Stratified Access to Science and Math Enrollment:
The Effect of Geographic Proximity to Postsecondary Educational Institutions

**Description of the Topic & Theoretical Focus:**

As higher education becomes increasingly compulsory for labor market success, the transition into college and the selection of a major or program represent one of the final links between the education life-course and the work-force. Put simply, what a student decides to study and where s/he decides to do it reflect heavily on social stratification in ways which have been under-researched. In this project, I bring together research on the geography of opportunity and the science, technology, engineering, and math (STEM) pipeline in order to explore an uninvestigated aspect of the transition into post-secondary education.

The most common college-choice model emphasizes the sequence of decision-making across time from first acquiring a predisposition for higher education based on primary and secondary school experiences, to next searching for potential colleges and programs, to finally choosing where to apply and enroll (Hossler and Gallagher 1987). Recent research demonstrates that traditional models of college decision-making often fail to consider the significant effect of geographic convenience on enrollment, particularly for socially disadvantaged groups who often opt to remain closer to home for familial, cultural, or financial reasons (López Turley 2009). After controlling for various student and contextual factors, additional colleges in proximity significantly increase the odds of applying to and enrolling in college. Further, López Turley (2009) finds that for each additional postsecondary educational institution (PSEI) in the vicinity, low SES students enjoy a greater increase than their higher SES peers in the odds of enrollment and an even greater increase in odds for enrollment in local colleges in particular, supporting a convenience mechanism for college selection. Thus, selection of a college is in constrained by the availability of local options and this constraint impacts the college choice process of some students more than others.

If this is true, then in what way(s) is the selection of a college major or program affected by geographic context and how are these two facets of the college enrollment process connected? In recent years, sociologists studying post-secondary education have paid particular attention to enrollment and performance patterns in the natural and physical sciences, technology, engineering, and mathematics (STEM). This is largely due to the early and extreme patterns of stratification across these fields for racial and ethnic minorities (Crosnoe et al. 2004; Ginorio and Grignon 2000), women (Blickenstaff 2005), and the economically disadvantaged (Ma 2009). However, assuming that students strategically enroll in these programs based on personal inclination, positive social sanctions, and promising labor-force expectations, students with more limited access to this pipeline may 'leak' out of STEM in predictable ways. Therefore, I am interested not only in enrollment in STEM programs but also in enrollment in the health and applied technological sciences – fields which require substantial STEM literacy but are not traditionally considered as such. Importantly, these "STEM alternatives" contribute more directly to local economies and may be more accessible to students with weaker science and math college preparation, those who may have fewer post secondary institutions nearby, and students who chose to stay closer to home for a variety of reasons.

I build on López Turley's (2009) work by considering the geography of opportunity with respect to college enrollment in STEM programs and STEM alternatives to paint a more detailed picture of access to higher education and the ways in which various student demographics experience more limited prospects. Key questions in this effort include the following: (1) Does the local concentration of post-secondary educational institutions (PSEIs) impact college enrollment of high school graduates into STEM fields and STEM alternatives at both 2 year and 4 year institutions?; (2) How is the effect of geographic context on rates of enrollment moderated by (i) SES (ii) race and ethnicity (iii) gender (iv) urbanicity and rurality?; (3) Do these findings, like López Turley's (2009) findings regarding college enrollment, similarly support a convenience mechanism for college decision making regarding STEM fields and STEM alternatives?

**Data:**

In answering these questions, I make use of the Educational Longitudinal Study of 2002 (ELS). This dataset is ideally suited for the project in that it includes a large, nationally representative sample of high school students, including 14,625 who completed high school by the second follow-up in 2006. The dataset contains detailed high school transcript data, post-secondary application and enrollment information with reasons for PSEI selection, field of study, zip code, demographic information, and residence during enrollment (see preliminary descriptive statistics, Table 1). The data on PSEIs in ELS is linked to the Integrated Postsecondary Education Data System (IPEDS) which allows for the collection of more detailed institutional data including programs offered, Carnegie classifications, and the geographic location of the institution. Arcview software is used to map and measure distances based on zip codes to gain the independent variable of interest, the concentration of PSEIs close to home. "Close to home" is operationalized in the same way as was done in López Turley's (2009) work on geographic proximity; the median distance from the home zip code to the first choice PSEI for students identifying staying close to home as "very important" in their decision making process. In López Turley's analysis, this distance was 12 miles for urban students and 24 miles for rural and suburban students. Thus, concentration of PSEIs close to home for each student is defined as the number of PSEIs within this distance from the home zip code of the student during the first follow up at which point the majority of the sample was completing high school.

**Research Methods:**

The necessary variables for this study will be compiled into SAS from ELS 2002 and IPEDS, and the concentration of PSEIs in proximity will be obtained using Arcview. Two sets of multi-level modeling using logistic regression will evaluate the effect of the concentration of PSEIs on enrollment into (1) traditionally defined STEM fields and (2) the health sciences and applied technologies. These models will incorporate controls for individual level characteristics including gender, race, and ethnicity, having a single parent, the number of siblings in the family, parental educational attainment, parental income, college enrollment expectations, test scores, high school science and math course-taking, the importance of staying close to home for the student, and time lived in the current neighborhood. Neighborhood level predictors to be incorporated into the modeling include median household income for the zip code, the total number of colleges in proximity (two and four year), urbanicity, and region. Additionally, interaction effects will be included to examine if the effect of the concentration of PSEIs in proximity is moderated by parental income, race and ethnicity, gender, or urbanicity. Squared

terms will test to see whether the impact of PSEI concentration has increasing or decreasing "rewards" for student enrollment given additional PSEIs in proximity.

Table 1: **Descriptive Statistics: ELS 2002 Students who have Completed High School*

| **Selected Variables** | **N=14625** | | |
|---|---|---|---|
| | n | mean | SD |
| Demographic Characteristics | | | |
| Female | 14625 | 0.51 | 0.5 |
| Race | | | |
| White | 14625 | 0.577 | 0.494 |
| Black | 14625 | 0.127 | 0.333 |
| Latino | 14625 | 0.139 | 0.346 |
| Asian | 14625 | 0.103 | 0.303 |
| Other | 14625 | 0.054 | 0.226 |
| Total family income from all sources (BY) | 14625 | $50-70k** | |
| Biological Parent Household | 13872 | 0.613 | 0.487 |
| # years parent has lived in current neighborhood | 14625 | 7.439 | 10.268 |
| # of siblings student has | 14625 | 0.621 | 3.44 |
| Highest level of Parental Education (1=college) | 13869 | 0.43 | 0.495 |
| | | | |
| F1 Characteristics (2004) | | | |
| Standardized Test Score (Composite) | 14625 | 50.479 | 12.293 |
| Student intends to attend Post-Secondary Ed Insitution (PSEI) | 13114 | 0.939 | 0.24 |
| F2 Characteristics (2006) | | | |
| Obtained high school diploma by 2006 | 14625 | 0.963 | 0.19 |
| Ever applied to a PSEI | 13301 | 0.845 | 0.362 |
| # of PSEIs applied to | 11233 | 2.812 | 2.128 |
| Whether has ever attended PSEI | 13303 | 0.787 | 0.41 |
| Intended field of Study upon enrollment | | | |
| STEM field | 10435 | 0.435 | 0.496 |
| Reason for Choosing PSEI (1=yes) | | | |
| chose PSEI1 for cost of ed | 10427 | 0.205 | 0.404 |
| chose PSEI1 for family or personal reasons | 10427 | 0.086 | 0.281 |
| chose PSEI1 for location | 10427 | 0.235 | 0.424 |
| chose PSEI1 for other reasons | 10427 | 0.096 | 0.295 |
| chose PSEI1 for program | 10427 | 0.244 | 0.43 |
| chose PSEI1 for reputation of school | 10427 | 0.134 | 0.34 |
| Full Time enrollment at PSEI1 (1=full time) | 10440 | 0.865 | 0.342 |
| | | | |
| Enrollment Status 2006 | 13303 | 0.643 | 0.479 |
| Has declared a major (or double major) | 8529 | 0.756 | 0.43 |
| Major in 2006 (2 digit) | | | |
| STEM field | 6445 | 0.156 | 0.363 |
| Residence while enrolled in spring 2006 (1=home) | 8446 | 0.365 | 0.481 |

** High school diploma, GED, or certificate of Attendance obtained by second follow-up, 2006.*

*** Denotes median*

**Expected Findings:**

Early findings suggest that while socially disadvantaged groups, specifically racial and ethnic minorities, are generally more likely to enroll in the health sciences and applied technologies than into STEM fields, they are more likely to enroll in STEM programs closer to home when there are larger numbers of PSEIs available. The modeling strategy proposed here seeks to discern patterns of how contextual factors, primarily geographic context and proximity to PSEIs affect enrollment into postsecondary education and into the STEM fields in particular. It goes on to examine patterns of enrollment into the health sciences and applied technologies, fields which may contain some of the leakage from the STEM pipeline. It may be the case that "access" to the STEM pipeline means something very different for rural students than the urban poor. For example, findings could suggest that while additional PSEIs close to home boost odds of enrollment for all students, geography is a larger obstacle to rural youth while economic disadvantage and academic preparation may be larger obstacles to the urban poor. The way in which structural factors including geographic location, SES, and other demographic characteristics impact enrollment into STEM fields and STEM alternatives has important implications for social stratification and remains as yet under-researched.

Cited Literature:


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