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Board 256: Development and Evolution of Workshops to Support Online Undergraduate Research

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Development and Evolution of Workshops to Support Online Undergraduate Research

Abstract

Under a National Science Foundation (NSF) Improving Undergraduate STEM Education (IUSE) grant, the Research Scholars Program was developed at Embry-Riddle Aeronautical University — Worldwide. The objective of the Research Scholars Program is to promote undergraduate research for the online students at the Worldwide campus and to formalize the process in which the students can participate in research. A significant aspect of the project was to create a support network for the students that incorporated existing services provided by the university and established new services to aid students throughout their mentored research experience. One of the new services was the development and delivery of starting in the second year of the grant and continuing through the third year. The purpose of the workshops is to introduce students to different aspects of research. The first series of workshops (offered in the 2021-2022 academic year) were mostly informational and provided initial support for undergraduate researchers. From the experience of developing and hosting the first series, the style of the second series (offered in the 2022-2023 academic year) was modified to try to promote more audience participation.

Introduction

Undergraduate research is a high impact practice where studies in traditional learning environments show gains in disciplinary knowledge and skills [1], [2], persistence [3], [4], STEM identity and attitudes [5], [6], [7], transferable skills [8], [9], and career ambition [10]. Online students have a strong interest in participating in undergraduate research [11], [12], and online faculty have shown to have comparable levels of interest in regards to mentoring undergraduate research as residential faculty [13]. To help address some of the unique challenges for online students to participate in undergraduate research, the authors developed the Research Scholars Program at Embry-Riddle Aeronautical University (ERAU), Worldwide campus. As part of the program, a series of workshops were developed to cover diverse topics related to undergraduate research. These workshops have provided an opportunity for students, faculty, and subject matter experts to interact and share their perspective, while expanding topical awareness.

This paper features an overview of the topics covered by the workshops, including a discussion regarding how the style of the workshops changed as the program progressed.

Figure 1: New support network components of the Research Scholars Program.

Research Scholars Program

To help reduce barriers faced by online undergraduate students at the Worldwide Campus, the Research Scholars Program was designed to formalize the process in which the students can participate in research. The Research Scholars Program created a single location to help guide students through the complete undergraduate research experience, from determining a topic and finding a faculty supervisor to disseminating their work and being recognized for completing the program with a certificate and a pin for their graduation regalia. Recruitment for the program was originally targeted at engineering technology and engineering students. However, the program was advertised to all students, and all undergraduates could participate regardless of major. The goal was to focus data collection from engineering technology and engineering students, but it was later broadened to include other STEM majors.

A major component of the Research Scholars Program was to develop an extensive support network for the students that includes resources already available to Worldwide students, as well as new resources. The support network provides scaffolding in four areas that students will progress through during their research journey, spanning from research curiosity to accomplished researcher: Early Experiences, Bridge to Research, Undergraduate Research, and Culmination. The existing resources used in this support network include written and verbal communication support through the Virtual Environment for Communication: Teaching, Outreach and Research (VECTOR) online writing lab, the Virtual Communication Lab (VCL) [14]; online digital materials and research guides available through the university's Hunt Library [15], [16]; and internal dissemination methods such as Discovery Day [17] and Beyond: Undergraduate Research Journal [18]. VECTOR resources provide support during the Bridge to Research and Undergraduate Research areas. The library resources provide support in all areas, and the internal university dissemination methods support the Undergraduate Research area.

Three new resources were specifically developed for Worldwide's online undergraduate students to be successful in participating in research. These resources were research mentoring, workshops, and an independent study course (Fig. 1). An overview of the mentoring and independent study course is provided in this section, but more details on the development of these resources are available in previously published papers from the authors [19], [20].

When students decide to begin their research journey, they can sign up for research mentoring and are assigned a research mentor. The faculty who serve as research mentors have a strong background in research but do not need to be familiar with the specific topical research areas of their mentees. The role of the research mentor is to guide their mentees through the research process, from forming a research idea to promoting their research experience after disseminating their research results. Research mentoring provides support in the Bridge to Research, Undergraduate Research, and Culmination areas. Research mentoring is relationship-oriented and is focused on a long-term mutually beneficial dynamic, but also includes an element of coaching as supporting students through the research process often involves a task-driven focus with a specific outcome in mind. This is distinct from research supervision, though, as that role is reserved for faculty within the topical research area and is a short-term relationship offering supervision during the research-active phase. Since the College of Arts and Sciences at Worldwide houses the Center of Mentorship Programs & Student Success (COMPASS), the research mentoring resource was added and co-administrated as an arm of that academic structure.

When students are nearing the end of their research project, they can enroll in a guided independent study course, RSCH 395. Prior to enrollment, a student must first secure a faculty member's approval of their proposed project and agreement to provide supervision of their work (i.e., course instruction). This course has two main purposes: help students prepare research for dissemination and receive academic credit for their research. These purposes support the Undergraduate Research area of the Research Scholars Program. The final product of the course is a draft manuscript that is ready to be submitted for publication. Students take this independent study course under their research supervisor, the faculty member with the expertise in the research area of the student's project.

Workshops

The third new resource developed for the Research Scholars Program was the Research Skills Workshops. These online, synchronous workshops target multiple aspects of research through the different areas of the student's journey (Early Experiences, Bridge to Research, Undergraduate Research, and Culmination). While the workshops were developed for the Research Scholars Program, any student was welcomed to attend and the events were advertised broadly to all students at the Worldwide Campus. To fully complete the Research Scholars Program and be recognized with a certificate and graduate regalia pin, a student is required to attend at least four workshops, in additional to other criteria.

The first series of workshops were held during the second year of the grant and were designed to cover topics important to the Early Experiences, Undergraduate Research, and Culmination areas. Using the experience gained during the development and implementation of the first series, a second series of workshops were developed and held during the third year of the grant. The second series had topics that covered all areas of a student's research journey, but this series had a larger focus on beginning a research project (Early Experiences and Bridge to Research) and dissemination of research outcomes (Undergraduate Research).

Advertising the workshops to the student population was accomplished using several methods.
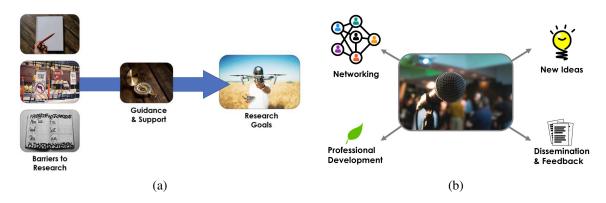
Figure 2: Example graphical abstracts used for workshop promotion: (a) Formulating Your Research Vision and (b) Conference Attendance Preparation. [Images used were obtained through free platforms including Pixabay.com and Pexels.com]

The Research Scholars Program has a dedicated course hosted on Worldwide's learning management system, with announcements and landing pages for each workshop posted there. Direct emails were sent to students through their respective academic college. Banner announcements were also posted on the university's internal portal website. Additionally, research mentors encouraged their mentees to attend specific sessions. Each of the outreach methods described the workshop, provided a link to the virtual session, and provided a graphical abstract as a visual to represent the topics covered. Two examples of the graphical abstracts are provided in Fig. 2. Attendance at the workshops typically ranged from two to seven students.

First Series

Even though the first series of workshops were not held until the second year of the grant, the topics were selected at the initial conception of the Research Scholars Program. These topics focused on introducing undergraduate research, publishing research results, describing different types of research, and how the student can use the research experience to advance their academic or career goals. Covering the full research journey, the authors decided that these topics would provide a good initial support for students interested in research or active in research.

Six workshops were held in the first series. For each workshop, one or more of the authors would act as host. The host would present information related to the workshop topic and facilitate any discussion. The list below provides the title for each workshop, a brief overview of the contents of each workshop, the specific focus area of the research journey, and any invited guest presenters, speakers, and panelists.

1. Formulating Your Research Vision

   - Overview: Establishing a research vision is a key first step in a successful undergraduate research project. This workshop covered some of the basics of getting started in undergraduate research and addressed the most common barriers students face, such as knowing what opportunities are available, knowing where to start and who to talk to, securing resources and using institutional supports, and finding time for research. Various roles within a research team were also explored.

- Area: Early Experiences

2. Submission & Review Gauntlet

    - Overview: This workshop explored the research manuscript submission process and discussed why articles are rejected, options if they are rejected, and how to respond to reviewer and editor feedback.

    - Area: Undergraduate Research

3. Getting Your Paper Noticed

    - Overview: This workshop addressed how to make your paper stand out through strong titling, graphical abstracts, and search engine optimization. Also explored was how to promote work through public profiles like LinkedIn, ResearchGate, and Scholarly Commons. The workshop concluded with an exploration of sharing preprints and postprints ethically.

    - Area: Undergraduate Research

    - Guest: Assistant Director for Research and Instruction Services at the Hunt Library

4. Academic vs. Industry Research

    - Overview: This workshop explored differences between research in an academic setting versus industry, including how work is planned, executed, and disseminated.

    - Area: Undergraduate Research

    - Guests: Academic researcher in the field of occupational safety, industry researcher from the Ford Motor Company, and government researcher from the US Army

5. Research Next Steps: Building into Grad School and/or Entrepreneurship

    - Overview: This workshop explored stepping stones from the undergraduate research experience, whether going into grad school, entering a research-focused career, or engaging in research-based entrepreneurial activities.

    - Area: Culmination

    - Guest: Director of the Center for Innovation & Entrepreneurship

6. Promoting Undergraduate Research on Your Resume

    - Overview: This workshop explored how to best ways to present undergraduate research experiences to potential employers.

    - Area: Culmination

    - Guests: Program Manager from NASA, Executive Director of ASSURE, Assistant Director of Career Services, and Branch Chief from US Army Research Laboratory

The workshops for the first series were mostly information with most having guest speakers, which did lessen the formality of the events. While every workshop included time for audience

questions, the workshops during the first series mostly had the feel of seminars and did not promote as much active participation from the audience as the authors intended.

Second Series

The topics for the second series of workshops were decided by the authors when the first series was concluding. As recruitment into the Research Scholars Program had been slow, several workshops were therefore dedicated to the earlier phases of research. Students active in research were also starting to disseminate their work, so related workshop topics were selected. To try to increase audience participation, the style of most of the workshops were changed to be more engaging. At least one of the authors still hosted, and each workshop usually started with a brief introduction to the topic, lasting 15-20 minutes. Following the introduction, invited guest speakers would then participate in a roundtable discussion or breakout rooms. To keep the discussion informal, guest speakers did not need to prepare anything in advance to present. The only exceptions to this style were the workshops related to writing a research proposal and support through the Office of Prestigious Awards. These two workshops were more informational in a style similar to the first series.

Eight workshops were held in the second series. The list below provides the title for each workshop, a brief overview of the contents of each workshop, the specific focus area of the research journey, and any invited guest presenters, speakers, and panelists. For workshops that cover topics relevant to more than one focus area, the main area is provided first with additional provided in parentheses.

1. How to Join Faculty Research

    - Overview: This workshop provided suggestions and tips for approaching faculty to join active research projects followed by a discussion of current faculty research projects.

    - Areas: Bridge to Research (Early Experiences)

    - Guests: Active faculty researchers at Worldwide

2. Finding a Faculty Supervisor

    - Overview: This workshop focused on students who have their own research project in mind and want support from a faculty supervisor. An explanation of the roles of research mentors and supervisors were given, and tips for approaching faculty were explored. A conversation with current supervisors was included.

    - Areas: Bridge to Research (Early Experiences)

    - Guests: Active faculty researchers at Worldwide

3. The Student Research Experience

    - Overview: In this workshop, active undergraduate researchers shared their experiences. Also included was a discussion on the benefits and barriers of undergraduate research, lived experiences, and more from the active undergraduate researchers and mentors.

- Areas: Early Experiences (Bridge to Research, Undergraduate Research)
- Guests: Active undergraduate researchers and the research mentors

4. Writing a Research Proposal: Topic Selection & Refinement

- Overview: This workshop discussed best practices in writing a research proposal, whether if it is for an application seeking internal or external support, securing a faculty supervisor, or for a course-based research experience like a research-based independent study or a capstone course.
- Areas: Early Experiences (Bridge to Research)

5. Non-Traditional Scholarly Publication

- Overview: This workshop explored alternative publication method outside of publishing in a research journal. Some examples included editorials, standard operating procedures, books or book chapters, internally published research (e.g., FAA or DoD research), creative works, and data sets.
- Area: Undergraduate Research
- Guests: Faculty with experience in non-traditional publications

6. Conference Attendance Preparation

- Overview: This workshop addressed questions about conferences such as finding conferences in a specific field, preparing conference proposals, and what to do at a conference to maximize the experience.
- Area: Undergraduate Research
- Guests: Active faculty researchers at Worldwide

7. Research Posters that Engage

- Overview: This workshop discussed best practices for high-quality research posters, including design and presentation. Internal and external opportunities to present a posted were discussed.
- Area: Undergraduate Research
- Guests: Co-Director of VECTOR

8. Support through the Office of Prestigious Awards & Fellowships

- Overview: In this workshop, the Office of Prestigious Awards shared their framework of support (including workshops, one-on-one meetings, and mock interviews) as well as discussed current opportunities that may be of interest to aspiring and active undergraduate researchers. This workshop also covered tips for building strong relationships so that impactful recommendation letters can be secured.
- Area: Culmination
- Guest: Staff from the Office of Prestigious Awards and Fellowships

With the change to a more informal workshop style, audience participation did increase. By moving away from the seminar format, the speakers at the workshops were able to provide more personal stories related to the workshop topic. These personal stories helped the students in the audience better relate to the speakers by showing that the professionals had (and may still have) many of the same concerns and hurdles that student research are going through.

Going Forward

The authors are currently investigating different ways for the Research Scholars Program to continue beyond the lifetime of the grant. One idea is to incorporate the program into a research minor. While not discussed in this paper, a significant barrier for students is adding the independent study course if they do not have any open elective credits in their degree program. If students add a minor, then any required courses are officially added to their degree map, which will help students who receive some form of aid for their courses. In addition to opening the workshops to other undergraduate STEM majors, graduate students were also invited to attended. It was noted that graduate academics feature a strong connection to the development and implementation of research skills and that their participation could provide them with further contextual benefit, while also potentially enabling the further exchange of ideas, perspective, and inquiry during the question and answer phase of each workshop. Observation of such inclusion has led to the consideration of how graduate students might be included in subsequent updates of the program, such as near-peer research mentors to the undergraduate students.

In whatever form the Research Scholars Program takes in the future, workshops are still planned. The two series of workshops discussed in this paper have been organized into an open educational resource and are available through the university's Scholarly Commons. Any future workshops will be added to this resource [21]. Attendance at the workshops was low, so methods to increase participation numbers will be investigated. If a minor is created, then the workshops can be integrated into appropriate courses. Even without a minor, adding incentives for students to attend workshops in research related courses could be explored.

Acknowledgments

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