A Multivariate Study of Graduate Student Satisfaction and Other Outcomes Within Cooperative Research Centers

Thesis Research

by

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Assumptions

• I/UCRCs have a positive impact on student’s training (Scott, C., Schadd, D. & Brock, D. (1991))

• The training experience provided by individual centers varies

• Those difference have the potential to affect student outcomes
Purpose of Research

- To explore benefits, experiences, and satisfaction of current graduate students in cooperative research centers
- To identify key center mechanisms needed to achieve those educational benefits
- To develop a tool for providing centers with immediate feedback from graduate students
  - Centers would benefit by more real time feedback from graduate students, providing a better understanding of which center components may assist in a better education/training of graduate students
Research Questions

• What individual and/or center characteristics are related to graduate students’...
  – satisfaction with their center experiences?
  – outcomes (such as technical and non-technical skills)?
  – career goals (e.g.: pursue careers in industry, academia, and/or government)?
  – scholarly achievements (e.g.: presentations, publications, patents)?
  – organizational commitment
  – perceptions of having a competitive advantage
Individual Center Mechanisms

Center Mechanisms

• Formal Activities
  • Meetings, Workshops, Seminars
• Center Projects
  • #, Involvement, Relevance to goals
  • Broad, Innovative, Applied
• Internships/Jobs
• Interactions
  • Frequency and Type
• Mentoring

Process/Outcomes

• Benefits
  – Psychological
  – Knowledge/Skills
  – Career Marketability
• Satisfaction
  – Opportunities
  – Education
  – Support
  – Well prepared
  – Autonomy
  – Time
  – Management
• Organizational Commitment
• Competitive Advantage
• Scholarly Production
• Career Goals
Overview of Data Analysis Strategy

- Descriptive statistics
- Exploratory factor analyses
  - Scale construction
    » Removed necessary items
- Regression hypothesis testing
  - Bivariate regressions
  - Multivariate regressions
Response Rate

- Response Rate
  - 528 Sent out
  - 208 Returned (39% response rate)
    - 14 not usable (missing data, not qualified, etc.)
  - 194 Total (37% response rate)
    - Excluding Center who used listserv
      - 45% returned
      - 43% usable
- Number of Centers: 34 (81%)
  - Includes 1 STC
Population and Sample Characteristics

- Average number of doctoral degree students
  - Participating Centers: 18.69
  - Full Population: 12.34
- Average number of master’s degree students
  - Participating Centers: 10.10
  - Full Population: 7.59
- Multi site vs. single site universities
  - Participating Centers
    » 22 Multi-site Centers = 64.7%
    » 12 Single-site Centers = 35.3%
  - Full Population
    » 27 Multi-site Centers = 64.3%
    » 15 Single-site Centers Population = 35.7%
Student Characteristics

- Students have been in graduate school for an average of 3.2 years
- About half of them fall into the age range of 25-29 years old
- About three-fourths of participants are males and one fourth are females
  - Full population: 77.6% Male, 22.4% Female
- Almost all (90%) are current students, but about ten percent are recent center graduates
Citizenship

Citizenship

Non-U.S. citizen: 48%
U.S. Citizen: 52%

Employment Plans of Non-U.S. Citizens

U.S.: 68%
My country: 23%
Don’t know: 9%

Compare to full population: 56.4% U.S. citizens, 43.6% non-U.S. citizens
Degree & Thesis

Highest degree student will be pursuing

- Masters: 87%
- PhD: 13%

Thesis/dissertation based on a Center project

- Yes, it is: 67%
- Yes, it will be: 17%
- No, it is not or will not be: 9%
- Don't know Yet: 7%
**Thesis**

**Number of academic departments on committee**

- 23%: 1
- 17%: 2
- 11%: 3 or more
- 49%: Don’t have a committee yet

**Number of industry or government Center members/participants on committee**

- 22%: 0
- 53%: 1
- 12%: 2 or more
- 13%: Don’t have a committee yet
Technical Project Involvement

1 Factor: 5 items

Reliability = .78

Scale Mean = 4.11 (S.D. = .74)
Enhanced Technical Mechanisms

- Regular project team meetings: 3.49
- Regular Center team meetings: 2.61
- Scientific seminar series featuring student speakers: 2.40
- Scientific seminar series featuring outside speakers: 2.23
- New Center sponsored academic courses: 1.65
- Mentoring: 1.46
- Internship placements: 1.40

Full Population: Involvement

Relevance = .68
(7 items)

Scale Mean = 2.18 (S.D. = .74)

Level of Involvement:
1 = “Not at all involved” to 5 = “Extremely involved”
**Center Experiences**

**Experiential and Expanded Center Experiences:**

Reliability = .726 (7 items)

<table>
<thead>
<tr>
<th>Experiential and Expanded Center Experiences (Scale Mean = 3.2 (S.D. = .41))</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working on scientific problems that are innovative and on the cutting edge</td>
<td>3.43</td>
<td>0.64</td>
</tr>
<tr>
<td>Opportunities to be a leader</td>
<td>2.96</td>
<td>0.80</td>
</tr>
<tr>
<td>Relying on the cooperation and collaboration of other principal investigators/scientists</td>
<td>3.01</td>
<td>0.80</td>
</tr>
<tr>
<td>“Hands-on” learning/learning-by-doing approach</td>
<td>3.34</td>
<td>0.62</td>
</tr>
<tr>
<td>Receiving an education that encourages me to listen, discuss, evaluate, and to learn from the ideas of others</td>
<td>3.21</td>
<td>0.63</td>
</tr>
<tr>
<td>Showing how a particular concept can be applied to an actual problem or situation</td>
<td>3.23</td>
<td>0.65</td>
</tr>
<tr>
<td>Working with people from diverse backgrounds (e.g., ethnicity, gender, nationality)</td>
<td>3.26</td>
<td>0.77</td>
</tr>
</tbody>
</table>

**Multidisciplinary Experiences:** Reliability = .762 (4 items)

<table>
<thead>
<tr>
<th>Multidisciplinary Center Experiences (Scale Mean = 2.98 (S.D. = .58))</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrating and synthesizing information from different fields in solving problems</td>
<td>3.20</td>
<td>0.60</td>
</tr>
<tr>
<td>Working/interacting regularly with faculty from other disciplines</td>
<td>2.60</td>
<td>0.87</td>
</tr>
<tr>
<td>Using knowledge and research from other disciplines ***</td>
<td>2.89</td>
<td>0.71</td>
</tr>
<tr>
<td>Frequent interactions with students from other disciplines ***</td>
<td>2.82</td>
<td>0.91</td>
</tr>
</tbody>
</table>

“My involvement in the Center includes…

1 = “Strongly Disagree” to 4 = “Strongly Agree”
Satisfaction

1 Factor: 10 items such as workload, center management, interactions, financial support, equipment, supervision, etc.

Scale Mean = 3.68 (S.D. = .72)

Reliability = .90
## Scales

<table>
<thead>
<tr>
<th>Scale Description</th>
<th>Mean</th>
<th>S.D.</th>
<th>Reliability</th>
<th># of items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Center Experiences (2 factors) Scale: 1 = “Strongly Disagree” to 4 = “Strongly Agree”</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiential and Expanded Center Experiences</td>
<td>3.20</td>
<td>0.41</td>
<td>0.73</td>
<td>7</td>
</tr>
<tr>
<td>Multidisciplinary Center Experiences</td>
<td>2.98</td>
<td>0.58</td>
<td>0.76</td>
<td>4</td>
</tr>
<tr>
<td><strong>Formal Training Mechanisms (2 factors): Scale: 1 = &quot;Not at all involved&quot; to 5 = &quot;Extremely involved&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhanced Technical Mechanisms</td>
<td>2.18</td>
<td>0.74</td>
<td>0.68</td>
<td>7</td>
</tr>
<tr>
<td>Unconventional Formal Mechanisms</td>
<td>1.36</td>
<td>0.76</td>
<td>0.63</td>
<td>2</td>
</tr>
<tr>
<td><strong>Technical Project Involvement (1 factor) Scale: 1 = &quot;Not at all involved&quot; to 5 = &quot;Extremely involved&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Project Involvement</td>
<td>4.11</td>
<td>0.74</td>
<td>0.78</td>
<td>5</td>
</tr>
<tr>
<td><strong>Satisfaction (1 factor) Scale: 1 = &quot;Not Satisfied to 5 = &quot;Extremely Satisfied&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>3.68</td>
<td>0.72</td>
<td>0.90</td>
<td>10</td>
</tr>
<tr>
<td><strong>Organizational Commitment; Scale: 1 = “Strongly Disagree” to 5 = “Strongly Agree”</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational Commitment</td>
<td>3.89</td>
<td>0.84</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td><strong>Skills (2 factors) Scale: 1 = &quot;Beginner&quot; to 5 = &quot;Expert&quot;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Technical and Problem Solving Skills</td>
<td>3.83</td>
<td>0.66</td>
<td>0.88</td>
<td>6</td>
</tr>
<tr>
<td>Soft/Applied Skills</td>
<td>3.84</td>
<td>0.61</td>
<td>0.80</td>
<td>4</td>
</tr>
</tbody>
</table>
Outcomes
Career Goals

- Upon entry into graduate school
- Upon highest degree completion

<table>
<thead>
<tr>
<th>Career Goals</th>
<th>Upon entry into graduate school</th>
<th>Upon highest degree completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>57.3%</td>
<td>29.4%</td>
</tr>
<tr>
<td>Academia</td>
<td>55.0%</td>
<td>25.8%</td>
</tr>
<tr>
<td>Government</td>
<td>2.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Other</td>
<td>0.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Don't Know</td>
<td>11.3%</td>
<td>13.4%</td>
</tr>
</tbody>
</table>
Career Goals

Expected to go into Industry:
Current Goals

- 82% Industry
- 11% Academia
- 6% Government/Other
- 1% DK

Expected to go into Academia:
Current Goals

- 68% Academia
- 18% Industry
- 10% Government/Other
- 4% DK
## Regressions: Satisfaction

### Satisfaction

<table>
<thead>
<tr>
<th>R Squared = .46</th>
<th>Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.152</td>
<td>0.018</td>
</tr>
<tr>
<td># of interactions with advisor</td>
<td>0.222</td>
<td>0.001</td>
</tr>
<tr>
<td># of interactions with industry members</td>
<td>0.147</td>
<td>0.034</td>
</tr>
<tr>
<td>Technical project involvement</td>
<td>0.118</td>
<td>0.074</td>
</tr>
<tr>
<td>Experiential and expanded center experiences</td>
<td>0.303</td>
<td>0.000</td>
</tr>
<tr>
<td>Multidisciplinary center experiences</td>
<td>0.179</td>
<td>0.029</td>
</tr>
</tbody>
</table>
## Regressions:
### Advanced Technical and Problem Solving Skills

<table>
<thead>
<tr>
<th>Advanced Technical and Problem Solving Skills</th>
<th>R Squared = .31</th>
<th>Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years in university</td>
<td>0.302</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td># of interactions with committee</td>
<td>0.227</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Technical project involvement</td>
<td>0.237</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Multidisciplinary center experiences</td>
<td>0.248</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>
## Regressions: Soft/Applied Skills

### R Squared = .22

<table>
<thead>
<tr>
<th>Citizenship status</th>
<th>Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years in university</td>
<td>0.225</td>
<td>0.001</td>
</tr>
<tr>
<td>Technical project involvement</td>
<td>0.240</td>
<td>0.000</td>
</tr>
<tr>
<td>Enhanced technical mechanisms</td>
<td>0.111</td>
<td>0.094</td>
</tr>
</tbody>
</table>
### Organizational Commitment

<table>
<thead>
<tr>
<th></th>
<th>Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Squared = 0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td># of interactions with center director</td>
<td>0.146</td>
<td>0.034</td>
</tr>
<tr>
<td>Experiential and expanded center experiences</td>
<td>0.365</td>
<td>0.000</td>
</tr>
<tr>
<td>Multidisciplinary center experiences</td>
<td>0.144</td>
<td>0.056</td>
</tr>
</tbody>
</table>
Preliminary Conclusions

- There is a fair amount of variability on characteristics and experiences across centers.
- Experiential and expanded center experiences and multidisciplinary center experiences are strong predictors, particularly for satisfaction and organizational commitment.
- Formal training mechanisms seem to have a smaller effect.
- Explain modest amount of variance.
  - High homogeneity across centers.
- Strong potential for an IUCRC student feedback questionnaire.