Undergraduate Research Participation: Predictors and Relationship with Research Career Pursuits

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Tongshan Chang\textsuperscript{a}, William Armstrong\textsuperscript{b}, Cinnamon Danube\textsuperscript{c}, Kristen McKinney\textsuperscript{d}, Matt Reed\textsuperscript{a}

\textsuperscript{a}University of California Office of the President, \textsuperscript{b}University of California - San Diego, \textsuperscript{c}University of California - Merced, \textsuperscript{d}University of California - Los Angeles
Topics Covered

Background--research purpose and previous research

Research questions

Method--data sources, population, and data definitions

Results

Conclusions
Relationship between Undergraduate Research Participation (UGRP) and the Choice of a Research Career

Existing research shows that UGRP:

- Helps clarify students’ interest in research careers and increases students’ expectations of obtaining a PhD (Russell, Hancock, & McCullough, 2007)

- Increases likelihood of pursuing doctoral, medical, and law degrees and increases likelihood of engaging in post-undergraduate research activity (Hathaway, Nagda, & Gregerman, 2002)
Retains talented students in the pipeline toward postgraduate science education (Lopatto, 2007)

Linked to improved graduate school performance in key skill areas (Gilmore, 2015)

Enhance interest of minority students in pursuing graduate studies in the Life Sciences (Villarejo, 2008) (Lopatto, ibid)
Background

Relationship between student characteristics and participating in undergraduate research?

- Positive outcomes were associated with age and class level (Willis, 2013)
- Differences in perceived value and ROI of UGRP for URM participants (Walker, 2013)
- Research review found a relative paucity and gaps in prior research on student characteristics, post-baccalaureate employment, graduate education and UGRP
- A primary goal of the present study is to provide new data and evidence on the relation between selected student characteristics, outcomes, and UGRP
Research Questions

1. What are the predictors of undergraduate student research participation?
2. Is undergraduate research participation associated with obtaining an advanced (graduate) degree?
3. Is undergraduate research participation associated with pursuing a career in a research-related field?
Data Sources--Research Participation

- Measure of research participation: assisted faculty in research
- University of California Undergraduate Experience Survey (UCUES)
  - UCUES instrument: academic experience, globalization skills, civic & community engagement, and student development.
  - Administered once every two years
  - Response rate: around 40%, around 60,000 responses
### Data Sources--Research Participation

#### Research related- questions

<table>
<thead>
<tr>
<th>Expectations</th>
<th>Experience</th>
<th>Aspirations</th>
</tr>
</thead>
</table>
| • Having **courses** with faculty members who refer to their own research  
• Learning research **methods**  
• Assisting faculty members in their research  
• Pursuing your own research | • **Participated** in a small research-oriented seminar with faculty, research or creative project outside of regular course, a research project or research paper as part of your course work  
• **Assisted** faculty in conducting research  
• **Satisfied** with opportunities for research experience, library research resources, library and online information research skills | • Highest degree: doctorate (Ph.D., Ed.D., etc.), etc.  
• **Career** plan after graduation: enroll in graduate or professional school, educator, researcher, scientist, etc. |
Data Sources--Graduate Degrees

• Measure of graduate degrees: doctorate or professional doctorate
• The National Student Clearinghouse (NSC)
  o Submitted student's name and birthdate to NSC to identify graduate degree information
  o Master’s, doctoral, professional doctoral, or non-graduate degree
Data Sources--Employment

- Measure of research-related fields: Higher Education, other Education, R&D Social Science, or other Professional/Science areas
- The California Employment Development Department (EDD)
  - Submitted students’ SSNs to EDD to identify alumni’s employment
  - Research-related fields: Higher Education, other Education, R&D Social Science, other Professional/Science areas
Data Sources--Demographics/Background

- University of California Data Warehouse (UCDW) at UC Office of the President
  - Ethnicity: African American, American Indian, Asian, Chicano/Latino, International, White, and Unknown/Other
  - First generation: no parents received a bachelor’s degree
  - Student level when started at UC: freshman vs. transfer
  - Pell grant status: ever received a Pell grant at UC
  - Major: Intended major and degree major
  - First year GPA at UC
  - Graduation GPA at UC
Population

Bachelor’s degree recipients in spring 2006 24,765

Respondents to UCUES administered in spring 2006 9,437, 38%

- Participated in faculty research 3,693, 39%
- Obtained PhD/prof. doctorate 930, 10%
- Pursued career in research fields 2,642, 28%
Population and Survey Respondents by Selected Demographics

First Generation Status
- DR: 12% Not First-Generation, 31% First Generation, 56% Unknown
- SR: 5% Not First-Generation, 32% First Generation, 63% Unknown

Pell Grant Status
- DR: 36% Not Pell, 64% Pell Recipients
- SR: 35% Not Pell, 65% Pell Recipients

Race/Ethnicity
- African American: 9% DR, 8% SR
- American Indian: 38% DR, 39% SR
- Asian: 12% DR, 11% SR
- Chicano/Latino: 35% DR, 37% SR
- International: 12% DR, 11% SR
- White: 11% DR, 12% SR
- Unknown/Other: 28% DR, 27% SR

Degree Discipline
- Engi/CS: 28% DR, 27% SR
- Humanities: 20% DR, 21% SR
- Other: 25% DR, 24% SR
- Science: 16% DR, 15% SR
- Social Science: 11% DR, 12% SR

DR=degree recipients in spring 2006    SR = survey respondents to UCUES
Analytic Strategy

Used logistic regression to examine predictors of each of our three outcomes:

1. Participated in research with a faculty member
2. Obtained a PhD/Professional Doctorate
3. Pursued a career in a research-related field
## Results - Predictors of Research Participation

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds ratio and significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year GPA at UC</td>
<td>OR=1.44, p &lt; .001</td>
</tr>
<tr>
<td>Plan to Pursue PhD/Professional Doctorate (0 = no, 1 = yes)</td>
<td>OR=2.88, p &lt; .001</td>
</tr>
<tr>
<td>Plan to Enroll in Graduate School (0 = no, 1 = yes)</td>
<td>OR=1.48, p &lt; .001</td>
</tr>
<tr>
<td>Declared/Intended Field: Science (ref) vs. Humanities</td>
<td>OR=.27, p &lt; .001</td>
</tr>
<tr>
<td>Declared/Intended Field: Science (ref) vs. Social Science</td>
<td>OR=.67, p &lt; .001</td>
</tr>
<tr>
<td>Declared/Intended Field: Science (ref) vs. Other Discipline</td>
<td>OR=.62, p &lt; .001</td>
</tr>
<tr>
<td>Applicant level: Transfer (0) vs. Frosh (1)</td>
<td>OR=1.18, p &lt; .01</td>
</tr>
<tr>
<td>Race/ethnicity: White (ref) vs. International</td>
<td>OR = 1.77, p &lt; .001</td>
</tr>
<tr>
<td>Race/ethnicity: White (ref) vs. Unknown</td>
<td>OR = .83, p &lt; .04</td>
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</tbody>
</table>

R-square: 14-18%

Notes:
- n=9,104
- **Non-significant predictors:** reading/writing skills; Engineering discipline; research skills; Pell Grant eligibility status; American Indian race/ethnicity; Asian race/ethnicity
### Results - Predictors of Earning a PhD or Other Professional Doctorate

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds ratio and significance</th>
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</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>19-41%</td>
</tr>
<tr>
<td>Assisted Faculty in Research (0 = no, 1 = yes)</td>
<td>OR = 1.82, p &lt; .001</td>
</tr>
<tr>
<td>Plan to Pursue PhD/Professional Doctorate (0 = no, 1 = yes)</td>
<td>OR = 12.42, p &lt; .001</td>
</tr>
<tr>
<td>Plan to Enroll in Graduate School (0 = no, 1 = yes)</td>
<td>OR = 2.27, p &lt; .001</td>
</tr>
<tr>
<td>Baccalaureate Degree: Science (ref) vs. Engineering/Computer Science</td>
<td>OR = .48, p &lt; .001</td>
</tr>
<tr>
<td>Baccalaureate Degree: Science (ref) vs. Humanities</td>
<td>OR = .23, p &lt; .001</td>
</tr>
<tr>
<td>Baccalaureate Degree: Science (ref) vs. Social Sciences</td>
<td>OR = .39, p &lt; .001</td>
</tr>
<tr>
<td>Baccalaureate Degree: Science (ref) vs. Other</td>
<td>OR = .34, p &lt; .001</td>
</tr>
<tr>
<td>Undergraduate GPA at Graduation</td>
<td>OR = 1.68, p &lt; .001</td>
</tr>
<tr>
<td>Applicant level: Transfer (0) vs. Frosh (1)</td>
<td>OR = 1.38, p &lt; .01</td>
</tr>
<tr>
<td>First Generation Status: Not First Generation (0) vs. First Generation(1)</td>
<td>OR = 1.23, p = .03</td>
</tr>
<tr>
<td>Race/ethnicity: White (ref) vs. International</td>
<td>OR = .39, p &lt; .01</td>
</tr>
<tr>
<td>Race/ethnicity: White (ref) vs. Hispanic</td>
<td>OR = 62, p &lt; .01</td>
</tr>
<tr>
<td>Race/ethnicity: White (ref) vs. African American</td>
<td>OR = .45, p = .02</td>
</tr>
</tbody>
</table>

**Notes:**
- n=8,602
- **Non-significant predictors:**
  - reading/analytic skills; research skills; Pell Grant eligibility status; American Indian, Asian, Unknown race/ethnicity
results- predictors of employment in a research-related field

<table>
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<tr>
<th>Predictor</th>
<th>Odds ratio and significance</th>
<th>R-squared</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assisted Faculty in Research (0 = \text{no}, 1 = \text{yes})</td>
<td>OR = 1.20, (p = .01)</td>
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</tr>
<tr>
<td>Plan to Pursue PhD/Professional Doctorate (0 = \text{no}, 1 = \text{yes})</td>
<td>OR = 1.61, (p &lt; .001)</td>
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</tr>
<tr>
<td>Reading/Analytic Skills at Graduation from UC</td>
<td>OR = 1.13, (p &lt; .04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baccalaureate Degree: Science (ref) vs. Engineering/Computer Science</td>
<td>OR = 0.69, (p &lt; .01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Generation Status: Not First Generation (0) vs. First Generation(1)</td>
<td>OR = 1.18, (p = .03)</td>
<td></td>
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</tr>
</tbody>
</table>

Notes:

- \(n=4,690\)
- **Non-significant predictors**: research skills at Graduation from UC; applicant level; Pell Grant eligibility status; race/ethnicity; humanities, social science, other degree discipline; plans to enroll in graduate school; undergraduate GPA at graduation
Conclusions – Research Questions

1. What are the predictors of undergraduate student research participation?
   - Intent to pursue further education
   - Science major
   - High-achieving student
   - Generation status

2. Is undergraduate research participation associated with obtaining an advanced (graduate) degree?
   Yes

3. Is undergraduate research participation associated with pursuing a career in a research-related field?
   Yes
Conclusions – Limitations and Next Steps

Chicken and egg?
Combine into a single model to better view determinants

Challenge of identifying “research fields” in employment data
Potential other sources for data?

Remaining questions regarding opportunity to participate
Questions?
References

Adedokun, Omolola A.; Zhang, Dake; Parker, Loran Carleton; Bessenbacher, Ann; Childress, Amy; Burgess, Wilella Daniels (2012). Research and Teaching: Understanding How Undergraduate Research Experiences Influence Student Aspirations for Research Careers and Graduate Education. : Journal of College Science Teaching, v42 n1 p82-90 Sep


Villarejo, Merna; Barlow, Amy E. L.; Kogan, Deborah; Veazey, Brian D.; Sweeney, Jennifer K (2008) Encouraging Minority Undergraduates to Choose Science Careers: Career Paths Survey Results. CBE - Life Sciences Education, v7 n4 p394-409 Win


