Research Opportunity Interventions and College/Career Success in STEM Fields: The Role of Multilevel Strengths and Student Role Strain

Krystal L. Williams, Ph.D. Candidate
Center for the Study of Higher and Postsecondary Education
Graduate Student Research Assistant, The National Center for Institutional Diversity

UNIVERSITY OF MICHIGAN

Abstract

Guided by a strength-based role strain and adaptation model, this research presents preliminary findings concerning the influence of students' academic and financial barriers (i.e. role strain) and multilevel strengths on the efficacy of an exemplary pipeline intervention—the Summer Research Opportunity Program (SROP). This analysis specifically focuses on traditionally underrepresented students of color in science, technology, engineering and mathematics (STEM) because of the need to strengthen and diversify the education pipeline to STEM professions for this population. Given the role-strain and adaptation theoretical orientation and existing empirical evidence concerning SROP, we expect to find that students' financial and academic barriers negatively influence successful STEM college and career outcomes, but that these deleterious effects can be buffered by students' multilevel strengths. This research hopes to expand existing literature and inform future policy implementation by better explicating the various factors that influence intervention outcomes.

Problem and Significance

There is a growing interest in better understanding factors that influence pipeline interventions' ability to increase the number of students from underrepresented groups who succeed in higher education and competitive career fields (Greene & Forster, 2003; Greene & Winters, 2005; Perna, 2006). While evaluation studies have supported the overall efficacy of these interventions, less is known about the elements that impede and enhance the success of various program participants. As a result, there is a growing collaboration among several governmental agencies and non-profits to support more comprehensive approaches to understanding and improving pipeline interventions that promote success among minorities and women in STEM fields. Guided by a strength-based role strain and adaptation model, my dissertation seeks to better clarify how financial and academic barriers impact the efficacy of an innovative pipeline intervention on successful educational and career outcomes of underrepresented students of color (USC) (e.g. Bowman, 2006).

Specific Aims

This research employs a series of analyses and uses *intervention survey data* to investigate the following specific aims:

Aim 1: Do financial and academic barriers represent distinct dimensions of student role strain for intervention participants?

Aim 2: What are the relative effects of an exemplary pipeline intervention, student role strain, and adaptive strengths on successful STEM-relate outcomes?

Aim 3: Are the effects of an exemplary pipeline intervention on successful STEM-related outcomes "moderated" by student role strain and adaptive strengths?

Aim 4: Does self-efficacy "mediate" the effects of an exemplary pipeline intervention and student role strain on successful STEM-related?

Aim 5: Does exemplary pipeline intervention combine with student role strain and self-efficacy in the same manner for underrepresented students with high and low levels of extended family support?

Aim 6: Does exemplary pipeline intervention combine with student role strain and self-efficacy in the same manner for female and male students from underrepresented groups?

Related Literature

The strengths-based role strain and adaptation approach specifies pivotal social psychological mechanisms that can impede or enhance the efficacy of interventions designed to promote successful college and career outcomes (e.g. Bowman, 2006; Gadsden &Bowman, 1999; Reyes, 2002). ***Three basic propositions*** can be derived from the role strain and adaptation model:

(1) *The adverse effects of student role barriers on successful outcomes are exacerbated by risky cognitive appraisals (i.e. lower self-efficacy).*

(2) *Objective and cognitive aspects of student role strain impede the efficacy of pipeline interventions on successful outcomes.*

(3) *Multilevel strengths can enhance the efficacy of interventions.*

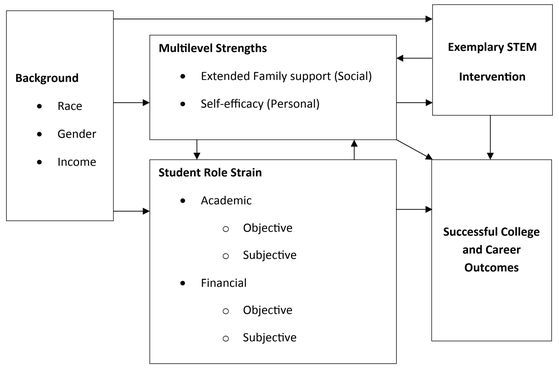
Objective Student Role Strain:

- The are powerful adverse effects of objective financial (e.g. St. John, 1991; 1999; St. John & Noell, 1989) and academic barriers (e.g. Williams, in press) on successful educational and career outcomes among USC.
- The lack of objective financial resources has a detrimental effect on students' success in college.
- The lack of academic preparation is a significant barrier that many USC must overcome largely due to systematic K-12 educational inequalities (Hearn, 1984; Horn & Kojaku, 2001; Rose & Betts 2001).

Social Psychological Factors:

- We lack a theoretical understanding about how the adverse effects of objective student role strain might be influenced by social psychological mechanisms.
- A growing number of studies support the role strain and adaptation propositions (Bandura, 1986; Bowman, 2006; Sedlacek, 2004; Trent, Lee, & Owens-Nicholson, 2006).

Conceptual Framework



Influence of Multilevel Strengths, Student Role Strain and Exemplary Pipeline Interventions on Successful College and Career Outcomes

Data

- CIC Summer Research Opportunities Program (SROP) survey data
- Sample includes USC in STEM fields who are SROP participants (n=94) and Non-Participants (n=75) who applied
- Phone, mail and web instruments used for data collection
- Data includes students' background; education and aspirations; self-assessment of academic and leadership abilities; program experiences; educational interests; academic achievement; college preparation process; involvement on campus; and future goals.

Methodology

Component 1: Psychometric Analysis of Role Strain
Factor analysis will be used to determine the number of latent constructs that are represented amongst the individual measures and if objective and subjective aspects of those factors are distinguishable. After conducting an exploratory factors analysis, I will also examine the relationships between individual items to identify the latent constructs represented. I anticipate that a total of four factors will emerge: (1) Subjective and Object Financial Role Strain and (2) Subjective and Object Academic Role Strain

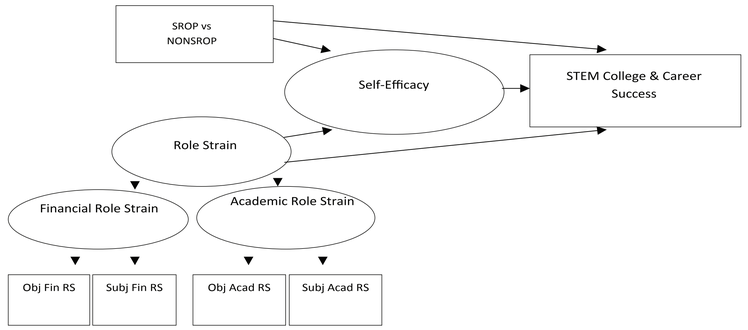
Component 2: Investigating Independent Effects
Hierarchical regression analysis will be used to investigate the independent effects of the intervention, financial and academic role strain, and self-efficacy on STEM-related outcomes. The following successive linear models will be considered:

(1) $Y = \beta 0 + \beta 1\ Int + \varepsilon$
(2) $Y = \beta 0 + \beta 1\ Int + \beta 2\ OFRS + \beta 3\ SFRS + \beta 4\ OARS + \beta 5\ SARS + \varepsilon$
(3) $Y = \beta 0 + \beta 1\ Int + \beta 2\ OFRS + \beta 3\ SFRS + \beta 4\ OARS + \beta 5\ SARS + \beta 6\ SE + \varepsilon$

Component 3: Moderating Relationships
Ordinary least square regression analysis will be used to examine how the intervention interacts with student roles strain and strengths. Equation 4 provided the functional form for this analysis:

(4) $Y = \beta 0 + \beta 1\ Int + \beta 2\ OFRS + \beta 3\ SFRS + \beta 4\ OARS + \beta 5\ SARS + \beta 6\ SE + \beta 7\ Int\ X\ OFRS + \beta 8\ Int\ X\ SFRS + \beta 9\ Int\ X\ OARS + \beta 10\ Int\ X\ SARS + \beta 11\ Int\ X\ SE + \varepsilon$

Component 4: Mediating Relationships
Structural equation modeling techniques will be used to investigate if self-efficacy mediates the effects of SROP participation and student role strain on STEM-related outcomes. The following figure illustrates the structural model to be considered:



Methodology (continued)

Component 5: Moderated-Mediation
The relationship between the intervention, role strain, self-efficacy and the outcome will be examined for students within the following categories

- High Levels of Extended Family Support vs Low Levels of Extended Family Support
- Males vs Female

The mediating relationships presented in Component 4 will be assessed for each of those groups and the direct and indirect effects of the intervention and role strain on the outcome for students in the comparable groups will be examined to determine if these relationships manifest differently for students within different subsamples.

Preliminary Findings

Descriptive Statistics for SROP and NON SROP Participants (N=169)

	Mean	Min	Max	SD
Outcomes				
Amount of education expected	4.2	1	5	0.64
Certainty about:				
(1= completely certain; 5= almost certain I will not)				
Graduating in major	1.2	1	2	0.39
Pursuing a PhD	1.8	1	5	0.89
Role Strain				
Hrs/week working part-time	2.8	1	6	1.57
Financial Issues:				
(1= none ; 4= great deal)				
Personal money or financial problems	2.6	1	4	1.09
Personal job problems	1.7	1	4	0.90
Kept financial and other problems from hurting school performance				
(1= not well; 5= very well)	3.6	1	5	1.10
High school GPA	3.6	1	4	0.53
College GPA	3.5	2	4	0.33
Self Assessment compared to peers:				
(1= lower 10%; 5= upper 10%)				
Note taking ability	4.1	1	5	0.97
Reading speed/comprehension	3.7	1	5	0.89
Writing ability	3.7	1	5	0.88
Math/quantitative skills	3.9	1	5	0.94
Strengths				
Response that the following are applicable:				
(1= strongly agree; 4= strongly disagree)				
Having someone to talk to about school problems	1.6	1	4	0.72
Having access to someone in the career of interest	1.7	1	4	0.80
The following people are availabe to give advice if a problem occurs:				
(1= definitely yes; 5= definitley no)				
Faculty/Staff	1.8	1	5	1.09
Family Member	1.3	1	4	0.62
Best Friend	1.4	1	4	0.68
Background Characteristics				
Black (%)	57.4			
Hispanic , Latino or Spanish Origin (%)	38.5			
Native American/Alaska Native (%)	3.6			
Native Hawaiian/Other Pacific Islander (%)	0.6			
Female (%)	69.2			

Acknowledgements

The project described was supported by Award Number R01GM088750 from the National Institute of General Medical Sciences. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of General Medical Sciences or the National Institutes of Health.

Contact Information

klwms@umich.edu