

Undergraduate Research for Online Students

Funding: NSF IUSE – Engaged Student Learning Level 1 (NSF# 2021221)

Budget: \$295,966

Project Dates: October 2020 – September 2023

Research Team

- Emily Faulconer (PI), Associate Professor
- Brent Terwilliger (Co-PI), Associate Professor
- Robert Deters (Co-PI), Associate Professor

Description: The goal was to establish a support framework for undergraduate research for students completing their degree programs completely online.



Research Objectives:

1. Increase STEM program persistence (take rate and withdrawal rate)
2. Increase STEM student retention in degree programs
3. Increase academic performance of students engaged in research
4. Positively influence STEM identity and attitudes
5. Improve key transferable skills

Key Findings

- Most online students are interested in undergraduate research; interest was not impacted by the COVID-19 pandemic.
- Mentee self-reported outcomes suggest positive impacts on sense of belonging as well as course and career outcomes.
- Virtual research mentors tend to demonstrate strong mentoring competencies in key areas, evaluated through parallel mentor and mentee measures.

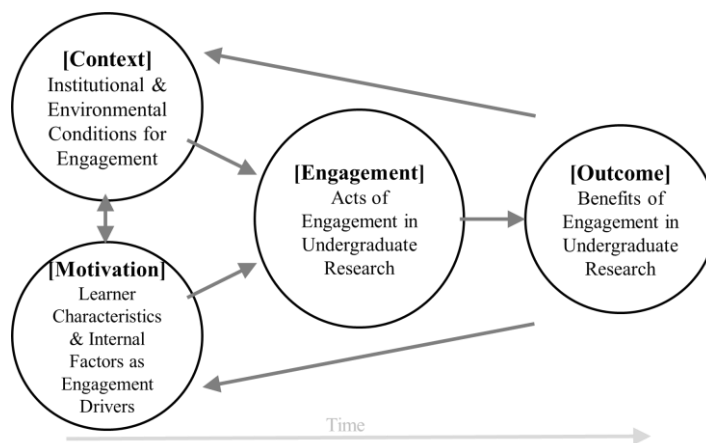


Undergraduate Research for Online Students

Post-COVID-19 Research Interest Among Online Students

Because the COVID-19 pandemic had wide-reaching impacts on many students' lives, we felt it prudent to replicate a previous study to determine if student interest in engaging in research had shifted.

- 72% online students had not participated in undergraduate research or were unsure if they had engaged in research, with nearly half of the students in the second half of their degree progress.
- Less than 50% of online students were aware of research opportunities
- 74% of online students were interested in undergraduate research
- Perceived benefits of undergraduate research were resume-building, skills development, networking, gaining practical experience, and more.
- Strong preference for credit-bearing research opportunities
- Preferred incentives are related to coursework (credit hours or course grade) or a financial compensation
- The largest perceived barriers to research were time, costs, knowing who to contact, knowing where to start, and accessing physical resources.



Challenge

- Low survey response rate, limiting generalizability of sample to population

Faulconer, E., George, K., Terwilliger, B., & Deters, R. (2023) *Online student interest and engagement in undergraduate research: impact of a pandemic.*
[Manuscript under review]

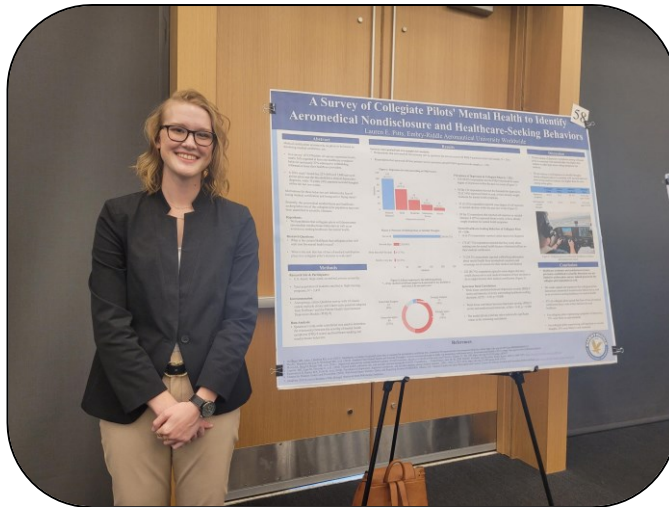


Undergraduate Research for Online Students

Mentee Perspectives on Research Mentoring

Because online research mentoring with globally distributed students and faculty is atypical, we wanted to explore the positive impacts experienced by students in this format through a single case study using interviews. Mentees reported:

- Growth in time management, collaboration, communication, and information evaluation skills
- Enhanced motivation, improved self-confidence, and a stronger sense of belonging in the academic community
- Research skill development including research ethics



Undergraduate Lauren Pitts at Discovery Day 2023, Daytona Beach, FL

Challenges

- Small sample size in a pilot program
- Future work should use quantitative measures to evaluate mentoring and collect parallel quantitative measures from both mentees and mentors

Faulconer, E., George, K., Terwilliger, B., & Deters, R. (2023) *Guiding Undergraduate Researchers in the Virtual World: Mentoring Experiences of Globally Distributed Students*. [Manuscript under review]

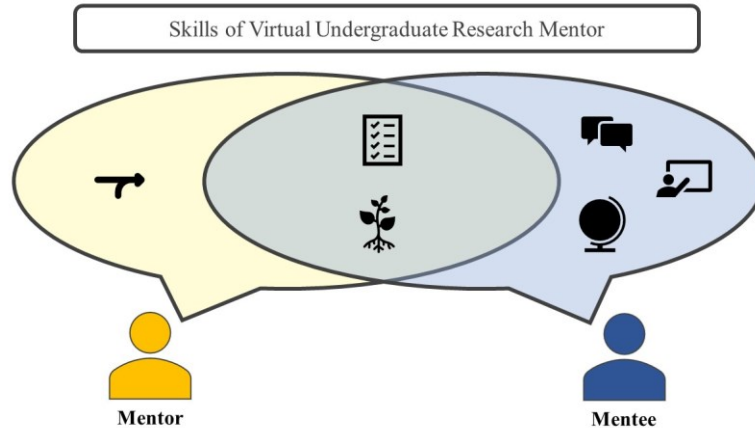


Undergraduate Research for Online Students

Evaluation of the Mentoring Program

To evaluate the distributed research mentoring program, the Mentoring Competency Assessment was used in parallel by mentors and mentees. We drew clear boundaries to disambiguate and disaggregate the roles of the research mentor and the research supervisor. Future work will explore the research supervisor-undergraduate researcher relationship.

- Mentees felt mentors demonstrated strong mentoring competencies in all areas: maintaining effective communication, aligning expectations, assessing understanding, fostering independence, addressing diversity, and promoting professional development.
- Mentors self-reported strong mentoring competency in aligning expectations and moderately strong competency in assessing understanding and fostering independence.
- Mentor and mentee perspectives on competencies did not always align.
- Mentees tended to rate competencies higher than mentors rated themselves



Challenge

- Small mentor and mentee population in pilot program

Faulconer, E., Terwilliger, B., & Deters, R. (2023) *Exploring the Effectiveness of Virtual Mentorship for Undergraduate Research Completed Fully Online: A Comparative Analysis of Mentors and Mentees Perspectives*. [Manuscript under review]



Undergraduate Research for Online Students

Synchronous Undergraduate Research Skills Workshops

The Research Scholars Program hosted regular research skills workshops aimed at four key areas in a student's research journey. This collection was made public to reach a wider audience beyond ERAU students. The process and challenges in developing and facilitating these workshops were shared in a peer reviewed publication. The Open Educational Resource Collection can be found here: <https://commons.erau.edu/ww-research-scholars-workshop/>

Early Experiences

The Student Research Experience <https://doi.org/10.5281/zenodo.7756936>

Formulating Your Research Vision <https://doi.org/10.5281/zenodo.7756614>

Writing a Research Proposal <https://doi.org/10.5281/zenodo.7756950>

Bridge to Research

Finding a Faculty Research Supervisor <https://doi.org/10.5281/zenodo.7756565>

How to Join Faculty Research <https://doi.org/10.5281/zenodo.7756771>

Active Research

Academic vs. Industry Research <https://doi.org/10.5281/zenodo.7756961>

Conferences Q&A <https://doi.org/10.5281/zenodo.7684932>

Research Posters that Engage <https://doi.org/10.5281/zenodo.7756874>

Submission and Review Gauntlet <https://doi.org/10.5281/zenodo.7756924>

Non-Traditional Scholarly Publication <https://doi.org/10.5281/zenodo.7756853>

Support Through the Office of Awards and Fellowships

<https://doi.org/10.5281/zenodo.7829071>

Culmination

Research Next Steps <https://doi.org/10.5281/zenodo.7756823>

Promoting Undergraduate Research on your Resume [Recording unavailable]

Getting Your Paper Noticed <https://doi.org/10.5281/zenodo.7756669>

Deters, R., Terwilliger, B., Faulconer, E., & George, K. (2023, June) Development and Evolution of Workshops to Support Online Undergraduate Research. 2023 ASEE Annual Conference and Exposition. Retrieved from <https://peer.asee.org/42702>



Undergraduate Research for Online Students

Additional Research Team Outputs

Conference Presentations

1. Terwilliger, B., Deters, R., & Faulconer, E. (2023, May). *Engaging Online Education Through Mentored STEM Research*. [Conference presentation]. Association for Uncrewed Vehicle Systems International XPonential 2023, STEM Education Track, Denver, CO, United States.
2. Faulconer, E., Terwilliger, B., & Deters, R. (2023, April). *Supporting Undergraduate Research for Globally Distributed Students and Mentors*. [Conference presentation]. Experiential Learning in Online Courses, online.
3. Deters, R., Terwilliger, B., Faulconer, E., & George, K. (2022, June). *Building Undergraduate Research in a Fully Online Engineering Program*. [Conference presentation]. American Society for Engineering Education Annual Conference & Exposition, Minneapolis, MN, United States. Retrieved from <https://commons.erau.edu/publication/1910/>
4. Faulconer, E., Deters, R., Terwilliger, B. (2021, October). *Undergraduate Research in a Fully Online Engineering Program: Building the framework of support*. [Conference presentation]. Florida Undergraduate Research Association, Florida Statewide Symposium - Best Practices in Undergraduate Research, Gainesville, FL, United States.

Scholarly Publication

1. Faulconer, E., Terwilliger, B., Deters, R., & George, K. (2022) Is a Framework of Support Enough? Undergraduate Research for Online STEM Students. *Journal of College Science Teaching*, 51(3). Retrieved from <https://www.nsta.org/journal-college-science-teaching/journal-college-science-teaching-januaryfebruary-2022/framework>

Program Metrics as of 8/1/2023

Canvas Page Members: 211

Completed RSCH 395 Enrollments: 2

Trained Mentors: 6

Mentees: 34



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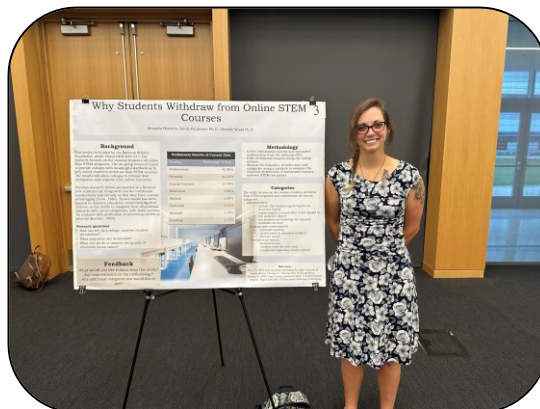
Undergraduate Research for Online Students

Stakeholder Communication

1. Deters, R., Terwilliger, B., & Faulconer, E. (2023, September). *NSF IUSE grants for undergraduate research: Results and going forward*. Embry-Riddle Aeronautical University, Worldwide Campus, online.
2. Faulconer, E., Terwilliger, B., & Deters, R. (2023, September). *Year 3 Annual Report*. National Science Foundation.
3. ERNIE Headline (2023, May). *Research on Pilot Mental Health and Drone Swarms Top Student Showcase*. Retrieved from <https://news.erau.edu/headlines/research-on-pilot-mental-health-drone-swarms-top-student-showcase>
4. Faulconer, E., Terwilliger, B., & Deters, R. (2022, September). *Year 2 Annual Report*. National Science Foundation.
5. Deters, R., Terwilliger, B., & Faulconer, E. (2022, February). *Research Scholars Program - Faculty Roles in Online UG Research Skills Development* [webinar]. Embry-Riddle Aeronautical University, Worldwide Campus, College of Aviation's Stay Current Discussion, online.
6. Faulconer, E., Terwilliger, B., & Deters, R. (2021, September). *Year 1 Annual Report*. National Science Foundation.

Other Research Team Activities

Student research poster display at College of Arts and Sciences Building at ERAU Worldwide Headquarters in Daytona Beach, FL. Travel tripods were included for mobile displays for events.



Undergraduate Amanda Branton by her research poster



Undergraduate Research for Online Students

Undergraduate Researcher Outputs

Peer Reviewed Publications

1. Chamberlain, Jr., D., **McGuinness, P.**, Faulconer, E., & Wood, B. (2024). *Using Trees to See a Forest: Leveraging Machine Learning to Classify Student Thinking*. Proceedings of the 26th Annual Conference on Research in Undergraduate Mathematics Education: SIGMAA on RUME, Omaha, NE. [Manuscript submitted]
2. Faulconer, E., Wood, B., **Branton, A.** & **Chuaunsu, M.** (2023). *Withdrawal in Online STEM courses*. [Manuscript submitted].
3. **Pitts, L.** & Faulconer, E. (2023). Flying under the radar: a survey of American air transport pilots to identify aeromedical nondisclosure and mental healthcare-seeking behaviors. *The Collegiate Aviation Review International*, 41(1). Retrieved from <https://ojs.library.okstate.edu/osu/index.php/CARI/article/view/9422>
4. Cerreta, J., **Denney, T.**, Burgess, S. S., Galante, A., Thirtyacre, D., Wilson, G. A., & Sherman, P. (2022). UAS for Public Safety: Active Threat Recognition. *International Journal of Aviation, Aeronautics, and Aerospace*, 9(2). Retrieved from <https://commons.erau.edu/ijaaa/vol9/iss2/1>

Stakeholder Communication

1. Colwell, M. & **Schulmeisters, H. L.** (2023, July 1). Optimizing human performance in airport security [Webinar]. Resilience Reimagined: Dean's Speaker Series.
2. **Forde, T.** (2023, June 9). Developing critical thinking and effective communication (CTEC) skills to support the TSA workforce in critical infrastructure protection. Presented at the U.S. Capitol, H-122.

Competitions

1. ERAU RASC-AL Competition Club. NASA's Revolutionary Aerospace Systems Concepts Academic Linkage ([RASC-AL](#)) 2024 competition, theme "AI-Powered Self-Replicating Probes – An Evolutionary Approach". Faculty Supervisor: Melissa Morris.



Undergraduate Research for Online Students

Undergraduate Researcher Outputs

Conference Presentations

1. **Chunara, N.** (2023). *Armed and Unarmed Drone Perception in Conflict Zones*. [Poster session]. National Conference for Undergraduate Research. Eau Claire, WI, United States. <https://ncur.secure-platform.com/2023>
2. **Pitts, L.** (2023). *A survey of collegiate pilots' mental health to identify aeromedical nondisclosure and healthcare-seeking behaviors*. [Poster session]. Embry-Riddle Aeronautical University Research Symposium, Daytona Beach, FL, United States. <http://commons.erau.edu/discovery-day/db-discovery-day-2023/poster-session-2/3>
3. **Branton, A.,** Faulconer, E., Wood, B. (2022). *Why students withdraw from online STEM courses*. [Poster session]. Embry-Riddle Aeronautical University Research Symposium, Daytona Beach, FL, United States. <https://commons.erau.edu/db-srs/2022/poster-session-one/18/>
4. **Chunara, N.** (2022). *UAS and the Psychological Influence*. [Poster session]. Embry-Riddle Aeronautical University Research Symposium, Daytona beach, FL, United States. <https://commons.erau.edu/db-srs/2022/poster-session-two/22/>
5. **Adams, J.** (2021) *Sexuality: The Empathetic Liberator*. [Poster session]. Embry-Riddle Aeronautical University – Worldwide, Student Research Symposium, Poster, online. <https://commons.erau.edu/db-srs/2021/thesis-session/9/>

Graduate Student Outputs

Peer Reviewed Publications

1. Rahman, S. (2024). *A qualitative analysis of multi-vector cyberattacks for threat detection and prevention*. [Manuscript in progress]

Other Scholarly Works

1. Pik, E. (2024). *The pilot shortage: implications, repercussions, and tried solutions*. *Journal of Aviation/Aerospace Education & Research* [Manuscript under review]
2. Pik, E. (2024). *Gender diversity, equity, and inclusion in the North American Aviation and Aerospace Industry*. *Journal of Air Transport Management* [Manuscript under review]
3. Pik, E. (2024). *Airport security: The impact of AI on safety, efficiency, and the passenger experience*. *Journal of Aviation/Aerospace Education & Research* [Manuscript under review]

Competitions

1. ICAO Innovation 2024 competition. *Business and private aircraft as a meteorological sensor*.



Undergraduate Research for Online Students

The Future of the Research Scholars Program



Funding: NSF IUSE – Engaged Student Learning Level 1 (NSF# 2315560)

Budget: \$399,183

Project Dates: October 2023 – September 2026

Team: Robert Deters (PI), Brent Terwilliger, Darryl Chamberlain, Emily Faulconer

Objectives:

1. Increase undergraduate research participation in online students STEM students.
2. Lead to impactful student research outputs
3. Positively influence STEM attitudes
4. Support STEM career pathways (STEM identity and career ambitions)



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