ASSOCIATION FOR INSTITUTIONAL RESEARCH
Data and Decisions for Higher Education

Back to All Proposals

PROPOSAL DETAILS

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Project Description I

Title:

Predicting Successful Remediation Among Hispanic Students

Statement of the research problem and national importance:

The proposed grant activities seek to identify factors that predict successful math remediation among Hispanic students. The study addresses the national need for institutions to be able to identify effective strategies that support students' academic success. Increasing degree completion rates for Hispanic students is critical for the U.S. to meet its future workforce and societal needs (Santiago, 2011). Hispanics are projected to make up one-fourth of the total population by 2050 (Llagas, 2003) and yet this group continues to lag behind others in terms of degree completion (Fry & Lopez, 2012; U.S. Census Bureau, 2012). In particular, there is a need to increase the number of Hispanics earning undergraduate degrees in science, technology, engineering and mathematics (STEM) fields (Chen & Weko, 2009). Unfortunately, substantial gaps exist with regard to how institutions can effectively promote equity in degree completion (both in and outside of STEM fields) among Hispanic students (Crisp & Nora, 2012).

A recent review by Crisp, Taggart, and Nora (2012) notes the absence of research that helps to identify college experiences that serve to influence academic outcomes for Hispanic students. There is evidence to suggest that completion of college-level mathematics classes, often referred to as "gatekeeper" courses, may be one such experience that warrants empirical attention. Successful completion of college-level math courses has been shown to positively influence vertical transfer and degree completion (Adelman, 2005). Moreover, findings by Roksa and Calcagno (2008) reveal that the academic benefits associated with passing college-level math may be twice as large for underprepared students. Further, results suggest that enrollment in college math courses may function as a gatekeeper to STEM degrees among students attending Hispanic Serving Institutions (HSIs) (Crisp, Nora & Taggart, 2009).

Developmental education is viewed by many as a college experience that opens doors to economic and educational advancement for traditionally underrepresented groups (Bahr, 2010) by providing academically underprepared students with the skills to pass college-level courses (Bettinger & Long, 2005; Boylan & Saxon, 2000). Hispanic students often begin postsecondary education with lower levels of college readiness due to societal inequities. As such, Hispanics are overrepresented in remedial courses (Bettinger & Long, 2005; Sparks & Malkus, 2013) and are assumed to benefit from such coursework (e.g., Grimes & David, 1999; Penny, White, & William, 1998). However, with the exception of findings from a previously funded AIR grant (i.e., Crisp & Nora, 2010) and from Bahr (2010), there is a dearth of evidence documenting the role of remediation in promoting academic success for Hispanic students (Nora & Crisp, 2012).

An understanding of the role of remediation in shaping Hispanic students' postsecondary choices and outcomes is imperative (Howell, 2011). In particular, there is a need to understand the obstacles faced by students who require remediation in mathematics (Bahr, 2008). More students enroll in remedial math courses than any other subject area (Bahr, 2007). Regrettably, findings reveal that the majority of students requiring math remediation do not successfully attain college-level math skills (Bahr, 2008) and that Hispanic students are less likely than White and Asian American students to remediate successfully (Bahr, 2010). Unfortunately, with the exception of a recent white paper by Nora and Crisp (2012), very little is known (even at a descriptive level), regarding the characteristics and developmental needs of Hispanic students who remediate. Moreover, no study to date has modeled the characteristics associated with successful math remediation among Hispanic students. As such, the focus of the grant activities will be to examine Hispanic students' remedial math needs and outcomes. Specifically, the proposed study will model the socio-demographic characteristics, pre-college experiences, academic goals, environmental pull-factors, college experiences, and institutional characteristics that predict successful remediation in math among a national sample of Hispanic students.

Results will be of importance to researchers, campus leaders, and policy makers interested in achieving equitable degree outcomes. Findings will also contribute to research and theory by providing a better understanding of the role of various characteristics and experiences in promoting success among Hispanic students who enter post-secondary education with academic deficiencies. Results are expected to have direct implications for policy and practice by providing means of targeting developmental students who are at risk of not successfully remediating. Moreover, findings will offer valuable information regarding institutional characteristics that contribute to successful math remediation. Furthermore, results will be of relevance to initiatives designed to retain Hispanic students' interest and participation in STEM fields.

Review the literature and establish a theoretical grounding for the research:

The following paragraphs provide empirical and theoretical grounding for the proposed research. The conceptual model used to frame the analysis was informed by two related lines of literature, including: (1) studies explaining academic outcomes among Hispanic students and (2) research studying the effects of developmental education. Together, these lines of work explain that, among Hispanic students, successful remediation is likely influenced by a combination of socio-demographic characteristics, pre-college experiences, academic goals, environmental pull-factors, college experiences, and institutional characteristics.

In a recent systematic review of 63 studies, Crisp, Taggart, and Nora (2012) provide a comprehensive summary of empirical evidence specific to the factors related to Hispanic student academic outcomes. Findings reveal that students' gender, high school grade point average, parental education, finances, and academic confidence have repeatedly been shown to be related to Hispanic students' grades, persistence decisions, *and* odds of degree completion. Moreover, having supportive relationships, being academically motivated and committed, enrolling in college immediately following high school, attending college full-time, and having positive perceptions of the racial climate were found across the reviewed studies to influence several student outcomes positively. These results bring attention to the need for research to better understand the role of Hispanic students' developmental and non-developmental college experiences in predicting academic outcomes. Further, findings highlight the need for research that properly accounts for the institutional context in explaining Hispanic student outcomes.

Within the developmental education literature, mixed findings have been shown with regard to the impact of enrolling in developmental courses (e.g., Easterling, Patten, & Krile, 1998; Fike & Fike, 2008; Grimes & David, 1999; Jepsen, 2006; Kolajo, 2004; Lavin, Alba, & Silberstein, 1981; O'Connor & Morrison, 1997; Waycaster, 2001). Overall, results suggest that some, if not all, of the negative effects of remediation may be attributable to characteristics of students rather than to participation in remedial courses (Attewell, Lavin, Thurston & Tania, 2006; Bailey, 2009; Grubb, 2001; Levin & Calcagno, 2007). A recent white paper prepared for the Hispanic Association for Colleges and Universities (HACU) by Nora and Crisp (2012) identifies several meaningful differences between the characteristics and experiences of Hispanic students who do and do not enroll in remedial courses. Descriptive data reveals that Hispanic students who enroll in developmental courses may be more likely to be female, to be Mexican American, to have a lower high school GPA, to have taken less rigorous math courses in high school, and to receive lower levels of financial aid when compared to their non-remedial counterparts.

Despite the prevalence of Hispanic students in remedial courses, there is very little evidence documenting the role of developmental education in promoting academic success among Hispanic students (Nora & Crisp, 2012). Findings from a previous AIR grant (i.e., Crisp & Nora, 2010) indicate that the odds of persisting in college and/or earning a degree in the second year of college is positively related to enrolling in remedial courses among a national sample of Hispanic community college students. No relationship was found between outcomes and remediation in

students' third year of college. Results also reveal that developmental students' persistence and/or degree outcomes may be positively influenced by parental education, not working more than 20 hours per week off campus, receiving enough financial aid to pay for college, and enrolling full-time.

Although not specific to Hispanic students, there is a growing body of work documenting the characteristics of students who remediate in mathematics. Descriptive findings suggest that developmental math students may be systematically different from students who do not require remediation in terms of gender, ethnicity, and high school GPA (Hagedorn, Siadat, Fogel, Nora, & Pascarella, 1999). Additionally, work by Calcagno, Crosta, Bailey, and Jenkins (2007) suggest that older students may be overrepresented in remedial math courses. Bahr's (2010) analysis of students in California find that Hispanic students are more likely than White students to place into the highest level developmental math upon entering college. Bahr concludes that the degree of math deficiency entering college likely contributes to the overrepresentation of Hispanic students in remediation. However, little is known regarding Hispanic students who enroll in math remediation. As such, descriptive work is needed to identify the characteristics and developmental needs of Hispanic students who enroll in post-secondary education unprepared to enroll in college-level mathematics courses.

A critical review of literature by Melguizo, Box, and Prather (2010) highlights the absence of research on the impacts of developmental math that properly controls for student characteristics and pre-college experiences. Notable exceptions include research by Bettinger and Long (2005) who find that, among a sample of community college students in Ohio, those who enroll in remedial math courses are 15 percent more likely to transfer to a four-year institution than those with similar test scores and pre-college academic preparation who do not enroll in remedial math. Additionally, work by Bahr (2008, 2010) indicates that long-term academic outcomes among remedial students who earn college-level math credit may be comparable to non-remedial students.

However, findings by Bahr (2008) also reveal that the majority of students requiring math remediation do not successfully attain college-level math skills. Moreover, additional work by Bahr (2010) suggests that Hispanic students are less likely than White and Asian American students to remediate successfully. Further, a strong relationship is found to exist between Hispanic students' initial math skill deficiency and the likelihood of successful remediation. It is notable that no study to date has modeled the characteristics and experiences associated with successful math remediation among Hispanic students. Findings by Bahr (2010) suggest that, among community college students in California, successful remediation is influenced by students' gender, high school math courses taken, age, English competency, academic goals, several proxies of socioeconomic status, enrollment inconsistency, and the racial composition of the student body. However, the analysis was not run separately for Hispanic students, who only represented 34 percent of the sample. It is therefore unclear to what extent the variables influencing completion of college-level math credit may be similar or different among a national sample of remedial Hispanic students.

Describe the research method that will be used:

Research Questions

The grant activities will address the following questions:

What socio-demographic characteristics and high school experiences describe Hispanic students who enroll in remedial mathematics courses?

What socio-demographic characteristics, pre-college experiences, academic goals, environmental pull-factors, college

experiences, and institutional characteristics predict successful remediation among Hispanic students?

Sample

The sample will include the 730 Hispanic students in the Beginning Postsecondary Students Longitudinal Study (BPS: 04/09) dataset who were less than 24 years of age and who enrolled in one or more remedial math courses. The decision to limit the sample to traditional age students was based on limitations of the BPS data, which do not capture complete data for high school related data elements for older students. (Note that traditional age students represent 90 percent of the Hispanic students in the dataset). Less than half (46%) of the Hispanic students in the sample successfully remediated within six academic years.

Variables/Conceptual Model

A survey item in the Postsecondary Education Transcript Study (PETS) for BPS will be used to flag students who enrolled in remedial math coursework within six academic years. Developmental courses have been identified using the 2010 College Course Map, which provides a taxonomy system for coding classes. The dependent variable will be defined as "earning college-level math credit within six academic years." A broad range of courses is coded by NCES as college-level, including algebra, geometry, applied mathematics, statistics, algebra for teachers, and business math (Bryan & Simone, 2012). As previously mentioned, the conceptual model guiding the multi-level regression analysis posits that among Hispanic students, successful remediation is influenced by a combination of socio-demographic characteristics, pre-college experiences, academic goals, environmental pull-factors, college experiences, and institutional characteristics.

Several variables will be included as *socio-demographic* characteristics, including students' gender, Hispanic ethnic subgroup, and parental education. *Pre-college experiences* will also be modeled including students' high school GPA, highest math course taken during high school, and whether a student delayed enrollment in college following high school. Students' *academic goals*, as measured by degree expectations during the first year of college, will be used. The model also accounts for several *academic experiences and pull factors*, including hours worked, the amount of financial aid received, whether a student enrolled exclusively full-time across six academic years, whether a student stopped out of college, first year cumulative GPA, and enrollment in developmental or college-level English. Further, the analysis will account for various *institutional characteristics* of the colleges and universities attended by students, including whether an institution is a two or four-year college, institutional control (i.e., public or private), tuition and fees, enrollment size, and designation as a Hispanic Serving Institution (HSI).

Analysis

Percentages will be used to describe the socio-demographic characteristics and high school experiences of Hispanic students who enroll in remedial mathematics courses. Hierarchical generalized linear modeling (HGLM) techniques will then be utilized to account for the impact of student and institutional characteristics on successful remediation. HGLM is the appropriate analytic technique to use, given the binary outcome variable and the nested nature of students within postsecondary institutions (Raudenbush & Bryk, 2002). An unconditional model will be run to provide a measure of estimated success rates for the sample of institutions. The dichotomous nature of the outcome makes calculating the intra-class correlation (ICC) non-instructive (Raudenbush & Bryk, 2002). Therefore, following practice by Rumberger and Thomas (2000), box plots showing the variation in the average chance of remedial success will be evaluated using estimates derived from empirical Bayes residuals.

Student-level predictors will be added to estimate the student-level variables related to successful remediation. All equations will be fixed to constrain the effect of the within-institutional predictors to be the same for all institutions. Variables will be grand-mean centered to aid in interpreting parameter estimates and control for differences in student characteristics and experiences between institutions (Raudenbush & Bryk, 2002). The level 1 structural model will take the form:

$$\log[\varphi_{1j}/1-\varphi_{1j}]] = \beta_{0j} + \beta_{1j}(GENDER)_{ij} + \beta_{2j}(HISPTYPE)_{ij} + \beta_{3j}(PAREDUC)_{ij}$$

$$+ \beta_{4j}(HSGPAREP)_{ij} + \beta_{5j}(HSMATH)_{ij} + \beta_{6j}(QEENGR)_{ij}$$

$+\ \beta_{7j}(\text{DELAYENR})_{ij} + \beta_{8j}(\text{HIGHLVEX})_{ij} + \beta_{9j}(\text{TOTAID})_{ij}$

$+\ \beta_{10j}(\text{JOBHOUR})_{ij}, + \beta_{11j}(\text{ENINPT6Y})_{ij}, + \beta_{12j}(\text{STNUM6Y})_{ij}, + \beta_{13j}(\text{GPA})_{ij}$

Level 2 predictors will then be added to measure hypothesized contextual influences on successful remediation. Following recent practice by Porchea, Allen, Robbins, and Phelps (2010), only institution-specific random intercepts will be specified. The level 2 structural model will be estimated as follows:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{FLEVEL})_j + \gamma_{02}(\text{FCONTROL})_j + \gamma_{03}(\text{ENRLSIZE})_j + \gamma_{04}(\text{TUITION2})_j + \gamma_{05}(\text{OCRHSI})_j + u_{0j}$

$\beta_{1j} = \gamma_{10}$

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$\beta_{17j} = \gamma_{130}$

For all models, the sampling model will be Bernoulli:

$\text{Prob}\ (Y_{ij} = 1/\beta_{ij}) = \varphi_{ij}$

Models will be estimated using a high-order Laplace approximation of maximum likelihood (ML), as this approach has been shown to produce accurate approximations to ML for all parameters (Raudenbush, Yang, & Yosef, 1998). Unit-specific, model-based, and robust standard errors will be compared to identify possible misspecification of the distribution of random effects (Raudenbush & Bryk, 2002). Logit coefficients will be interpreted using odds-ratios, representing the change in the odds of successful remediation associated with a one-unit change in the independent variable, holding all others constant (Peng, So, Stage, & St. John, 2002).

Uploaded Appendix Document(s):

Project Description II

Will you use NCES target dataset? Yes

Please check all NCES datasets that apply
- Beginning Postsecondary Student (BPS) Longitudinal Study and Transcript Data

Explain why each dataset best serves this research. Include a variable list for each dataset used.

Data in the Beginning Postsecondary Students Longitudinal Study (BPS: 04/09) provide a wide range of variables that describe the characteristics, high school and college experiences of a national sample of Hispanic students. Moreover, the BPS data provide institutional characteristics that allow for an examination of the influence of institutional characteristics in predicting successful remediation. Further, the recently released BPS Postsecondary Education Transcript study (PETS) provides a wealth of data needed to understand the role of course taking in predicting success outcomes. The following variables will be used:

Variables used to identify the sample (HISPANIC, AGE, QEMATHR)

Flag for institutional ID (UNITID)

Socio-demographic characteristics (GENDER, HISPTYPE, PAREDUC)

Pre-college experiences (HSGPAREP, HSMATH, DELAYENR)

Academic goals (HIGHLVEX)

College experiences and pull-factors (JOBHOUR, TOTAID, ENINPT6Y, STNUM6Y, GPA, QEENGR)

Institutional characteristics (FLEVEL, FCONTROL, ENRLSIZE, TUITION2, OCRHSI)

Outcome – All college-level mathematics: credits earned (QEMATERN)

Will you use NSF target dataset? No

Explain why each dataset best serves this research. Include a variable list for each dataset used.

Will you address the NPEC focus topic? No

If yes, please briefly describe:

Project Description III

Provide a timeline of key project activities:

The proposed activities will be completed in a one-year timeframe. I already have access to both restricted datasets and have previously used both for related projects. I am also comfortable using both SPSS and HLM software and have conducted HGLM analyses for other studies.

Timeline of key activities:

January 2013: Submit expedited IRB application
June 2013 to August 2013: Clean and format data; conduct initial descriptive analysis
Fall 2013: Complete HGLM analysis
December 2013: Submit mid-year progress report to AIR
January 2014 through March 2014: Complete write-up of findings
April 2014: Present findings at AERA conference
May 2014: Present findings at AIR forum
June 2014: Complete final progress report; submit paper to top tier journal

List deliverables such as research reports, books, and presentations that will be developed from this research initiative:

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1. National conference presentation – American Educational Research Association
2. National conference presentation – Association for Institutional Research
3. Findings presented in policy brief - Center for Research and Policy in Education (CRPE)
4. Publication in top-tier journal (Journal of Higher Education, Review of Higher Education, or Review of Higher Education)

Describe how you will disseminate the results of this research:

In addition to disseminating findings to higher education scholars around the country, results will be shared with the following individuals/organizations:

- Loui Olivas, President, American Association of Hispanics in Higher Education (AAHHE)
- Emily Calderon Galdeano, Director of Research and Information, Hispanic Association of Colleges and Universities (HACU)
- Raymund Paredes, Higher Education Commissioner, Texas Higher Education Coordinating Board (THECB)
- Lee Holcombe, Director of the Texas Higher Education Policy Institute, Texas Higher Education Coordinating Board (THECB)

Provide a reference list of sources cited:

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IRB Statement

Statement of Institutional Review Board approval or exemption:

The research proposal will be submitted for expedited review by the Institutional Review Board at UTSA in January 2013. The typical turnaround time for expedited applications is two weeks. Approval will therefore be obtained well within time for the activities to begin in June.

Statement of Use of Restricted Datasets

All of the required permissions and security procedures are in place for this project. I currently have access to the restricted BPS: 04/09 and PETS data files (IES Restricted Data License # 08070029).

Biographical Sketch

Gloria Crisp's Biography Sketch

Gloria Crisp is an Associate Professor in the Educational Leadership and Policy Studies Department at The University of Texas at San Antonio (UTSA). Dr. Crisp earned her doctorate degree in 2006 from the University of Houston. She is an Associate Editor of the *Review of Higher Education* and a member of the Forum Program Committee for the Association for Institutional Research (AIR). She also serves as a book/monograph and scholarly article reviewer for AIR. Prior to her academic appointment, Dr. Crisp worked in institutional research at both two and four-year institutions.

Dr. Crisp's work has been published in top journals including *Research in Higher Education, The American Educational Research Journal*, *The Review of Higher Education, Teachers College Record*, *Journal of College Student Development*, and the *Hispanic Journal of Behavioral Sciences*. She is also co-author of numerous book chapters including a volume of *Higher Education: Handbook of Theory and Research*. The focus of Dr. Crisp's scholarship includes understanding how mentoring is perceived and experienced by college students, the factors that influence the success of community college and/or Hispanic students, and the impact of institutional and state policy on student transfer and persistence. Her survey instrument, the College Student Mentoring Scale (CSMS), is currently being used by institutions in both the United States and abroad including Florida Gulf Coast University, The University of Maryland, University of Texas at Brownsville, The University of Laval in Québec, University of New Castle in Hong Kong, and The University of Ulm.

Dr. Crisp's recent work focused on Hispanic student success position her well to conduct the proposed study. She received an AIR research grant in 2008-09 with Amaury Nora to study the impact of developmental education on the persistence decisions of Hispanic students attending community colleges using BPS 04:06 data. Since that time, Dr. Crisp has conducted numerous quantitative studies around Hispanic student success using a variety of multivariate analysis techniques including structural equation modeling (SEM) and hierarchical generalized linear modeling (HGLM). Dr. Crisp has published six articles and book chapters using NCES datasets, including ELS, BPS, PETS, and IPEDS. Additionally, she recently used the BPS and PETS data to develop several white papers for the Hispanic Association for Colleges and Universities (HACU). Dr. Crisp's current funded work includes a study supported by HACU to develop a typology of Hispanic Serving Institutions (HSIs) with co-investigators Anne-Marie Nunez and Diane Elizondo.

Budget Requirements

Gloria Crisp' Budget

Personnel-Time on Project
%(FTE) Academic Year: 12.94
%(FTE) Summer: 86.25

Personnel-Salary & Benefits
Academic Year: $ 68293.00
Summer: $ 22764.00

Graduate Research Assistant's Budget

Personnel-Time on Project
%(FTE) Academic Year: 0.00
%(FTE) Summer: 0.00

Personnel-Salary & Benefits
Academic Year: $ 0.00
Summer: $ 0.00

Total Salary and Wages: $28471.06

Travel: $3432.00

Other travel related expenses: $2748.00
Other research expenses: $300.00
Total Request: $34951.06

Funding History

Dr. Crisp does not have any current or pending support for this or related research. She received an AIR research grant in 2008-09 with Dr. Amaury Nora for a related project. Findings from that project were presented at the AIR Forum and were subsequently published in *Research in Higher Education* (i.e., Crisp & Nora, 2010).