Scholars of Excellence in Engineering and Computer Science Program, an NSF S-STEM grant: Assessment and Lessons Learned – First Award

KARINNA M. VERNAZA, PH.D.
SCOTT E. STEINBRINK, PH.D.
BARRY J. BRINKMAN, PH.D.
THERESA M. VITOLO, PH.D.

ICEER 2014 – McMaster University, Hamilton, Ontario
August 25, 2014
SEECS at-a-glance

- Funded by US National Science Foundation (NSF) under Division of Undergraduate Education S-STEM program;
- Cross-disciplinary, multi-class enrichment program, aiming to improve access to educational opportunity for gifted, low-income students;
- Currently in second four-year funding cycle
- 22 graduates, to-date;
- XX students currently in the program

Scott Steinbrink
Karinna Vernaza
Theresa Vitolo
Barry Brinkman
Increase enrollment of academically talented, financially disadvantaged students

Foster professional development

Assist students through to graduation
Objective of this Paper

Consider efficacy

- of SEECS program as a tool for meeting NSF objectives;
- of tools used for student selection for participation in the SEECS program;
- of specific initiatives within SEECS program;

Thoughts upon future directions for the SEECS program

The paper covers SEECS activity from fall 2009 through spring 2013.
Goals to be met:

- NSF S-STEM goal: increase the number of US citizens and US permanent residents entering into careers in STEM fields;
- SEECS goal: increase the number of low-income students pursuing STEM education, and improve retention to graduation relative to the university and college, at Gannon University
Efficacy of student selection process
Incoming freshmen are selected for SEECS scholarships by committee, whose members consider:

- High School GPA;
- class standing, when known;
- SAT score (or equivalent ACT score);
- Financial need, as determined by FAFSA, and
- stated intended major
Note on figures to follow:

- “All scholars” refers to SEECS students recruited as new incoming freshmen during the first four years of the SEECS program;
- “Left the program” includes only students who were separated from the program or who switched major due to poor in-major performance;
- The figures do not take students’ timelines into consideration – they do not display FRESHMAN retention rates.
Retention in Relation to SAT Score

![Bar chart showing retention in relation to SAT scores.](chart.png)

- Number of Students
- SAT or Equivalent ACT Score
  - All Scholars
  - Scholars Leaving

- Score ranges: <1151, 1151-1200, 1201-1250, 1251-1300, 1301-1350, >1350
Figure 2: Retention as Related to HS GPA

- **<3.3**
- **3.31-3.6**
- **3.601-3.9**
- **3.91-4.0**
- **>4.0**

- **All Scholars**
- **Scholars Leaving**
Generally, as SAT rises, retention rises, but significant attrition occurs among most of the SAT spectrum; There appears to be a stronger correlation between HS GPA and SEECS retention than between SAT and SEECS retention

- 15 students recruited with GPA above 3.9, only one has left the program (6.7% attrition);
- 15 students recruited with GPA below 3.9, 11 of whom have left the program (73.3% attrition)

**SAT appears to be useful but less predictive than GPA, for SEECS success**
Efficacy of SEECS initiatives
SEECS Initiatives

- Provide enrichment through professional development;
- personal development, and
- design experiences

- Provide student support services not offered to other university students
  - paid conference attendance;
  - Fundamentals of Engineering and GRE exam prep courses;
  - direct mentoring
Design and Mentoring in SEECS

Honoken and Ralston (2013):
- “… students expect to communicate with faculty outside of class”
- “…encourage group studying by designing a variety of assignments to be completed with other students.”

Knight, Carlson and Sullivan (2007):
- “… an interdisciplinary first-year projects course should be required in all engineering programs.”

SEECS is styled to incorporate each of these recommendations
Based upon anecdotal evidence, the design and mentoring activities seem to be quite effective:

- Many students who have been forced from the program by lack of financial need have voluntarily continued without scholarship aid, solely for the design and professional development opportunities.

- Student comments with respect to design activities are very positive.
From Service-Learning Survey: Engineering Identity

- ... have provided opportunities to assess my abilities and *interest* in my chosen *major and career*  
- ... have *redefined* engineering as a helping profession

Source: Vitolo, Vernaza, Steinbrink and Brinkman, ASEE 2013 Annual Conference
### From Service-Learning Survey: Attitude

| ... have allowed me to understand the **impact** of engineering solutions in a societal context | Strongly Agree |
| ... have increased my **self-esteem** | Strongly Agree |
| ... have challenged my **creativity** | Strongly Agree |
| ... have improved my attitude towards **community service** | Strongly Agree |

Source: Vitolo, Vernaza, Steinbrink and Brinkman, ASEE 2013 Annual Conference
### From Service-Learning Survey: Skill

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>... have increased my self-confidence to operate in multidisciplinary teams</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>... have improved my ability to communicate effectively</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

Source: Vitolo, Vernaza, Steinbrink and Brinkman, ASEE 2013 Annual Conference
Summary of student attitudes

Annual survey of SEECS Scholars shows:

- Overall satisfaction with seminar
- Better appreciation of aspects of engineering design
- Improved awareness of interdisciplinary interactions within engineering field
- Heightened appreciation for service as professional aspect

Source: Vitolo, Vernaza, Steinbrink and Brinkman, ASEE 2013 Annual Conference
So, how did we do?
How did we do?  
(Part one: Freshman Retention)

<table>
<thead>
<tr>
<th></th>
<th>ENTERED Fall 2008 RETURNED FALL 2009</th>
<th>ENTERED Fall 2009 RETURNED FALL 2010</th>
<th>ENTERED Fall 2010 RETURNED FALL 2011</th>
<th>ENTERED Fall 2011 RETURNED FALL 2012</th>
<th>ENTERED Fall 2012 RETURNED FALL 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SEECS FRESHMEN Retained In School of Engineering and Computer Science</td>
<td>75.00% (6 of 8 retained)</td>
<td>83.33% (5 of 6 retained)</td>
<td>70.00% (7 out of 10)</td>
<td>77.78% (7 of 9 retained)</td>
<td></td>
</tr>
<tr>
<td>2. Within the School of Engineering</td>
<td>93.75%</td>
<td>85.11%</td>
<td>83.33%</td>
<td>75.00%</td>
<td>82.81%</td>
</tr>
<tr>
<td>3. SEECS FRESHMEN Retained In University</td>
<td>100% (8 of 8)</td>
<td>83.33% (5 of 6)</td>
<td>80% (8 out of 10)</td>
<td>88.89% (8 of 9 retained)</td>
<td></td>
</tr>
<tr>
<td>4. Within the University</td>
<td>81.57%</td>
<td>79.35%</td>
<td>79.48%</td>
<td>80.15%</td>
<td>79.09%</td>
</tr>
</tbody>
</table>
Freshman Retention

Results are a mixed bag:

- Retention for SEECS students is ABOUT THE SAME AS or LOWER THAN overall retention for the college of Engineering and Computer Science, as a whole;
- Retention for SEECS students is BETTER THAN overall retention for the university as a whole

However:

- SEECS retention is not measured the same as overall retention for the college, so the data may be misleading
Overall:

- we believe retention is up due to our efforts, but more data is needed to verify the belief.
- Data comparing SEECS students to “high achieving” non-SEECS students is needed for a true comparison of retention rates.
# How did we do?  
## Part two: Placement

<table>
<thead>
<tr>
<th></th>
<th>Graduated in Spring ...</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEECS Scholars</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduates</td>
<td></td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Survey Respondents Employed within STEM field</td>
<td>100.0% (2)</td>
<td>100.0% (6)</td>
<td>75.0% (3)</td>
<td>100.0% (5)</td>
<td></td>
</tr>
<tr>
<td>Pursuing graduate studies, full-time</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Pursuing graduate studies, part-time while employed</td>
<td>66.7% (2)</td>
<td>0%</td>
<td>0%</td>
<td>40.0% (2)</td>
<td></td>
</tr>
<tr>
<td>Employed in non-STEM field</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>25.0% (1)</td>
<td>0%</td>
</tr>
<tr>
<td>Unreported</td>
<td></td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Within the School of Engineering</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responding Graduates</td>
<td></td>
<td>23</td>
<td>33</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Employed within STEM field</td>
<td></td>
<td>69.6%</td>
<td>66.7%</td>
<td>83.3%</td>
<td>77.5%</td>
</tr>
<tr>
<td>Pursuing graduate studies</td>
<td></td>
<td>13.0%</td>
<td>15.2%</td>
<td>8.3%</td>
<td>20.0%</td>
</tr>
<tr>
<td>Unreported</td>
<td></td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td><strong>Within the University</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responding Graduates</td>
<td></td>
<td>455</td>
<td>420</td>
<td>435</td>
<td>472</td>
</tr>
<tr>
<td>Employed within major field</td>
<td></td>
<td>44.4%</td>
<td>44.4%</td>
<td>42.5%</td>
<td>42.4%</td>
</tr>
<tr>
<td>Pursuing graduate studies</td>
<td></td>
<td>43.3%</td>
<td>43.6%</td>
<td>43.9%</td>
<td>43.4%</td>
</tr>
<tr>
<td>Unreported</td>
<td></td>
<td>62</td>
<td>72</td>
<td>66</td>
<td>64</td>
</tr>
</tbody>
</table>
Placement rate of SEECS students is better than the placement rate of the school for three out of four years. This may be illusory, due to disparate response rates between SEECS and the School of Engineering and Computer Science. This might also reflect a difference between student populations between SEECS and ECS. Placement rate of SEECS students and ECS students are each better than for the university as a whole. May reflect a common difference between STEM and non-STEM fields.

More data is needed before definitive claims can be made.
Lessons Learned
SAT or ACT is a useful tool, but not as good as High School GPA for prediction of success in our program;

While retention rates are not as good as hoped for, there is anecdotal evidence that the SEECS program is valued by students;

More effective means of prediction of student affinity for STEM careers is needed
References

- Common Data Set Team, *Common Data Set Initiative*, [http://www.commondataset.org](http://www.commondataset.org)
Acknowledgement

The work reported in this paper and presentation were supported by the National Science Foundation under grant DUE-0806735.

Opinions, findings, conclusions and recommendations presented are those of the authors, and do not necessarily reflect the views of the National Science Foundation.
Questions ?