

Comparison of Voluntary and Paid Undergraduate Research Experiences

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and GROW). With an interdisciplinary background—including a Bachelor’s degree in Finance, a Master’s degree in Hospitality Management, and doctoral training in Engineering and Computing Education—she offers a distinctive blend of strategic program management, academic leadership, and research expertise. Prior to her current role, Ms. Kayyali held progressive leadership and administrative positions within the CEC. She led the Graduate Education, Admissions, and Recruitment (GEAR) team and provided strategic administrative support to the Associate Dean for Academic Affairs in the Office of the Dean. Earlier, she served as Program Coordinator/Coordinator of Administrative Services in the Department of Electrical and Computer Engineering (ECE) and as Program Assistant in the Department of Civil and Environmental Engineering (CEE). These cumulative experiences across graduate education, academic affairs, and departmental operations have equipped her with comprehensive institutional insight and a systems-level perspective that informs her leadership today.

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Work In Progress: Comparison of Voluntary and Paid Undergraduate Research Experiences

Abstract

This paper is a work-in-progress (WIP). Undergraduate engineering and computing students have various possibilities of engaging in research, including volunteering or participating in a dedicated program. Several engineering and computing education studies focus on the potential contribution of undergraduate research experiences to engineering students' skill acquisition, persistence, and success. However, this prior research does not compare volunteer research experiences with paid and structured research experiences to investigate potential differences that exist. The purpose of this work-in-progress study is to compare students' prior experience participating in research on a voluntary basis versus their current experience in an organized undergraduate research program, the Opportunities for Undergraduate Research and Opportunities (OURS) program. The OURS program is housed within the College of Engineering and Computing at Florida International University, where undergraduate students ranging from freshmen to seniors work alongside a faculty mentor. These students engage in research for 10 to 15 hours per week on average and are provided with a monthly stipend during the Fall and Spring semesters. Participants submit monthly progress report forms to document their research activities. After one semester participating in the OURS program, those who previously participated in research on a voluntary basis will complete an open-ended survey asking them to reflect on their experiences volunteering compared to participating in the OURS program. The participants' survey responses will be analyzed as text using a three-cycle thematic analysis to identify salient themes across their experiences. The findings from this study will contribute to engineering and computing education scholarship by providing a more in-depth understanding of the impact of different types of undergraduate research experiences for engineering and computing students.

Introduction and Background

Undergraduate engineering and computing students have various opportunities to engage in research, including volunteering or participating in a dedicated program. Participation in undergraduate research experiences has been associated with a range of positive outcomes, including increased technical skill development, enhanced self-efficacy, growth in research skills, stronger professional identity formation, improved persistence in engineering programs, higher grade point averages, and a greater likelihood of pursuing graduate education or research-oriented careers [1]-[8]. In addition to individual student gains, undergraduate research programs can contribute to institutional goals by improving retention, supporting student success, enhancing research capacity, and strengthening the visibility of departments and colleges in the broader scientific and engineering communities [6], [7], [9], [10]. Moreover, such programs can benefit industry by fostering communication, technical, and critical thinking skills that support workforce readiness [6], [9]. Thus, all stakeholders involved, students, academia, and industry, can benefit from these research programs at the undergraduate level [2], [6], [7], [9].

Undergraduate research is implemented across higher education in multiple formats, including informal volunteering positions with faculty—where expectations and compensation are negotiated individually and may be less formally documented—, formal research experiences embedded in courses; and structured, compensated programs that operate during the academic

year or summer [6], [7], [10]-[13]. Course-based undergraduate research experiences and centralized research initiatives are often described as high-impact practices because they provide extended engagement with authentic problems, iterative feedback, and close mentoring relationships [2], [6], [10]. At the same time, informal volunteer research arrangements remain a common entry point, since they allow students to explore their interest in research, develop basic skills, and become acquainted with laboratory or project environments in a relatively flexible manner [6], [9], [13]-[15].

Recent literature has emphasized that program structure, timing, and mentoring practices shape the specific outcomes students derive from undergraduate research [5]-[7], [11], [14]. For example, studies using multi-institutional and campus-wide data have found that participation in mentored research is positively associated with gains in knowledge and skills, higher levels of institutional support and satisfaction, stronger faculty interaction, and higher cumulative GPA [5], [7], [8]. In more detail, longitudinal analyses of first-year research participation indicate that engaging in research early in an undergraduate program is associated with greater university satisfaction and improved academic performance later in the program [6]. Additionally, multi-campus studies that compare students who do and do not participate in faculty-mentored research also show substantially higher 4- and 6-year graduation rates for undergraduate researchers in engineering [7], [16]. In parallel, faculty-focused work highlights that undergraduates can make meaningful contributions to research productivity while developing critical thinking, communication, and problem-solving skills—particularly when intentional training and mentoring infrastructures are in place [6], [7], [9], [14].

Despite this broad literature base, most engineering education and STEM studies either contrast students who have participated in research with those who have not or focus on single type of structured program—such as centralized research initiatives or course-based models [2], [4]-[6], [10]-[13], [16], [17]. For instance, campus-wide and multi-institutional analyses might demonstrate that mentored undergraduate research is consistently associated with higher academic performance and persistence, but they do not differentiate between informal and formal volunteer roles, compensated positions, etc. [5]-[7]. Other studies document how faculty and institutions design training modules, mentoring approaches, and research-oriented workshops to expand undergraduate participation, yet these efforts typically treat “undergraduate research” as a single category without considering how compensation, accountability mechanisms, or program requirements change students’ day-to-day experience [6], [8], [10], [12], [14], [15]. Consequently, there is limited empirical evidence that directly compares different models of undergraduate research within the same institutional and disciplinary context [2], [4]-[6], [10]-[13], [17].

The purpose of this work-in-progress study is to compare students’ prior experience participating in research on a voluntary basis versus their current experience in a paid and structured undergraduate research program, the Opportunities for Undergraduate Research and Opportunities (OURS) program offered by Center for Development, Support, and Success in Engineering and Computing (CDSSEC) at Florida International University (FIU). At FIU, engineering and computing undergraduate students have opportunities to participate in informal, voluntary research agreements with faculty, as well as a paid, structured research experience through the OURS program. Prior literature suggests that conditions such as compensation, clearly defined expectations, and formal accountability structures can influence students’ ability to sustain engagement in research alongside academic and personal responsibilities, yet few

studies examine these factors by asking the same students to reflect across multiple research modalities [18]. In addition, prior research does not compare volunteer research experiences with paid and structured research experiences to investigate potential differences that exist. Understanding how students experience and interpret these different research models is essential for informing the design of inclusive and effective undergraduate research initiatives [14].

This study uses engineering and computing students' reflections to identify similarities and differences between both—volunteer and structured, paid—research modalities and to examine salient themes related to structure, mentorship, accountability, motivation, and perceived outcomes [11], [18]. Overall, the findings from this study are intended to contribute to engineering and computing education scholarship by providing a more in-depth understanding of how different types of undergraduate research experiences shape the development of engineering and computing students, building on and extending existing work on the impacts of undergraduate research programs [14]. In many engineering and computing programs, students encounter both informal, volunteer research roles and more structured, paid research positions, yet relatively little is known about how students compare these experiences in terms of learning and professional growth. Accordingly, the overarching research question guiding this study is: How do undergraduate engineering and computing students who have participated in both volunteer research and structured, paid research compare and contrast their experiences?

Program Context

The OURS program offered by CDSSEC is housed within the College of Engineering and Computing at FIU, where undergraduate students ranging from freshmen to seniors work alongside a faculty mentor [19]. These students engage in research for 10 to 15 hours per week on average, submit required monthly progress forms, and are compensated with a monthly stipend during the Fall and Spring semesters [19]. Additionally, professional development funding is available to support scholars in presenting their research at academic venues. This funding may also be used to attend events that support research development, including summer programs and opportunities to explore post-graduation pathways such as graduate school, job searches, and internships [19]. The students' monthly progress reports are not only used for accountability in monitoring and documenting advancements in their research, but also to reflect and document any professional development and outreach activities they participated in that month [19]. In contrast, students who engage in research on a voluntary basis do not get financially compensated and typically have an informal agreement with the faculty regarding timely participation, expectations, and outcomes. Therefore, the conditions in which undergraduate students participate in research opportunities can vary substantially.

Methodology

This exploratory work-in-progress study employs a qualitative research design to examine undergraduate engineering and computing students' experiences with volunteer research and with participation in a paid, structured undergraduate research program, OURS. A qualitative, open-ended survey approach was selected to capture students' reflective accounts and identify differences in perceptions and interpretations of their research experiences across these two distinct modes, which may not be accessible through quantitative measures. Although more in-depth information could be collected through interviews, our approach enabled us to gather preliminary insights as part of our exploratory research.

This study adopts a within-participant perspective, using the current students participating in the OURS program as the sample for the analysis and asking them to reflect on the research modalities they have experienced. Five program participants indicated they had previously participated in volunteer research experiences; they comprise the sample for this study. Although this study has a small sample size ($n=5$), the primary motivation for conducting this study is ultimately to improve the OURS program and potentially provide insight into how students experience differently structured research programs. Thus, after one semester participating in the OURS program, those who previously volunteered completed an open-ended survey asking them to reflect on their experiences of volunteering compared to participating in the OURS program. Participation in this study was voluntary, and all procedures conducted were in accordance with FIU's Institutional Review Board (IRB) approval or exemption requirements. Participants were assigned color-based pseudonyms to protect their identities.

The source of qualitative data utilized in this study is participants' responses to an open-ended reflection survey, which is listed in the Appendix. An open-ended survey style was selected to allow participants to articulate their research experiences in their own words. The survey prompt was designed to elicit reflective comparisons between their volunteer research experiences and their current experience participating in a paid and structured research program. The participants' survey responses were analyzed as text using a three-cycle thematic analysis to identify salient themes across their experiences [20].

This method of data analysis enables systematic identification of patterns and themes across participants' reflective accounts. The following steps outlined in Saldaña [20] were used to guide this thematic analysis. For this thematic analysis, a short word or phrase – a code – was used to assign an attribute to a portion of the data, later categorizing and grouping it into themes. The analysis began with first-cycle coding, which involves open descriptive coding to identify salient concepts and experiences described by the participants. Codes in this cycle captured references to research structure, motivation, compensation, and perceived outcomes. The second-cycle coding categorized the first group code into broader categories such as skill development, support, and validation. The third-cycle coding finalized the analysis, further refining the themes, interpreting the relationships among them, and identifying how these themes shaped students' experiences with the two research modalities.

Findings

Three interrelated themes emerged from the analysis described above.

Theme 1: Curiosity and Intrinsic Motivation as Entry Points into Research

Across the entries, participants described initial engagement in research as driven primarily by curiosity, desire for hands-on experience, and personal intellectual fulfillment. Volunteer research was often framed as exploratory and low-pressure, allowing students to test whether research aligned with their interests. For example, one participant wrote the following:

I first participated in undergraduate research on a volunteer basis... I spent a semester working in a lab simply because I wanted to gain hands-on experience. At that time, I was motivated by curiosity and the desire to learn techniques that I could eventually apply to independent projects of my own. Volunteering allowed me to explore research

without pressure, and it helped me confirm that I genuinely enjoyed being in a lab environment. (Yellow)

Theme 2: Financial Compensation as Stability and a Catalyst for Deeper Engagement

Several entries underscored financial hardship as a decisive factor forcing participants to leave research, delay academic goals, or pivot away from scholarly careers. Participants described paid research as a pivotal intervention that enabled them to remain in research without sacrificing material stability. In the most pronounced case, compensation was framed as both survival and moral recognition:

With OURS, I can now continue to further my research career without sacrificing my livelihood. Moreover, the financial compensation that OURS provides represents more than an aid to survival in a capitalist economy. To me, it is recognition of my prowess as a researcher, and it is acknowledgement of my contribution to science and the world at large. Essentially, I get paid to further the collective knowledge of all humanity and that [I think] is one of the most important jobs for our species. (Blue)

Compensation consistently emerged as an enabler of sustained and higher-quality engagement. Participants reported that paid research reduced the need for outside employment, allowing them to dedicate uninterrupted time and energy to their projects. Participants described improved productivity, deeper experimental thinking, and increased responsibility. Importantly, compensation not only added hours; it transformed the quality of engagement by creating mental space for growth. The following participant quotes demonstrate this theme:

Being paid to conduct research removed the financial stress of balancing a part-time job with academic responsibilities. Once I was able to leave my job, I suddenly had the time and mental space to dedicate fully to my projects. This increased availability allowed me to think more deeply about my experiments, stay consistent with my work and learn at a much faster pace. I was able to take on bigger responsibilities, make more progress, and contribute more meaningfully to my lab. (Yellow)

Being paid through the OURS program has not fully reduced financial stress, but it has helped me dedicate more consistent time to my research. Having some financial support still makes it easier to focus on my project without needing to take on as many outside commitments. (Purple)

Theme 3: Professional Identity Formation and Validation

Lastly, a recurrent point across the entries was the reframing of research from a hobby or learning opportunity into legitimate professional labor. Paid research validated participants' contributions and fostered confidence, commitment, and long-term career aspirations. Several participants explicitly described compensation as recognition of their value and competence as researchers. For instance, Pink wrote:

Participating in OURS and being awarded funding has allowed me to be more active in research and has tremendously helped me gain more trust with my faculty mentor. Because of OURS I have been encouraged to be put in more rigorous work and become more independent research under my PhD mentor. This program has made me more confident in what I have done and continue to achieve in the upcoming semester.

Discussion

This study examined how students who experienced both volunteer and paid structured research compare these two modalities. Students' reflections suggest that voluntary research experiences commonly serve as an entry point and introduction to research [4], [15], [19]. Within these settings, students explore emerging interests, gain exposure to basic research practices, and assess whether engaging in research aligns with their long-term academic or career development. Students described that voluntary research was motivated by curiosity, enjoyment of hands-on experience, and opportunities to gain experience beyond coursework [11], [17]. However, the flexibility that characterized these experiences leaves students without expectations, structure, or accountability. In several cases, the absence of clearly defined expectations or accountability limited students' ability to maintain continuous commitment or to envision a clear pathway for continued development in research, such as graduate school [1], [2], [17].

In contrast, participation in a paid, structured undergraduate research program offered students a more defined and supported research experience [3], [8], [14], [16], [19]. Clear expectations, regular time commitments, and intentional mentoring practices, such as progress reporting and required reporting of results, contributed to ongoing participation and deeper involvement in research tasks [7], [12], [13], [19]. Importantly, financial compensation enabled students to prioritize research alongside academic and personal obligations, reframing research participation as legitimate labor rather than an optional extracurricular activity [10]. Students reported greater stability, increased responsibility, and enhanced focus, all of which supported the development of a stronger professional identity and a greater sense of value for their contributions [2], [6]. Collectively, these findings highlight the need for undergraduate research opportunities that go beyond initial access and instead provide sufficient structure, financial support, and recognition to promote sustained and meaningful participation among students with different life circumstances [5], [6], [10].

Future Work and Conclusion

Future research will expand this investigation by including a third group of students participating in structured, but unpaid, course-based research experiences completed for academic credit. Examining this additional modality will allow for comparison across voluntary, paid, and credit-based research contexts, offering deeper insight into how different combinations of structure and compensation influence student motivation, sense of belonging, and perceived learning outcomes. This comparative approach can influence institutional decision-making by identifying research models that better support students' financial, academic, and personal constraints and foster long-term learning and professional development.

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Appendix

The following open-ended prompt was provided to the students for the survey:

If you participated in undergraduate research on a volunteer basis (unpaid) prior to joining OURS, please compare and contrast that volunteer experience with your experience in OURS (250-500 words). Some points to consider include:

- Why did you previously participate in research on a volunteer basis?
- How, if at all, does being paid to participate in research through OURS change your ability to conduct research?
- How, if at all, does being paid to participate in research through OURS change your attitude toward research?

If this prompt does not apply to you, please write “N/A” in the space below.