kline, 1994). Although the ESP literature does not tend to discuss GTA training and development in detail, many programs have in-house training sessions (e.g., Hsu, 1996) or send their GTAs to an annual session at the University of Texas at Austin (Epperson, 2003).

Several journal articles provide evidence of the ESP model's success and identify several kinds of effects. For example, ESP participants tend to achieve higher grades in calculus than underrepresented students who do not participate in the program—and often ESP participants receive higher grades than their (nonparticipant) white and Asian classmates (Alexander, Burda, & Millar, 1997; Bonsangue, 1994; Fullilove & Treisman, 1990; Moreno, Muller, Asera, Wyatt, & Epperson, 1999; Murphy, Stafford, & McCreary, 1998). ESP participants are more likely to complete the calculus sequence than nonparticipants (Alexander, Burda, & Millar, 1997; Murphy, Stafford, & McCreary, 1998). Furthermore, underrepresented minority students who participated in an ESP are more likely to persist in a calculus-based major (Bonsangue, 1994; Murphy, Stafford, & McCreary, 1998). The studies have had issues with defining appropriate control groups, if for no other reason than not being able to control for self-selection bias, i.e., the fact that ESP students choose to enter the program. Nevertheless, for the most part, the outcomes cited in these studies cannot be explained by preexisting differences in admissions criteria (e.g., SAT scores) between the ESP participants and the control groups. While there is scant research examining which program features contribute most to which outcomes and for what reasons, Herzig and Kung (2003) attempted to isolate the effects of cooperative learning and length of time in class. They concluded that "it is likely that the success of ESP results from some combination of the various aspects of the program, including length of time, use of group learning, types of students, and community-building activities" (p. 46).

Another question that arises regarding participant selection is the question of race identification. On the one hand, in the current post–affirmative action political climate, identifying potential ESP participants can be nontrivial. On the other hand, ESP has always emphasized diversity, recruiting students from all ethnic and racial backgrounds. For the most part (with the exception of Fullilove and Treisman [1990], which is outdated), details related to recruiting participants have been left to oral tradition and have not been systematically documented in the publicly available literature. It is believed that personal interactions with other units on campus and with high school teachers can facilitate the participant selection process. Some ESPs target specific high schools or geographic regions. Some work closely with units on campus that serve incoming freshmen. Several of the existing programs contact potential participants by letter. Then during summer freshmen advising time, ESP personnel meet with these students to explain the structure and philosophy of the program and, in some cases, ask students to pledge participation in the program.

In many cases, ESPs make use of both graduate and undergraduate teaching assistants. Although, again, this has not been the subject of research in the context of ESP, there is a belief among some program personnel that employing former participants as undergraduate teaching assistants has benefits at multiple levels. It is likely that the current ESP participants benefit from interacting with an upperclassman role model. It is also likely that the undergraduate teaching assistants themselves benefit both by mastering the course content at a new level and by experiencing teaching as a profession. This structure, where newcomers participate in increasingly legitimate and central ways, parallels that of the successful sites of stable communities of practice discussed in varied settings by Lave and Wenger (1991) and in mathematics teacher settings by Hsu (2004).

The process used to select graduate teaching assistants seems to be even more varied. For example, some coordinators identify potential graduate teaching assistants through informal conversations with department staff who interact with the GTAs and can discuss personalities and interests. Other departments rotate the teaching assignment through the GTAs so that it is not seen as a special teaching assignment (which might marginalize the program). The impact of these various processes has not been systematically investigated. However, teaching an ESP workshop is considerably more difficult than teaching in an average section, and we believe that ESP GTAs need to be carefully chosen for skill and diligence. Analogous to the belief that undergraduate teaching assistants themselves benefit, there is a belief that ESP experience can positively affect the teaching philosophy that graduate students take into their positions as teachers (Kung, 2005).

In her milestone report, Asera (2001) was one of the first researchers to document the role of the ESP coordinator. She noted that, behind the scenes, the ESP coordinator is responsible for the program environment. In practice, this means that the coordinator is responsible for identifying and recruiting students, and perhaps GTAs, as well as monitoring the structures that enable a community to form. Other coordinator responsibilities include student advising and organizing social events. In the ESP context, there is a need for research related to each of these aspects, including the role of the coordinator and the relative importance of program features such as use of challenging problems, use of group learning, length of class time, designated space, student advising, and social events. Some of these features have been studied in other contexts, including college in general (Light, 2001; Tinto, 1993), but the relative importance of each to the success of ESP is as yet undetermined. Nevertheless, twenty years after the initial ESP workshops, Seymour and Hewitt (1997) published work in which minority participants characterized programs that work best: "well-advertised, departmentally-based, field-specific, open to all students and accessible" (p. 389). Although these students were not specifically referring to ESP, the ESP model certainly emphasizes all of those features.

Essential Questions from Recent Research

As noted above, the initial research base for ESP began in 1974. More than three decades have passed since then, with several important key issues emerging from careful research and the hard-earned wisdom of practitioners. Anyone who hopes to support high minority achievement in collegiate mathematics can expect to grapple with these issues or risk repeating the mistakes of the past. This section is devoted to considering these questions in detail, pointing to relevant research and examining the ways ESP has wrestled with these emerging issues.

Question 1: Do Your Introductory Courses Introduce? Do Your Preparatory Courses Actually Prepare?

The original Emerging Scholars Programs, located at research institutions, focused on calculus courses as being the most important and tractable. The calculus courses' importance stemmed from their being the primary filter course for mathematics majors, with research revealing that African-Americans and Hispanics were failing calculus courses at a higher rate than their Caucasian and Asian counterparts despite strong preparation and high test scores. The calculus courses were tractable in the sense that they were viewed by the mathematics departments as important enough to the major that resources could be directed to building a community around complementary workshops. Many ESPs found success focusing on first-time calculus takers, mainly first and second-year students. The rationale was that newer students were vulnerable due to lack of experience, but also not yet scarred by failing calculus, so one could still build around them a community with a challenging honors environment.

While ESPs have historically focused on calculus, research has increasingly called attention to the role of the preparatory mathematics courses in determining a student's future trajectory in the field. It is worth noting that what counts as preparatory varies from one institution to another. In some institutions—for instance, research universities—the preparatory course might be precalculus; at other institutions—for instance, community colleges—it might be college algebra or below. In any case, minority students tend to begin their coursework one course before the official start of the mathematics major (Ruddock, 1996). In fact, national data reveal that underrepresented minority undergraduates disproportionately place into remedial mathematics courses in college (see Table 2). This is symptomatic of a national phenomenon, as reported in a study by the National Science Foundation (1999):

> The mathematics course-taking patterns of black students have an effect on their participation in other science, mathematics, and engineering fields. Participation rates are high at both the precollege level and at the levels of college algebra and precalculus. The participation rate is lower in calculus and lower than it should be in finite/discrete mathematics given the proportion of black students who major in computer science. (p. 44)

Certainly not all students who enroll in mathematics courses at the developmental, algebra, trigonometry, and precalculus levels intend to continue into calculus. However, these courses serve many students who do intend to pursue a calculus-based major (e.g., about 69% in Bergthold and Ng, 2004), and these courses are disproportionately populated with minority students. Thus, the experiences of minority students taking preparatory classes should be rethought. This may mean redistributing department attention and energy. Often mathematics departments value, in decreasing order, graduate courses, upper-division courses, lower-division courses, introductory major courses, and preparatory courses. That is, departmental investment tails off as one looks earlier into the major sequence—from courses that are seen to produce majors to courses that are not seen as feeding the mathematics-major pipeline. To effectively support the success of minority students, however, we need to work on the courses with which these students actually begin.

Table 2
Percentage of first- and second-year undergraduates who reported (1999–2000) ever taking remedial mathematics courses (National Center for Education Statistics, 2002, p.132)

Ethnic Group	% Taking Remedial Mathematics
White	13.3%
Black	19.5%

Hispanic (any race)	20.4%
Asian/Pacific Islander	12.6%
All Undergraduates	15.0%

If one frames the obstacle to building diversity in mathematics as high failure rates, a tempting solution is to achieve low failure rates by helping students not fail, as opposed to the ESP philosophy of pushing students to excel. Ruddock (1996) reframes the problem in terms of the course trajectories of students, showing that one must worry not just about how students do in preparatory courses, but about how they do in subsequent courses. Ruddock studied the success of students at the University of Texas at Austin who began their mathematics careers in precalculus compared to those who began in calculus. The course title *precalculus* emphasizes its role not as a proper subject of study, but as preparation for success in calculus. Thus, Ruddock tracked the success of groups of *precalculus-first* and *calculus-first* students. Defining *success* as receiving an A or B in a course, she found the precalculus group had a significantly lower percentage of success in both first-semester and second-semester calculus. This result held even when she restricted the study population to students scoring between 500 and 600 on the SAT Mathematics test to control for mathematics aptitude. The result also held when disaggregated by ethnic group. One particularly intriguing result was that students who scored a B in first-semester calculus were less likely to succeed in second-semester calculus if they were precalculus-first. She also examined mathematics major graduates to see what their beginning course was. Overwhelmingly, they began in calculus. Ruddock found similar results from the available data at the University of California at Berkeley. Schattschneider (in press), in a study of two four-year colleges and two two-year colleges, also found that between one-half and two-thirds of all students who passed precalculus did not pass first-semester calculus.

Attempts to adapt the ESP model to address underpreparation have met with varying degrees of success. For example, at the University of California at Santa Barbara, the initial ESP calculus results were so encouraging that they began including participants with lower and lower levels of preparation. The effect was negative both for the students and for the workshops as a whole. On the one hand, some students were put into a situation that was outside their capacity at that time; on the other hand, the workshops suffered under the strain of trying to support these students. The rule of thumb seems to be that students in a calculus workshop need to be within one standard deviation of the mean in terms of their mathematics background. In a more positive example, the University of Kentucky successfully took advantage of local history and resources to focus on precalculus as well as calculus. This work continues there as the successful MathExcel program. The strength of ESP lies in emphasizing excellence, but the details of how to implement this philosophy successfully and broadly in courses that precede calculus have yet to be pinned down.

Question 2: How Salient Should One Make a Student's Minority Status?

Minority academic performance is typically framed as an issue requiring the institution to serve its minority students differently, with solutions then framed as the creation of special programs for minority students (e.g., Minority Engineering Programs). Often, students are recruited for their minority status, and this status is highlighted throughout the proceedings.

Over the last three decades, this has been a pragmatic, simplified approach to the complicated issue of ethnic identity. Yet this approach is really too simplistic. In a seminal study, Seymour and Hewitt (1997) interviewed science, mathematics, and engineering (S.M.E.) undergraduate majors at seven institutions (none of which had an ESP). Among the 335 participants were 88 students of color—black (27), Hispanic (20), Asian-American (35), and Native American (6). From these interviews, Seymour and Hewitt identified areas that specifically affect students from these populations: "differences in ethnic cultural values and socialization; internalization of stereotypes; ethnic isolation and perceptions of racism; and inadequate program support" (p. 329). They also caution, however, that despite research efforts to characterize issues common to all students, and additional issues common to minority students, it is naive to think of minority students, or any group of minority students, as a uniform population. Seymour and Hewitt emphasized that

> differences among and within different racial and ethnic groups have greater significance for the chances of success than had previously been assumed. ... Failure to take such differences into account may, in and of itself, explain why programs intended to recruit or support "minority students" have not improved their chances of survival in S.M.E. majors. ... [Indeed], any statement purporting to summarize the experience and attrition risks of all non-white S.M.E. students tends to distort and mislead. "Minority programs" based on presumption of needs common to all "minorities" tend to founder, quite largely, because they do not address the needs of specific racial and ethnic groups. (p.322)

Race and ethnicity have always been much more complicated than can be captured by the simple categories used to track students. But race is more complicated today than it was even a decade ago. Indeed, the ethnic landscape has been changing. Racial integration of neighborhoods has been steadily increasing, and the number of multiracial families is growing rapidly. Furthermore, recent research calls attention to the idea that the act of highlighting people's identity (gender or ethnicity) can have unexpected and unintended negative consequences. Also, one cannot ignore the significant shifts in the political landscape with respect to affirmative action, which have large implications for many race-targeted programs. In the following sections, we present four themes from research related to the question of minority status: (1) Stereotype threat, (2) Multiethnic and multicultural racial identities, (3) Legal and political challenges to race-targeted programs, and (4) The changing landscape of race.

Stereotype threat. A fascinating series of experiments show that by making students' minority status salient, one can influence their test performance measurably. The original series of studies by Claude Steele, Joshua Aronson, and Steven Spencer used difficult questions from a GRE verbal test (Steele & Aronson, 1995). Two groups of students were given the same test. Each group had both white and black sophomore college students of equal academic qualifications randomly assigned. However, one mixed-race group was told the test measured their ability, and the other group was told it was not a test of ability but was instead designed to discover how students approached these problems. The performances of all the white participants and the "non-ability-measured" African-American students were similar, but the "ability-measured" group of African-American participants did measurably worse.

The theoretical explanation is that African-American students in the "ability-measured" group felt significant pressure not to confirm the negative stereotype about African-Americans having low intellectual abilities. This pressure, dubbed *stereotype threat*, caused them to underperform on the test. Neither the "non-ability-measured" group nor the white students experienced stereotype threat, and their performance was as expected. To show that students were actually experiencing a heightened awareness of negative stereotypes, Steele and Aronson repeated the original experiments with two intriguing pre-tests. First, participants were given a series of words with some letters known and some unknown, and were asked to complete the word by finding the missing letters. The twist was that in some cases there were multiple correct responses, some of which were related to stereotypes and some not. They found African-American participants in the "ability-measured" group answered with significantly more words relating to racial stereotypes than the "non-ability-measured" African-American participants or any of the white students. Students were also given a sports and music preference survey right before the test, and African-American students in the "ability-measured" group reported considerably less interest in stereotypically African-American preferences like basketball and hip-hop compared to the "non-ability-measured" group. This last result was interpreted to mean that students about to take an "ability-measured" test were unusually intent on not being stereotyped by their race.

One question left open by the original work was whether stereotype threat was the result of internalized self-doubt within African-American students or whether stereotype threat was triggered externally by making negative stereotypes salient. Later experiments extending the original work seem to have settled the question in favor of external triggers (Steele, 1997; Aronson, Quinn, & Spencer, 1998). For instance, white male students (who, as a group, are supposed to not have the same internalized self-doubt) had their mathematics test performance depressed when they experienced external triggers. That is, when they were told that Asian students outperformed whites, they experienced an externally induced stereotype threat (Aronson et al., 1999). Stereotype threat performance depression has been replicated for high-achieving female mathematics students (Spencer, Steele, & Quinn., 1999) and Hispanic students (Aronson & Salinas, 1997) as well. One intriguing small-scale study by Inzlicht and Ben-Zeev (2000) showed that female mathematics test performance decreased in proportion to the number of males in the room even though verbal test performance was unaffected. In a fascinating experiment with Asian-American women, participants were given one of three questionnaires that induced external stereotype threats: Questionnaire 1 made their female identity salient by asking questions about their sex and gender identity, Questionnaire 2 made their Asian identity salient, and Questionnaire 3 (the control condition) asked questions unrelated to sex or race. Once these questionnaires were completed, all of the groups were given a quantitative test. The results revealed that the "female" group (those receiving questionnaire 1) performed worse than the control group, while the "Asian" group (those receiving questionnaire 2) outperformed the control group (Shih, Pittinsky, & Ambady, 1999).

There is some evidence that telling participants explicitly that stereotype threat could affect them can eliminate its effects. For instance, Johns, Schmader, and Martens (2005) performed a test comparing performance on a mathematics test by women in a "non-ability-measured" group, the usual threatened "ability-measured" group, and a threatened "ability-measured" group that was then informed about stereotype threat and its likely effects on performance. While the second group performed worse than the first and the third, the "informed" group performed as well as the first. Another study (McIntyre, Paulson, & Lord, 2003) showed reading about successful women helped alleviate the effects of stereotype threat.

Multiethnic and multicultural racial identities. A good deal of research and practice makes a simplifying assumption that when we assign students to an ethnic category, they themselves identify with that categorization. This can be a helpful working assumption, and indeed some ESPs make this working assumption, but research has shown that it is becoming increasingly problematic. In what follows, we present four recent trends that complicate issues of race.

First, this generation of students entering college, regardless of ethnicity, is more likely than past generations to have grown up in a racially diverse community. To be certain, racial integration is not occurring at a constant level and is not ubiquitous. According to the Lewis Mumford Center's analysis (2001) of census data, both urban and suburban neighborhoods still tend to be segregated by race. However, there was a decrease in segregation in the 1980s, and a smaller, but still significant, decrease in the 1990s. Though the Mumford Center expresses worries about the slowing rate of diversification of neighborhoods, the fact remains that segregation continues to decrease, and the effects have been cumulative. Hence, our students may have very complicated ethnic identities compared to those who grew up with greater segregation a generation ago.

Second, this generation of students is more likely to identify with multiple or mixed ethnicities. Since 1960, rates of intermarriage between ethnicities have increased in every ethnic category. In 1960, 0.4% of all marriages were interracial; in 1980, 2% were interracial, and by 1992, 2.2%. In 2000, the census began recording a wider range of multiethnic identifications, and interracial marriages (including situations with two partners of mixed race) were recorded as 7.4% of total marriages. Interracial cohabitation made up 15% of the cohabitation responses (U.S. Census Bureau, 2003a). These rates are higher when restricted to the college-educated population (Qian, 1997, and Kalmijn, 1998), which makes this effect even more significant for college settings, as college-educated families are more likely to send children to college.

Third, what constitutes "black" identity continues to evolve. While a number of programs focus on urban poor African-Americans, there continues to be a growing African-American middle class. Pattillo-McCoy (1999) surveys the current research on the black middle class, and finds that the proportion of blacks with white-collar jobs has been increasing since World War II. At first the growth was explosive, triggered by the post-war economic expansion and the Civil Rights movement; growth slowed in the recession of the 1970s and has not to date recovered its rapid pace. Nonetheless, the percentage of African-Americans in middle class occupations rose from 39.6% (1980) to 44.9% (1990) to 49.8% (1995). Alba, Logan, and Stults (2000) argue that middle-class African-Americans live in neighborhoods that are significantly more integrated than the neighborhoods of inner-city blacks. To be sure, there is still significant racial inequality between the black and white middle classes: the black-white income gap remains, black middle class jobs are lower paying, and the black middle class lives on average in less safe neighborhoods. By almost every economic and social measure, the black middle class lags behind its white counterpart. Nonetheless, the black middle class continues to grow, is socially distinct from the urban black lower class, and is overrepresented in the college population. Sacks (2003, p. B7) reports that among black students at elite colleges, "60 percent of their fathers and more than half of their mothers were college graduates. One-third of their fathers had advanced degrees" (citing Massey, Charles, Lundy, & Fischer, 2002) and "nearly nine of 10 African-American students admitted to the most competitive colleges had come from families in the top two tiers of the social and economic ladder" (citing Bowen & Bok, 1998).

Another recent phenomenon affecting "black" identity is the new attention to subgroups of American-Americans: blacks whose ancestors were forcibly taken to America for slavery, immigrants from the West Indies, and immigrants from Africa. Students from each of these different subgroups are treated the same as African-Americans, despite the subgroups having completely different social histories. In fact, tensions between American blacks and West Indian blacks over jobs and culture date back to the early 20th century (Woodbury, 1993). In a provocative article, Phelps, Taylor, and Gerard (2001) claim that descendents of slaves have increased levels of cultural mistrust and attachment to their ethnicity compared to West Indian and African immigrants. These issues will only intensify in the coming years, as U.S. Census Bureau data (see Table 3) show that the percentage of the U.S. foreign-born population born in Africa has approximately doubled every decade. This immigrant group is more educated (88% with a high school education) and more affluent (more than a third more per-capita income) than native-born Americans and Asian immigrants (Speer, 1994). Half of the African-born immigrants are black.

The growth in the numbers of blacks who are voluntary immigrants from the West Indies and Africa has led to increasing debate over what constitutes black identity and the purposes of affirmative action programs (Johnson, 2005). Rimer and Arenson (2004) report from Harvard that Professors Lani Guinier and Henry Louis Gates caused an uproar when announcing "the majority of [the 530 black Harvard undergraduates] — perhaps as many as two-thirds — were West Indian and African immigrants or their children, or to a lesser extent, children of biracial couples." Furthermore, Rimer and Arenson cite a study of selective universities which showed "41 percent of the black students identified themselves as immigrants, as children of immigrants or as mixed race." Careful studies of this phenomenon at any one site are made difficult by the general aggregation of all these groups in campus statistics as "black."

Table 3
African-Born Living in the U.S. (U.S. Census Bureau, 1999, Table 2; 2003b)

Year	1960	1970	1980	1990	2000
Number of African-born living in U.S.	35,355	80,143	199,723	363,819	~870,000

Fourth, the composition of the Hispanic population is changing rapidly. It is well-known that the Hispanic population is the fastest growing minority group in America. The Hispanic population in the United States grew 57.9% between 1990 and 2000, increasing from 22.4 million to 35.3 million (U.S. Census, 2001a). One striking finding from the census was that the national makeup of the Hispanic population is changing. Historically, most Hispanics have been of Mexican, Puerto Rican, or Cuban descent. However, in the last decade, Hispanics from other countries nearly doubled from 5.1 million to 10.0 million, and the proportion of all Hispanics has increased from 22.7% to 28.3%. Prominent subgroups were Salvadorans, Guatemalans, Hondurans, Colombians, Ecuadorians, and Peruvians. One should not underestimate the effects of identification with distinct subgroups of the Hispanic population. Students may resent being lumped in with other subgroups with whom they feel no identification, or worse, rivalry. For instance, developers of bilingual educational software for the Los Angeles public schools reported friction from test groups over voiceovers in multimedia. The conflict was over the perception that the choice of regional Spanish accent showed bias towards either students of Mexican descent or students from other Hispanic groups, who considered themselves distinct and rival subgroups.

We only have space to mention briefly that an analogous issue affects the lumping together of students as "Asian". This paper itself is an example of this error. We have concentrated mainly on issues affecting black and Hispanic students, ignoring the fact that there are wide differences in academic performance among Asian subgroups. These subgroups have differences in socioeconomic status, national identity and immigrant experiences. Even within these subgroups, students will have had widely varying amounts of time since their family's immigration to the U.S.

Legal and political challenges to race-targeted programs. The *Hopwood v. Texas* decision made a splash nationally upon its issuance in 1996, and again in 2001, when the University of Texas declared an end to its legal appeals. The decision itself was fairly limited: it forbade the use of race-based admissions criteria in higher education institutions in the 5th Circuit of Appeals (Texas, Louisiana, and Mississippi). Furthermore, the Supreme Court refused to hear an appeal on the technical basis that the University of Texas Law School had changed the admissions policy in question, leaving open the possibility of revisiting the question of the merits of the appeal in the future. Nonetheless, the *Hopwood* case signaled a broader shift in the political climate against affirmative action. For instance, the University of California system ceased the use of race for admissions decisions even before Proposition 209 was passed in 1996.

Colleges and universities are increasingly choosing to stop the use of racial preferences, even for admissions to internal programs, in response to the political atmosphere rather than out of any specific legal obligation. The Supreme Court did revisit the issues of racial preferences in the twin 2003 decisions on *Gratz v. Bollinger* and *Grutter v. Bollinger*, and the Court issued a subtle (and puzzling to many) dual decision which allowed administrations to use race as a factor in admissions, but not in a mechanical way. This decision gives some legal maneuvering room for race-based programs, but the practical climate remains negative, and as a trend, campuses are putting pressure on programs to justify targeting students by race, which is why ESP has had an advantage over most other interventions aimed at supporting minority success in that the program has always recruited students from all ethnicities.

ESP and the changing landscape of race. One of the essential features of ESP is the need for a truly diverse classroom. Part of the effectiveness of the workshops comes from having students seeing other students from a wide range of ethnicities struggling and then succeeding with the same mathematics. For example, deep stereotypes can be broken when an African-American sees a Chinese student struggling and gets a more realistic measure of the work of mathematics. It is possible that this aspect of ESP helps to defuse the effects of stereotype threat. It certainly facilitates exposure to a variety of perspectives, approaches, attitudes, and values.

To these ends, ESP workshops have always recruited students of all races, and aimed for a mix of students. Because of this, at the University of Texas, ESP suffered less than most other programs aimed at supporting minorities in the post-*Hopwood* era. The University of Texas ESP does recruit black and Hispanic students more heavily, but it also targets rural whites, another "at-risk" group, and aims for an "ideal" calculus classroom in which minorities are more represented than they are usually, but are by no means the only students. Undoubtedly, ESP will need to evolve in response to the increasing mixing of ethnicities and increasing complexity of black and Hispanic identity. However, in principle, the ESP workshops have already been constructed to bring together a rich mix of students from many ethnic backgrounds, and it seems possible that this mix will only grow richer as student ethnicity evolves.

Question 3: How Can One Design a Program That Lasts?

In many ways, this is the most important practical question to be answered. ESP is an interesting program because many people in many different settings have attempted to adapt ESP to their local setting. Hence, the ESP community has gained experience with a wide array of locales. While we will focus on the experience of Emerging Scholars Programs, the structural analysis will be relevant for any campus efforts to increase student achievement in specific disciplines.

One might think that with all the experience of the years of work on ESP, there might be some kind of algorithm for optimally designing a local ESP. But the reality is that the reasons for success and failure at different sites are still mysterious. There are, of course, some rules of thumb and patterns that have emerged, but this is not the same as a systematic exploration of the factors that contribute to lasting effectiveness of a program. The most definitive work on the factors contributing to ESP's effectiveness is by Asera (2001). However, Asera cautions:

> When [ESP] staff described the program in comprehensive detail, other campuses tended to reproduce those details as exactly as possible, which was usually inappropriate. But when the staff resorted to describing instead the program's driving principles, that strategy, too, proved problematic, since the principles without the weight of specific examples were far too easily misunderstood. (p. 29)

The first step in designing a successful program is understanding local conditions. We present here a framework the authors have found useful for this purpose. One often refers to a system's potential to change as its *capacity*. Such a notion is more productive when broken into the components of *human capital, social capital, material resources,* and the *structural support* of the institution. These components change with time; it is crucial to understand them not just as resources at hand, but ones with a local history and a future trajectory.

Human capital refers simply to the knowledge, skills, and goals of the people available to do the work of a project. In the case of ESP, this means the project staff, the campus faculty and administrators that support and guide the project, and the graduate instructors who teach in the program. *Social capital* refers to the bonds of trust and reciprocity residing in a social network—e.g., the extent to which the members of a department cooperate internally, with the administration, and with other departments and student support units on campus. *Material resources* refers to funding, physical space, equipment, and other tangible resources. *Structural support* refers to the institutional arrangement of hierarchical relations, obligations, and incentives—e.g., policies encouraging joint work between academic departments and student support units, the process of reviewing and altering the sequence and the content of courses, and the college incentives for doing service or building innovative programs.

Starting a program requires a different configuration of resources than maintaining and developing a program. The experience of ESP is that there needs to be at least one driving advocate, and that advocate should be a senior faculty member. Such a person will have a better understanding of the structural supports available and, through reputation and history, wield more social capital in the department and campus social network. It is important to gain the help of people who have experience and access to the higher campus administration and national networks of scholars.

Compatibility with a college's structures of support is a crucial consideration. A program can exist briefly on short-term resources, such as a heroic individual leader (human capital), outside grants and other soft money (material resources), or the piecemeal support of sympathetic faculty and staff (social capital). However, for a program to last, it must ensure a future flow of each of these resources. Good structural support ensures the future resources that keep a program thriving and growing. What this means will change depending on the campus. But there are several themes that have emerged across many ESP projects.

First, as quickly as possible, the initial efforts should take the form of departmental committees given the power to develop the project. Committee work is a framework that can attract further human capital and invoke a broader sweep of a department's social capital. Perhaps most importantly, departmental committee work fits into the usual work and reward structure of a college institution. Furthermore, a committee institutionalizes a project as a departmental priority and helps a program survive turnover in faculty leadership.

Similarly, it is important for ESP workshops to be given for mathematics department course credit (as opposed to no credit or general education credit) as a lower-division seminar attached to a calculus course. Giving course credit structurally commits the mathematics department to devoting ongoing and future resources to the program in a way that is impossible if the program is housed in a non-departmental student support unit or in some other administrative unit. It commits the department to assigning teachers and staff (human capital) and classrooms and materials (material resources) into the future.

Some ESPs have designated office and class space on campus, and anecdotal evidence shows it is a great advantage to have this. It certainly adds an air of stability and legitimacy to an effort. Students and staff come to consider the physical location a "home," and it gives people a common site to establish continuity across different generations of staff and students. Structurally speaking, once an academic program has a physical location, it takes more effort for an institution to move it or eliminate it. If a program is lucky enough to get a physical foothold someplace, it will be under continual pressure from different sides to justify the use of the space. Nonetheless, having a site is a powerful way to ensure future access to space and equipment material resources.

One common structural obstacle is institutional discouragement of cooperation between departmental efforts and student support units. In principle, the student support units are potential resources in any effort to support minority students. In practice, they exist in a historical context. Often, support programs are underfunded and live on the edge of being merged or eliminated. It is not uncommon for such programs to develop an adversarial attitude toward both the administration and the academic departments. Historically, departmental initiatives may have proceeded without input from the support unit and served to sap both resources and students from the support units. In these cases, it will take work and real collaboration to avoid "turf wars." Unfortunately, many colleges don't give incentives or support for such difficult efforts, often using the excuse that such partnerships already ought to exist. If members of the department have good relations with the support units, that would be powerful social capital to draw upon.

One enduring challenge to ESP is dealing with turnover in human capital. For instance, ESP workshops are run by graduate instructors, and thus are guaranteed turnover in the classroom leadership. Naturally, different ESPs address this issue differently. The ESP at the University of Texas at Austin holds multiday teaching assistant orientations run by veteran workshop leaders. Workshop mathematics problems are passed from generation to generation in paper copies and in Internet-accessible searchable databases (Hsu, 1999). However, as ESP has become institutionalized in certain locations, it has been a challenge to maintain the highest standards for workshop leaders. In the early stages of such a program, often the first instructors are highly committed educators, sometimes drawn from the mathematics education group on campus. As the program becomes less novel and more routine, there is a danger the mathematics department will see the program as just another piece of its academic program and either make little effort to recruit excellent instructors for the program, despite the increased difficulty of the teaching task, or, in the worst case, intentionally randomly distribute graduate instructors out of a misguided sense of fairness.

The recurring, underlying caution is that every project must suit local institutional goals and culture. Indeed, it is essential that early in the process the leadership for a new ESP investigate the department and college's true needs. This means investigating the backgrounds and aspirations of the students one means to support and getting a true picture, both historical and projected, of the landscape of the different components of capacity mentioned above. What courses are students taking? What preparation do they have? Are there enough students to fill a calculus workshop, or are the students placing into precalculus or directly out of first-year calculus with Advanced Placement credit? Are majors getting weeded out in a course later than calculus? Because of the diversity of local situations, there is no simple formula for designing a program that lasts. The one thing that is certain is the better one understands institutional history, resources, and needs, the better one's chances at making an enduring difference.

Conclusion: Thirty Years of Research to Practice

ESP was created in response to a practical crisis at the University of California at Berkeley of overwhelming failure at the calculus level of black and Hispanic students, but was rooted in ethnographic research on black and Chinese communities of mathematics students. The last three decades have seen significant progress for minorities in mathematics, but there is still farther to go, and the issues are evolving with time and new knowledge. Research has highlighted the importance of different hidden structures in people's relationships to their ethnicity and academic environments, the landscape of race relations has been changing over time, and the political landscape has shifted as well.

Although ESP and its adaptations have evolved, the underlying philosophy remains much the same: "the philosophical stance that informs all the essential elements of the ESP model is that its purpose is not to 'fix the students,' but rather to change at least a small part of the university environment, by making it more welcoming, both socially and academically" (Asera, 2001, p. 19). In particular, the model continues to emphasize excellence, diversity, and community.

Along with the general trends and issues identified in this paper, three other major challenges are emerging specific to ESP. First is the issue of creation of mathematics majors. ESP has documented great success at having its students succeed in calculus and go on to science and engineering majors. However, in practice, it takes a significant mentoring structure to encourage ESP students to major in mathematics. In fact, this issue afflicts mathematics as a college discipline nationally. From 1993 to 2001, the absolute number of mathematics bachelor's degrees awarded has decreased every single year, from 14,870 in 1993 to 11,748 in 2001 (NSF, 2004), to the point where mathematics constitutes a mere 2.8% of all science and engineering bachelor's degrees. ESP has in fact produced a number of mathematics majors, but mainly in situations where extraordinary opportunities were created for students to engage in the work of mathematics, such as independent study and summer internships.

A second challenge is one of cooperation across ESP sites. One of the strengths of ESP has been its adaptability across diverse institutions. However, this has led to a lack of systematic and sustained cooperation across ESP sites. There has been cooperation to be sure, but it has tended to be ad hoc, e.g., the gathering of ESP veterans from the University of Wisconsin, the University of California at Berkeley, and the University of Texas at Austin to categorize and annotate the database of worksheet problems described in Hsu (1999). Other efforts have been informal, e.g., the sending of graduate teaching assistants to the new-GTA training at the University of Texas at Austin ESP. There is a growing movement by ESP sites to share experiences and resources as well as to document collectively the findings of practice.

A final challenge is the issue of leadership transition. The most successful programs are starting to encounter the issue of generational change in the program leadership. The University of California at Berkeley, the University of Kentucky, and the University of Illinois at Urbana-Champaign have seen the recent departure of the original torch-bearing faculty who established the local ESPs. Time will tell how these ESPs and others evolve and how well they continue to show resilience as a second generation of leadership takes charge, in a climate that is socially and politically different than it was thirty years ago.

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