Undergraduate Research in a Fully Online Engineering Program: Building the Framework of Support

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Undergraduate Research in a Fully Online Engineering Program

Building the Framework of Support

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Co-PI: Robert Deters
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Undergraduate engineering programs often face low persistence and retention.

- Females and ethnic minorities are underrepresented and show lower persistence
- Certain minorities may be less likely to enroll in online programs
- Lower persistence and retention in online students across disciplines
Undergraduate research may increase persistence and retention.

Online students likely underrepresented due to access limitations.
Proposed Solution: a framework of support

- **RSCH 202**
  - Credit-bearing introduction to research course

- **Research Mentoring**
  - Long-term partnership with faculty

- **Resources**
  - Workshops, tutoring, and other resources

- **RSCH 395**
  - Credit-bearing independent research course
Research on the pilot program was supported by the NSF (DUE – IUSE Level 1)

$295,966
Start Date: 10/15/2020
Duration: 36 months

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the view of the National Science Foundation.
The first step was to establish a Research Scholars Program at our Campus.

Requirements:
1. Completion of one or more terms of faculty-supervised research, demonstrating “proficient” or “satisfactory” for all research learning outcomes.
2. Presentation of one or more sessions (oral or poster) of original research at a conference or symposium (internal or external).
3. Participation in four or more research skills workshops.
4. Submission of manuscript of original research to Beyond, an external peer-reviewed journal, or peer-reviewed conference proceedings.
5. A letter of recommendation from a research mentor that demonstrates progress on one or more research learning outcome(s).
Next, we designed a research independent study course, RSCH 395.

**Student Learning Outcomes**

1. Evaluate information and its sources critically.
2. Define and articulate a research problem.
3. Design a course of action to solve a research problem using, as appropriate, multidisciplinary approaches.
4. Apply ethical principles in research.
5. Conduct research independently and/or collaboratively.
6. Reach decisions or conclusions based on the analysis and synthesis of evidence.
7. Convert relevant information into various communicable forms (e.g. equations, graphs, and diagrams)
8. Communicate research results.
A quick tour of the course:

**Module 1 – Preparing for Research (2 weeks)**
- Project Management Plan
- Literature Review
- Research Study Design & Safety
- Discussions & Self-Reflections

**Module 2 – Engaging in Research (5 weeks)**
- Project Status Reports
- Discussions & Self-Reflections
- Data Analysis

**Module 3 – Preparing to Share Findings (2 weeks)**
- Project Status Reports
- Discussions & Self-Reflections
- Manuscript Draft
- Research Dissemination Proposal
The next pillar of support developed was research mentoring.

- **Research Supervisor**
  - Disciplinary Knowledge, Skills, Abilities
  - Project Management

- **Research Mentor**
  - Broadening Perspectives & Horizons
  - Advice and Information

**Venn Diagram**

- Short Term
- Long Term
To provide networking opportunities, we established the Research Scholars Workshop Series.

**September 2021:** Formulating Your Research Vision

**October 2021:** Submission & Review Processes

- Guidance & Support
- Research Goals
- Barriers to Research
- Submission & Review Processes
Upcoming workshops welcome guest speakers from across the institution and beyond.

November 2021: Getting Your Paper Noticed

February 2022: Academic vs. Industry Research

March 2022: Research Next Steps – grad school and/or entrepreneurship

April 2022: Promoting Undergraduate Research on your Resume
Additionally, the program supports research-related communication using an existing initiative.

Virtual Communication Lab (tutoring) embedded in RSCH 359

Mentors advertise relevant workshops hosted through VECTOR

Requested specific video resources be developed on research-related topics:

- How to write a problem statement
- How to write research questions
- How to read a journal article
Rather than coordinate a distinct event for a limited cohort, virtual participation at Discovery Day has been established.
And we tied it all together into a framework of support.

- **RSCH 202**
  Credit-bearing introduction to research course

- **Research Mentoring**
  Long-term partnership with faculty

- **Resources**
  Workshops, tutoring, and other resources

- **RSCH 395**
  Credit-bearing independent research course
We are advertising the Research Scholars Program and its components multiple ways.

- ERNIE Banner
- eUnion
- Course announcements
- Canvas page for Research Scholars Program
- Mass student emails
- Outreach to advisors and faculty
- Approval for Research Scholars program
- Approval to form new course
- Administrative responsibility and workload allocation when expanding existing mentoring program
- Revenue differences when substituting an independent study for an elective course
- College silos
Challenges & Lessons: Recruitment

✓ Internal Support: Find champions and supporters
✓ Build a cadre of faculty – a pool of potential research supervisors
✓ Present specific project opportunities, while communicating the option to choose their own adventure
Challenges & Lessons: Marketing

✓ Ensure clear and consistent messaging
✓ Common repository with updatable and shareable media
✓ Critical details
Challenges & Lessons: Growth & Sustainability

✓ Evolving to address unforeseen challenges
✓ Creating and delivering support materials (hosting and recording webinars)
✓ Formulating student involvement in already established faculty research projects vs. student developed projects
✓ Consider responsibilities, deliverables, and common actions
Challenges & Lessons: Technology

✓ Enable new capabilities and/or address previously identified challenges

✓ Accessibility

✓ Familiarization (individual, group, organization, field) through training and documentation
# Program Evaluation: Research Productivity

<table>
<thead>
<tr>
<th>Measure</th>
<th>Benchmark</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication of peer-reviewed scholarly work by Research Track students (BSET-R)</td>
<td>70% will submit a manuscript as a co-author by graduation</td>
<td>Direct inquiry</td>
</tr>
<tr>
<td>Entries in Scholarly Commons by BSET-R</td>
<td>70% will have at least one entry in Scholarly Commons</td>
<td>Direct inquiry</td>
</tr>
<tr>
<td>Presentation at an external conference by BSET-R</td>
<td>70% will present at an external conference by graduation</td>
<td>Direct inquiry</td>
</tr>
<tr>
<td>Presentation at an internal conference by BSET-R</td>
<td>70% will present at Discovery Day by graduation</td>
<td>Direct inquiry</td>
</tr>
<tr>
<td>Secure internal funding for research by BSET-R</td>
<td>50% will secure internal funding for their RSCH 359 experience</td>
<td>Direct inquiry</td>
</tr>
<tr>
<td>Achievement of the Undergraduate Research Certificate</td>
<td>50% will earn the award at graduation</td>
<td>Program Data</td>
</tr>
</tbody>
</table>
# Program Evaluation: Mentoring

<table>
<thead>
<tr>
<th>Measure</th>
<th>Benchmark</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive experience as a BSET-R mentee</td>
<td>90% report a positive mentoring experience</td>
<td>COMPASS Survey</td>
</tr>
<tr>
<td>Positive experience as a mentor</td>
<td>90% of faculty report a positive mentoring experience</td>
<td>COMPASS Survey</td>
</tr>
<tr>
<td>Measure</td>
<td>Benchmark</td>
<td>Method</td>
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<tr>
<td>----------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
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<tr>
<td>Faculty completion of research supervision related professional development</td>
<td>100% of supervising faculty complete activities developed for supporting undergraduate research</td>
<td>LMS Data</td>
</tr>
<tr>
<td>Faculty completion of research mentoring related professional development</td>
<td>100% of mentoring faculty complete activities developed for supporting undergraduate research</td>
<td>COMPASS Data</td>
</tr>
<tr>
<td>Measure</td>
<td>Benchmark</td>
<td>Method</td>
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<tr>
<td>----------------------------------------------</td>
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</tr>
<tr>
<td>Improved persistence of BSET-R</td>
<td>70% will take at least four (4) courses during the academic year</td>
<td>Institutional data</td>
</tr>
<tr>
<td>Improved retention of BSET-R</td>
<td>80% will stay in the BSET program after 1 year</td>
<td>Institutional data</td>
</tr>
<tr>
<td>Improved academic performance of BSET-R</td>
<td>80% will have a B-average or better</td>
<td>LMS data</td>
</tr>
<tr>
<td>Improved STEM identity of BSET-R</td>
<td>70% will report an improved STEM identity</td>
<td>Survey</td>
</tr>
<tr>
<td>Improved STEM attitudes of BSET-R</td>
<td>70% will report improved STEM attitudes</td>
<td>Survey</td>
</tr>
<tr>
<td>Improved transferable skills of BSET-R</td>
<td>70% will demonstrate improved transferable skills</td>
<td>LMS data &amp; Institutional Data</td>
</tr>
<tr>
<td>Mastery of research learning outcomes by BSET-R</td>
<td>90% demonstrate “proficient” or “satisfactory” mastery at completion of RSCH 359</td>
<td>LMS data</td>
</tr>
<tr>
<td>Positive impacts for at-risk students</td>
<td>70% will report a positive impact</td>
<td>Institutional data; LMS data; Surveys</td>
</tr>
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Questions?

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