Examining Selected Outcomes of K-14 Reform: College Readiness among New Community College Entrants in Four Disparate Settings

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Introduction

A rise in remediation of new entrants to higher education is increasingly seen as an indicator of deficiencies in the entire P-16 educational system (Primary through grade 16). The existence of remediation in higher education suggests failures in preparing high school graduates for college-level course work (Kirst, 1998; Palmer, 2001). As students transition into higher education without adequate academic competencies, postsecondary institutions have no choice but to remediate them in fundamental academics (math, reading, writing) typically associated with secondary education. Foreseeing rising costs associated with growing postsecondary enrollments, more four-year colleges and universities are relegating the compensatory education of underprepared students to community colleges (Lewis, Farris, & Greene, 1996). Caught in the middle, remedial education increases within the nation's community colleges that promise open access for all students. In their study for the U.S. Department of Education, Lewis, Farris, and Green (1996) estimate 30% of new entrants to community colleges require remedial education, but Grubb (1999a) suggests this figure is too conservative. He suggests the remediation rate of new community college students ranges from 25 to 80%, depending upon the local communities served. More specific to recent high school graduates, Kirst (1998) estimates 50% of graduating high school seniors entering community colleges require remediation. No matter whose estimate is used, these figures confirm a high rate of remediation among new community college students.

Educational reforms designed to enhance secondary students' academic achievement have emerged during the past decade, including state-mandated changes in high school graduation requirements and raised academic standards. Further, educational reforms such as the Coalition of Essential Schools, High Schools That Work (HSTW), and others have proliferated, promising improved academic outcomes as a result of progressive policies to address the needs of all students, curricular changes emphasizing better academic preparation, and organizational restructuring that decentralizes authority while raising accountability requirements (Tyack & Cuban, 1995). Supported by federal legislation and funding, other reforms such as technical preparation (tech prep) and School-To-Work (STW) Opportunities have been implemented, attempting to articulate secondary and postsecondary programs, integrate academics with career-technical curriculum, and enhance student achievement utilizing partnerships between schools and businesses.

Whether any of these educational reforms have impacted students' educational outcomes, particularly their readiness for college – placement in courses generating college credit without the necessity for remedial education – is largely unknown. Whereas all of these reforms purport to impact academic preparation, to date little is known about their impact on student transition to college and subsequent behaviors and outcomes at the postsecondary level. This study addresses this problem by investigating college readiness among students who participated in a federally-funded K-14 (Kindergarten through grade 14) educational reform known as tech prep, an initiative that has extended to the majority of high schools and nearly all community colleges nationwide (Hershey, Silverberg, Owens, & Hulsey, 1998). This study draws upon data collected via a longitudinal study funded by the U.S. Department of Education, known as Community College & Beyond (CC&B) (Bragg et al., 1999)[1]. One overarching purpose of this study was to determine the college readiness (also referred to as college placement) of students who participated in tech prep versus those who were non-participants in four tech prep consortia located in different regions of the United States.

The Problem

Many graduating seniors enter community colleges without adequate educational competencies to be successful in college, and increasingly community colleges provide remedial instruction to assist them to fulfill basic academic requirements (Lewis, Farris, & Greene, 1996). Responsibility for remediation of these students – to prepare them to be "college ready" – is transferred, by default, from secondary schools to postsecondary institutions. For many students needing remedial course work developmental services are also needed, including peer tutoring,

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counseling, and learning labs (Shaw, 1997). Through these various strategies, remedial education is relied upon increasingly to bring students up to a level that enables them to be successful in their collegiate pursuits.

Among approaches advocated to reform education across the K-16 spectrum, many reforms emphasize standards-based testing (Palmer, 2001), with some concentrating on increasing the performance of college-bound students but more emphasizing improved standardized test scores for all students. In addition to higher learning standards and more testing, various educational reforms are advanced by governmental agencies, foundations, universities, and other groups, adding yet another layer of reforms designed to enhance student achievement. Among many initiatives, High Schools That Work (HSTW) (Bottoms et al., 1992), School To Work (STW) (see, for example, Pauly, Kopp, & Haimson, 1995), career academies (Stern, Raby, & Dayton, 1992; Kemple & Snipes, 2000), and tech prep (Parnell, 1985) are prominent. What these reforms have in common is an emphasis on enhancing students' academic competencies through curriculum that integrates academic courses with career-technical (vocational) courses through a 2+2 curricular arrangement that extends from the secondary level (or below) to two-year college (or above).

This study focuses on the K-14 reform known as tech prep, launched nationwide through the Carl D. Perkins federal legislation in 1990. The concept of tech prep centers on enhancing secondary education for "neglected majority" students (meaning the middle two quartiles of students based on standardized academic assessments) who have historically by-passed college to enter the workforce immediately after high school (Parnell, 1984, 1994). Lacking preparation for college, these students have exited secondary school without necessarily securing the requisite skills to be successful in college or work. Tech prep programs are designed to increase the proportion of high school students who complete rigorous academic courses while also completing career-technical course work needed to jump start their studies in technical fields at the postsecondary level. Typically the postsecondary component of these programs is offered by community colleges providing career pathways in technical/semi-professional fields such as allied health, information technologies (IT), business/management, engineering and engineering technologies, and so forth. Transfer to four-year college and preparation for professional positions may be a part of local tech prep initiatives, though it is not a requirement[2]. According to federal law, tech prep programs should be administered through regional consortium arrangements where numerous high schools feed students into a central higher education point, usually a community college.

The curricular and instructional changes introduced by tech prep programs may be subtle or, if implemented across the curriculum, may be fairly dramatic. Historically secondary curriculum has been associated with tracking, where only students in the highest track, the college bound, were deemed capable of partaking of rigorous and challenging content (Lucas, 1999). Describing the other tracks (general and vocational) of most U.S. high schools as inadequate, Tyack and Cuban (1995) observe "students in noncollege tracks were often offered watered-down 'general mathematics' and 'general science' instead of traditional academic courses" (p. 48). Referring to results of the National Assessment of Vocational Education (NAVE) study, a Congressionally-mandated study of the impact of federally-funded vocational education, Boesel (1994) confirmed that secondary vocational programs often do not include more capable students, noting vocational enrollments have increasingly focused on disadvantaged and low-achieving students because federal Perkins-funded vocational programs are "the chief source of services for disadvantaged secondary students who are not also disabled and/or of limited English proficiency" (p. 5).

In contrast to vocational education of old, tech prep programs are charged with offering a core curriculum that emphasizes challenging academic content integrated with career-technical education so that students obtain advanced academic competencies while preparing for future careers. These programs are not exclusively targeted at a particular student group, but they do tend to focus on "neglected majority" students, as Parnell (1985) suggested. Diverse student groups are encouraged to participate and the federal legislation identifies "equal access" as one of seven essential elements. All students are encouraged to participate in a "seamless" educational program that leads directly from high school to collegiate-level studies at the community college.

[2] Reauthorization of the Tech Prep Education Act in 1998, as part of the Carl D. Perkins Vocational and Technical Education legislation, encouraged articulation of tech prep programs to the bachelor's degree, creating 2+2+2 options.

The Purpose of the Study

The purpose of this study is to determine the impact of the tech prep reform on students' readiness to engage in college-level course work, as determined by placement exams. Recognizing persistent issues with tracking and vocational education of the past, it is important to know whether tech prep programs deliver on their promise to prepare high school students for postsecondary education and eventually technical employment opportunities. In this preliminary analysis, our fundamental goal is to ascertain whether tech prep participants are as "college ready" as other similar students, and to determine whether tech prep participants' college readiness varies by gender, race-ethnicity, or socioeconomic status (SES). Knowing whether there are differential effects on college readiness, taking into account tech prep participants' demographic characteristics and high school preparation, is important to understanding whether tracking continues to be associated with these vocationally-oriented programs. Social mobility theory (referring to changes in occupational status and income) (Blau & Duncan, 1967; Grusky, 2001) provides a useful framework for examining the college readiness of tech prep high school graduates. This theory suggests students' background characteristics (e.g., socioeconomic status) and educational preparation (e.g., academic course taking) effects educational attainment and social mobility (for a full discussion, see Pascarella & Terenzini, 1991). If tech prep helps high school students of diverse backgrounds transition successfully to college without remediation, thereby positively contributing to their educational attainment and social mobility, it seems reasonable to conclude that tech prep is a notable P-14 reform that deserves further attention and support.

The following research objectives guided the investigation in four disparate tech prep consortium settings in California, Florida, North Carolina, and Texas:

1. To examine the association between demographic characteristics, high school preparation (academic and vocational course-taking) and tech prep status for students completed the placement process at the lead community college in each of the four consortia.

2. To determine the degree of remediation in math, reading, and writing for tech prep participants and non-participants in each of the four consortia.

3. To determine the association between demographic characteristics and college readiness for tech prep participants and non-participants in each of the four consortia.

4. To determine the extent to which various demographic and educational factors predict college readiness for tech prep participants and non-participants in each of the four consortia.

Methods

In January 1998 a mixed-method, longitudinal study was undertaken to better understand tech prep implementation and student outcomes in eight purposively selected consortia in the United States. This study provided the basis for a data set containing over 4,700 student records representing students in eight localities in California, Florida, Illinois, Ohio, Oregon, North Carolina, New York, and Texas. These sites were chosen because they represent eight consortia thought by a panel of experts to have a strong commitment to tech prep as a primary vehicle of educational reform. The consortia were thought to be "mature" implementers of tech prep in a manner consistent with the state's intended tech prep policies and practices, and they had started planning and implementing tech prep in the early 1990s, given them time to enroll students at the high school *and* community college levels by the mid-1990s. According to the expert panel, these consortia were not perceived as too unique to offer valuable lessons about tech prep implementation to other consortia located in similar rural, suburban and urban locations in the U.S.

Four of the most demographically diverse consortia were chosen for this study because of our interest in examining diverse student characteristics relative to tech prep participation and college readiness. The four chosen

consortia are located in New York, Florida, North Carolina, and Texas[3], and Table 1 provides a brief synopsis of the major features of these four sites. In two consortia (New York and Texas) a community college has primary responsibility for administration of the tech prep grant and houses the consortium's headquarters, placing the community college central to administration of the local tech prep curriculum. In the other two sites (Florida and North Carolina), a secondary school district provides leadership for the grant, placing more administrative and curricular responsibilities at the secondary level. Though not examined directly here, future analysis will allow us to examine the impact of different consortium arrangements on students' educational outcomes.

Insert Table 1 about here

Within each consortium, a sample of tech prep participants and non-participants was selected using a systematic sampling approach. Local definitions provided the basis for participant selection within each consortium to insure we were sensitive to the unique conceptualizations of tech prep. First, a random sample of tech prep participants was obtained (approximately 300 in each site which, in most sites, represented the majority of all tech prep participants), ensuring representation indicative of the entire population of tech prep participants. Once this group was selected, a random sample of non-tech prep students was drawn, insuring the two groups (tech prep participants and non-participants) were equivalent on high school academic performance as measured by cumulative grade point average (GPA) and/or high school percentile rank (HSPR) at high school graduation. This sampling technique provided us with some control on individual differences due to academic performance during high school, a known predictor of college enrollment and completion (Pascarella & Terenzini, 1991). Care was also taken to insure that the two groups were equally represented by school within the consortium and also graduating class (1995, 1996, 1997, 1998).

Table 2 summarizes the sample used for this study. All students in the sample completed placement testing and had a placement decision made by the community college. Not all of these subsequently completed course work at the college, although most did. In Texas about two-thirds of the original participants went through the full placement process at the community college. In Florida, somewhat less than half the original group did so. In New York and North Carolina, the sample was much more sparse, as only a few more than 20% of the original sample participated in placement testing in these sites. These samples are further limited by the need to discard additional students for whom particular variables, such as race-ethnic identification, are missing. In all cases, it seems reasonable to generalize only to those students from the participating high schools who enrolled in the community college or at least seriously planned to do so.

Table 3 reveals that, even with the smaller sample used in the current study, the tech prep participants and non-participants remained similar on high school GPA or HSPR. In Florida, tech prep students had higher HSPR than did students in other high school programs. Generally, however, the difference between the two groups of students is very small and not significant, suggesting that in the main, the smaller sample is like the full sample in terms of the balance between tech prep and others in these high school performance indicators. An important result of this preliminary analysis is the finding that for two sites, Texas and New York, more tech prep participants than non-participants completed the placement process, while there were no differences evident in the other two consortia.

Insert Tables 2 and 3 about here

During the summer and fall of 1998 high school transcripts were acquired for 98% of the CC&B sample, and community college transcripts were obtained for all students who matriculated to the main community college. Two years later, in fall 2000-winter 2001, community college transcripts were secured from each site, again, to update college records for each student through summer term of 2000. By this time from about 20% to 60% of students had matriculated to their local community college based on the transcripts provided by the four colleges. In addition to transcript analysis, a follow-up survey was conducted to identify students' high school experiences related to work and academic preparation as well as college and work after high school graduation. These survey results are used to supplement the transcript data, particularly with respect to demographic characteristics. Response rates between 45% and 65% were obtained in the four consortia included in this analysis.

[3] State names are used to protect the identify of individual sites. Results are not generalizeable to the entire states represented here.

The independent variables studied were associated with three constructs reflective of student demographics, tech prep participation, and secondary preparation. Student demographics were gender, race-ethnicity, mother's education, and annual family income, collected via transcripts or the student follow-up survey. Tech prep participation was identified on an individual basis using local tech prep consortium's definitions. Secondary preparation in math, English, and career-technical course-taking and performance as measured by GPA were acquired from the transcript analysis. Student placement in remedial courses upon entry into the community college served as the dependent variable of interest. These placement decisions depend in part on the results of placement tests, and in part on the program in which the student plans to enroll. Required courses and their test-score prerequisites can vary between career and transfer programs. However, for this first analysis of college readiness, the institutional placement decision served as the dependent variable.

College readiness was defined in several ways. One dependent measure of college readiness was defined as entrance into college having passed all placement tests, a dichotomous variable. In another analysis, we examined the degree of college readiness by identifying the number of areas in which students required remediation, ranging from zero to three (math, reading, and writing). In yet another categorization, we examined the areas in which students needed remediation by identifying categories, such as math only, math and reading, math and writing, and so forth. Data regarding college readiness were drawn from community college transcripts, along with supplementary information provided by community colleges regarding placement policies.[4]

Analysis of the data involved descriptive and inferential statistics, first examining the frequency with which particular variables were occurring independently and in conjunction with other variables, utilizing measures of central tendency, frequency distributions, and cross-tabulation tables. Associations between categorical variables were examined with Chi-square statistics, and t tests and ANOVA were utilized when the dependent variables were continuous. Logistic regression was used to attempt to identify factors that influence the odds of college readiness among new college entrants.

Results

The first research question addresses the extent to which tech prep participants and non-participants who complete community college placement procedures are like each other in demographic characteristics and secondary preparation. Results by demographic characteristics and high school preparation follow.

Demographic Characteristics

Gender and Race-ethnicity. Table 4 provides gender and race-ethnic distributions for the four sites. There were no significant differences between tech prep and other students who completed community college placement procedures in the proportions who were male and female. The race-ethnic variable also showed no significant differences between the distributions for tech prep participants and non-participants. For purposes of this analysis, students who indicated they were "other" were dropped due to the difficulty in interpreting the meaning of this designation. The distributions in Table 4 were used to select race-ethnic categories with sufficient sample sizes for further analysis, and these clearly needed to differ from site to site. In no consortium were there enough Asian-American or Native American students for analysis; in New York, numbers in all but the African-American group were very small; in Texas, fairly substantial groups of African-American and Hispanic groups were noted, in addition to Whites; and in North Carolina, the distribution suggested that further analyses be limited to White and African-American students.

Insert Table 4 about here

Mother's Education and Annual Family Income. Table 5 displays distributions of mother's highest educational level for tech prep participants and non-participants who completed the placement process. At no site do

[4] In an effort to keep this paper within manageable length, the authors have omitted detailed information about the placement exams and cut-off scores utilized by each of the four postsecondary institutions. Readers interested in this information are urged to contact the lead author to obtain a copy of the forthcoming technical report on the Community College and Beyond study.

these distributions differ significantly. However, to test whether the average educational level of mothers of students who did and did not participate in tech prep differed, mothers' years of education were estimated from their highest level (11 years for those with less than a high school diploma, 12 for a high school diploma, 13 for some college, 14 for an associate degree, 16 for a baccalaureate, and 19 for a graduate degree). Comparison of the means for the two high school program groups at each site revealed only small differences that varied in direction from site to site, none of which was significant.

Table 6 displays family income distributions for tech prep participants and non-participants at each site. In order to test whether family income differs for these groups of students, median tests were conducted for each site. In Texas, more of the tech prep students than of the others have above average family incomes, but the difference is not significant. In Florida, the trend is reversed but not significant: a somewhat larger proportion of tech prep participants than non-participants are below the median income. In North Carolina and New York, there is practically no difference between the tech prep participants and the other students in median income. Thus, tech prep and non-tech prep students who go through the community college placement process in these sites do not seem to differ in family income. However, it is noteworthy that the median income is much lower in New York than in the other consortia, underscoring the differences among these sites.

Insert Tables 5 and 6 about here

High School Preparation

Mathematics. Table 7 provides a breakdown of semesters of high school mathematics taken by tech prep and other students and indicates the GPAs earned in mathematics courses. In Texas and Florida, tech prep participants tended to take fewer mathematics courses than did their classmates in non-tech prep programs. In Florida, the distributions differed significantly (chi square=22.320, df=2, p=.000), and the mean number of courses taken by non-participants was significantly higher than the mean for tech prep participants. In that site, about 50% of the tech prep participants took more than three years of math, compared to 72% of the other students. In Texas and North Carolina, approximately half of both groups an equivalent amount of math. In New York the percentages were lower, at 36 and 40%. As to performance in these courses, Texas and Florida students averaged about a C+, while students in New York and North Carolina had math GPAs closer to C.

Table 8 displays the distributions of highest mathematics course taken for tech prep and other students in each site. Also displayed are the means for each groups' highest math course level. (These levels are 1 for basic math, 2 for pre-algebra, 3 for computer math, 4 for algebra 1, 5 for algebra 1 honors, 6 for geometry, 7 for geometry honors, 8 for algebra II, 9 for algebra II honors, 10 for trigonometry or statistics, 11 for trig or stat with honors, 12 for calculus, 13 for AP calculus or statistics.) It is clear from the distributions and the means that Texas students appear to progress farther in the mathematics curriculum than do students in the other consortia. The New York sample progresses to a lower level than the other groups, averaging at the level of Geometry. In addition, differences between tech prep participants and non-participants are significant in Florida and North Carolina, but with no discernible trend as to direction. In Florida, students not enrolled in tech prep advance farther than do tech prep students, though both means are in the Algebra II or Algebra II honors range. In North Carolina, it is the tech prep participants who advance farther, to Algebra II honors on the average compared to Algebra II for the non-participants.

Insert Table 7 and 8 about here

English. Table 9 relates the number of semesters of English courses completed by students in tech prep and other programs. In all consortia, tech prep participants and non-participants are very similar in the distribution of semesters of English courses taken, in mean semesters, and in mean GPA in English courses. In all groups, at least 90% of the students took at least 7 semesters of English. Students' participation in four years of English is consistent with state high-school graduation requirements showing four years of English are universally required (refer again to Table 1). In Texas and Florida, the mean GPA is close to or at a B. As with Math, the GPAs are somewhat lower in New York and North Carolina, especially New York where students average about a C in English.

Table 10 indicates the number of semesters during which Advanced Placement (AP) or honors English courses were taken. The proportion of students taking no AP or honors English varies by consortium, with about 50% of students in Texas, Florida, and North Carolina taking none compared to almost 90% in New York. Of course, part of this difference is attributable to the different courses available to students within their high schools, though differences in AP offerings are not entirely responsible for differences noted among student groups. In Florida, students not participating in a tech prep program completed significantly more semesters of AP or honors English than did tech prep participants, as evidenced by significant differences in both distributions (chi square = 8.704, df=2, p=.013) and means. In the other three consortia, tech prep and other students were similar in their completion of honors and AP English.

Insert Tables 9 and 10 about here

Vocational Course Taking. Vocational course-taking was measured by determining whether the high school graduates qualified as vocational concentrators as defined by the National Center for Education Statistics (NCES) (Houser, 1995). By this definition, a vocational concentrator is one who takes three credits (6 semester courses) in an occupational area such as business, health, computer technologies, or precision production. Table 11 summarizes the number of such concentrations completed by tech prep and other students. It is clear from the distributions and means that in all sites except New York, tech prep participants complete more vocational concentrations, and thus take more vocational course work, than do non-participants. This is not surprising since vocational course work is a required component of tech prep core curriculum. The t tests confirm that these differences between means are significant in Texas, Florida, and North Carolina. In New York, however, the two groups both tend to take a fair amount of vocational course work, with 84 to 89% completing one or more vocational concentrations. Indeed the mean number of vocational concentrations completed by New York students who did not participate in tech prep is higher than the mean for tech prep students in both North Carolina and Texas. This finding is not surprising, however, because the New York sample was drawn from two vocational high schools where all students were participating in an intensive vocational curriculum.

Insert Table 11 about here

Research question two examines the degree of remediation needed by tech prep participants and non-participants in the four consortia. Placement in remedial math, reading and writing are ascertained as are placement decisions across the three areas.

Placement into Remedial Course Work

Table 12 portrays the number of Tech Prep and other students who place into remedial or college level course work in mathematics, reading and writing, and also indicates the numbers in each group placing into at least one remedial course vs. the number placing into college level course work in all three areas. Pooling tech prep participants and non-participants, mathematics was the most frequent area in which students needed remediation. Tech prep students were more likely than others to need remedial course work in mathematics in Florida; students not in tech prep were more likely to need remediation in writing in New York and in reading in North Carolina compared to tech prep participants. Overall, Florida students were more likely to need some remediation if they took the tech prep than another high school curriculum. Other differences between the two groups did not reach significance at the .05 level. The mean number of remedial courses into which students placed was generally less than one, and differences between the tech prep and non-tech prep groups were not significant except in Florida, where tech prep students needed more than one course, on the average, with students who had not participated in tech prep requiring fewer remedial courses on the average.

Placement Decisions by Area

Table 13 details the remedial courses in which students were placed. Generally speaking, of those needing remedial courses, more needed remediation in just one subject area than needed remediation in two, and even fewer needed remediation in all three areas. The exception was Florida, where almost as many tech prep students needed remediation in all three areas as in only one, and fewer students needed remediation in two than in all three areas. In three sites, all but New York, it was more common for students to need mathematics remediation, with or without remediation in writing or reading, than to need help with only verbal skills. We speculate that this has something to

do with the math level required for "college level" placement in NY, but more research is needed to confirm this hunch. In contrast to other sites, we also found that deficiencies in verbal areas were more common than in mathematics among New York students.

Insert Table 12 and 13 about here

Research question three examines the relationship between demographic characteristics and college readiness for tech prep participants and non-participants. Specifically, relationships between college readiness and gender, race-ethnic groups, and the SES indicators provided by family income and mother's educational level are examined.

Gender and Remediation

Partial correlations between gender (1=male, 0=female) and the need for remediation (1=needs remediation, 0=does not), controlling for high school program (tech prep or other), allowed the investigation of the relationship, if any, between gender and college readiness. Table 14 provides the correlation coefficients and their significance levels. Only in North Carolina is gender related to placement level, with tech prep controlled. Here, males are more likely than females to need remediation. Since requirements for college readiness are sometimes higher in transfer than in career programs, this correlation could arise through differential enrollment rates of males and females in transfer vs. career programs. Further analysis is planned to examine this relationship more fully.

Race-ethnicity and Remediation

Table 15 displays remedial placement rates for students of various race-ethnic categories. Representation of students of different race-ethnic groups varied greatly from consortium to consortium, so these comparisons differ from site to site. In addition, tech prep participants differed from non-participants in their remedial placement rates in one site, Florida, so that race-ethnic comparisons for that consortium were performed separately for the two student groups.

In North Carolina and New York there are no differences in remedial placement rates by race-ethnic group. However, in both Texas and Florida there are significant differences which favor White students. In Texas, White students are more frequently judged college ready than are African-American students, but the other group differences are not significant. In Florida, among tech prep participants, White students place into college level courses more frequently than do Hispanic students, but the Black-White difference is not significant. Among students in programs other than tech prep, White students place into college courses more frequently than do African-American students, but there is no difference between White and Hispanic students in the need for remediation.

Insert Tables 14 and 15 about here

Mother's Education and Remediation

Table 16 displays distributions of mother's educational level for those who did and did not need remedial course work. Using estimated years of education based on educational level, mean differences were tested and revealed that in Texas but no other site, mothers of college-ready students had more years of education, on average, than did mothers of students who needed remedial course work. Both means in Texas were at or slightly above the level of "some college". In fact, almost half of the students who needed remedial course work had mothers with no education beyond high school, compared to about a quarter of the college-ready students (48% vs. 26%). In the other sites, the differences were in the same direction, and of similar size, but they were not statistically significant.

Family Income and Remediation

Table 17 allows comparison of the distributions of family income for those who did and did not need remediation. Both distributions and tests of the significance of the difference in medians for the two groups are displayed, indicating that income differences are by and large miniscule. Only within the tech prep participant group

in Florida was there a tendency for the students who needed remedial course work to have lower incomes than the college- ready students. Both this and the findings for mother's educational level are somewhat surprising. Perhaps the tendency for "middle-majority" students to participate in tech prep has limited the effect of SES. That is, perhaps students are in the middle majority in part because of SES factors, and further effects of SES would not be very large.

Insert Tables 16 through 17 about here

Research question 4 examined the relationship of demographic characteristics and secondary education participation to college readiness for tech prep participants and non-participants. In the first of two analyses, need for at least one remedial course was predicted from the following blocks of variables: 1) SES (indexed by mother's years of education and income below the consortium median), 2) gender (male), 3) race-ethnic origin (Hispanic and African-American vs. White in Texas and Florida, African-American vs. White in North Carolina, and African-American vs. all other in New York), 4) tech prep participation, and 5) interactions of tech prep participation with each of the other variables. The questions addressed here are (1) whether SES, gender, and race-ethnic origin predict the odds that a student will need remediation, (2) whether tech prep participation is associated with greater or lesser odds of college readiness after differences in SES, gender and race-ethnic group are accounted for, and (3) whether the relationship of any of these individual characteristics with the need for remediation may differ for tech prep participants and non-participants.

Because the characteristics of the academic program are expected to differ between tech prep and other programs, no information about the high school program was used in the first analysis. However, a second analysis allowed some estimation of the extent to which differences between tech prep and other programs in academic intensity of the high school program might be involved in differences found in the first analysis. In the second, the blocks were as follows: 1) SES, 2) gender, 3) race-ethnic category, 4) tech prep participation, 5) academic intensity of high school program (indexed by the sum of semesters of English, mathematics and science taken in high school), and (5) interactions of tech prep participation with each of the other variables. In the first analysis, for New York and North Carolina none of these models fit the data significantly better than the model with no predictors. In both Texas and Florida, neither SES nor gender improved model fit, but the addition of race-ethnic information did significantly improve fit. In Florida, tech prep participation was significant in addition to these other factors, and there were no significant interactions. In Texas, tech prep participation was not significant, and there were several significant interactions. Table 18 summarizes the results for these two states, starting with the third block.

Insert Table 18 about here

In Texas, the introduction of race-ethnic information improved model fit, and indicated that with mother's education, income below median, and gender accounted for, the odds of needing at least one remedial course were more than four times greater for African-American than for White students (not shown). This coefficient was not substantially changed by the addition of information concerning participation in tech prep. However, introduction of the interactions suggests that the effects of both low income and Hispanic ethnicity are different for tech prep than for other students. The coefficient for African-American is no longer significant. To simplify the interpretation of these results, the model was rerun with only the significant interactions added at the sixth step. The results indicate that those with family income below their consortium median have odds of needing remediation that are more than five times as high if they are tech prep participants than if they are not (exp(+2.014-.287=5.62). At the same time, however, with all these other factors controlled, the odds that Hispanic students will need remediation are considerably lower if they are in the tech prep program than if they are not (exp(-.287-2.027)=.10).

In Florida, with SES and gender accounted for, the odds that African-American students will need remediation are more than nine times those of White students (not shown). With these factors controlled, tech prep participants are about three times more likely to need remediation than are non-participants, and the effect of being African-American is not much changed.

In the second analysis, with the sum of semesters of English, mathematics and science added as a measure of intensity of the high school program, once again in New York and North Carolina none of the models was able to predict the need for remediation significantly better than was the model with no predictors. In Texas, increased intensity of the academic program completed in high school was significantly predictive of lower odds of needing

remediation at the community college. However, the odds of a low income student needing remediation if the student were in tech prep still exceeded those of low income students in other programs by a factor of almost ten (exp(-.386+2.684)=9.95). Similar to the finding for the differential effect of being low income for tech prep and other students, the difference in the odds of needing remediation for Hispanic students in Texas varied between tech prep and others as it had without the introduction of the academic intensity measure. With the sum of English, mathematics and science semesters as well as the other variables accounted for, Hispanic students who were in a tech prep program had odds of needing remediation that were considerably lower than the odds for students in other programs (exp(-.386-2.668)=.05). For the low income Hispanic student, of course, the effects tend to counteract each other, but the odds of the student needing remediation are still only about 70% as high if the student is in tech prep than if not (exp(-.386+2.684-2.668)=.69).

The reasons for these two interaction effects is unclear. Since the total number of English, mathematics and science courses is held constant, some other difference(s) between the tech prep and non-tech prep programs or of the students in them would seem to be responsible for these effects. Perhaps the level of courses taken differs, for example. Further analyses might compare tech prep with other students within the low income and Hispanic groups on other characteristics of the high school program such as the proportion of English courses that are basic on the one hand or AP/Honors on the other, highest level of mathematics and science course achieved, the proportion of these courses that are applied, and the number of science courses taken.

In Florida, addition of the total semesters of English, mathematics and science taken in high school did not improve model fit over the fit achieved by the other variables. This addition also had little impact on the significant effects of both status as an African-American and participation in tech prep. Thus, tech prep participants had higher odds of needing remedial course work at the community college than did non-participants by a factor of nearly three, and African-American students' odds of needing remediation were higher than White students' by a factor of ten. In Florida, tech prep non-participants took significantly more semesters of AP/Honors English than did participants, and advanced to a higher level in mathematics as well. These differences involve the level of courses, rather than merely the number of courses, and thus may be at least partly responsible for the significant difference between the two student groups in the odds of needing remediation after number of semesters of English, mathematics, and science are accounted for.

To test this hypothesis, the model was rerun, with semesters of AP or honors English and highest level of mathematics course achieved added to the variables used in the model portrayed in Table 19. Indeed the addition of these two variables provided a model with significantly better fit (block X^2=15.305, df=2, p=.000 and model X^2=37.006, df=9, p=.000). Tech prep participation was no longer significant at the .05 level (p=.067), and semesters of AP/Honors English was significant (p=.014) with an additional semester yielding odds of needing remediation that were 79% the odds without that semester of AP/Honors English. Thus, it seems that the level of course work taken, at least in English, is important to remedial need, and that the difference in level of course work is at least one factor in the greater need for remediation among tech prep than other students.

Insert Table 19 about here

Conclusions and Significance of the Study

This study examined associations between demographic characteristics, tech prep participation, secondary preparation, and college readiness with the ultimate goal of determining how tech prep participation relates to student success in transitioning into college-level course work, which may affect social mobility and educational attainment. The tech prep reform has received federal support since the early 1990s, resulting in nationwide implementation in the majority of high schools and nearly all community colleges in the country (Hershey, Silverberg, Owens, & Hulsey, 1998). Even so, little is known about the impact of tech prep on student outcomes, including college readiness, and this paucity of information lead to the need for this study.

Given this purpose, results suggest that tech prep was not associated with tracking of students by gender, race-ethnicity, or SES (as measured by mother's education and family income). Indeed, there was no difference between the tech prep participants and non-participants on any of the demographic characteristics. In two of the four consortia, tech prep participants completed the community college placement process at higher rates than did

non-participants. One of these, New York, is the site with a relatively high concentration of African-Americans and students with low income and low levels of maternal education. Thus, the relatively high rate of participants' completion of placement is an especially positive result for that consortium's tech prep program, although it is necessary to point out that the overall rate of placement in New York is slightly more than one in five.

Results did show a tendency for tech prep participants to take less math than other similar students do; however, these results are not pervasive across all sites. In fact, of the four sites, one consortium showed tech prep participants achieved a higher level of math courses whereas, in another site, non-participants' highest level exceeded that of participants. Once again, these results underscore the site-specific nature of curriculum changes relative to tech prep reform, especially in math. In most consortia, English courses and AP/honors course-taking is similar for both groups, suggesting less need for concern about this aspect of the curriculum.

Looking specifically at the number of remedial placements, in three sites the need for remediation did not differ for tech prep participants from other students, suggesting tech prep participants in these sites are not disadvantaged by their enrollment in this reform. It is important to point out, however, that tech prep does not appear to reap advantages for participants relative to other similar students when it comes to college readiness. A more stringent test of the effects of tech prep programs on preparing students for college and ultimately educational attainment and social mobility involved controlling for gender, race-ethnicity, and SES. In two consortia, we found no effects whatsoever, but the sample size may have been sufficiently small to limit our ability to find significant results. In our analysis of the other two sites, somewhat disconcerting findings were observed. In one site (Florida), the odds of tech prep participants needing remediation were higher than the odds of non-participants. There were no differential effects by gender, race-ethnic origin, or SES, but with these other factors controlled, the tech prep participants appeared not to be as likely to be "college ready". This is cause for concern since a fundamental goal of tech prep is to improve student preparation to enter college without remediation. Further analysis indicated that the tendency for tech prep participants to take lower level mathematics courses and fewer AP and Honors English courses than did the other students accounted for some of the difference in college readiness, suggesting ways in which the tech prep program might be upgraded in this site. In the other site (Texas), tech prep participation was associated with a relative disadvantage for low-income students, but an advantage for Hispanic students, when other factors were held constant. Once again, results for the low-income students, especially those who are not Hispanic, are cause for concern.

Additional research is needed to explore whether tech prep participants differ from their non-participant counterparts on gender, race-ethnic origin, or SES in their tendency to complete the community college placement process. Our findings do not show that tech prep participants exceed other students in college readiness, and this may be attributable to the unevenness of academic offerings within tech prep programs across sites. Thus, while tech prep did not differ in it's impact on the college placement decisions of tech prep participants and non-participants in two sites, the overall group of tech prep participants lagged behind non-participants in college readiness in one site; in another low-income tech prep participants were disadvantaged in college-level placement as compared to other groups. These results should not be glossed over because they suggest a continuing challenge to construct beneficial course offerings in some high schools. Given the focus of tech prep on enhancing students' preparation for college, these results seem to suggest the need for greater deliberation and consistency in the construction of core curriculum. However, we readily admit that these results are preliminary and limited to only a few select sites among many tech prep consortia operating nationwide. Hopefully, future studies can include larger samples of students who have engaged in tech prep and related K-14 reform to determine their impact on college readiness and other educational outcomes. Our own plans call for further analysis utilizing the full capacity of the Community College and Beyond database to help us develop a more complete understanding of how tech prep may be influencing educational attainment and social mobility.

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