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The Impact of an Undergraduate Engineering Research Matching Platform

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Abstract
In the fall of 2024, a digital platform for managing undergraduate research opportunities for academic credit was implemented at a medium-sized, private university in the Midwestern United States. The platform enabled faculty members to post research position announcements, allowed undergraduate students to apply for available positions, and provided a structured process through which faculty could review applicants and select students for enrollment in research credit courses.

The primary objective of this initiative was to enhance transparency in access to research experiences by ensuring that all students were aware of available opportunities. By formalizing what had previously been an informal, network-dependent process, the platform sought to unveil a hidden door to undergraduate research participation. Additionally, it has the potential to connect students and faculty on research projects across departmental and college bounds to create multidisciplinary teams. To promote participation for all, the College of Engineering mandated the use of the platform for all faculty and students; registration overrides were not granted outside the system. In contrast, the College of Science permitted voluntary adoption for faculty to post projects.

This study leverages a policy difference as a natural experiment to evaluate the impact of the research-matching platform on undergraduate research participation. Results show that the College of Engineering, where platform use was required, experienced a 57.5% increase in the number of students conducting research for academic credit compared to the previous two academic years. Statistically significant increases were observed across student groups, including men, women, first-generation and continuing-generation students, as well as underrepresented minority and majority students. In contrast, the College of Science, where platform usage was optional for faculty, did not increase undergraduate research participation following the matching system's introduction. Additionally, formal posting of research opportunities through the platform has not initially generated greater multidisciplinary collaboration across colleges but it has the potential to do so.

Keywords: *undergraduate, research, discernment, experiential learning, selection process*

Introduction
The current study was conducted at a medium-sized, Midwestern, private research university with a 91% 4-year graduation rate. At the institution studied, undergraduate research with a faculty member has long been an option to replace course credit. This has been a common pathway for students in the Colleges of Science and Engineering, although it has continued to gain popularity over time. Engineering has five departments: Aerospace and Mechanical Engineering, Chemical and Biomolecular Engineering, Civil and Environmental Engineering,

Computer Science and Engineering, and Electrical Engineering. The College of Science has 6 departments: Applied Computational Mathematics and Statistics, Biological Sciences, Chemistry and Biochemistry, Mathematics, Physics and Astronomy, and Preprofessional Studies. Between 2021-2025, 38% of undergraduate students in the College of Engineering at the institution studied conducted undergraduate research for credit at some point during their undergraduate experience. In the College of Science, 70% of undergraduate students participate in undergraduate research at some point during their undergraduate experience during the studied period (especially high because of the number of students planning to apply to medical school from the College of Science).

In engineering, undergraduate research credit is applied towards degree requirements as replacements for technical elective courses (3-6 credit hours, varies by program). The majority of engineering students conduct research in engineering (91%) with the remaining (9%) conducting research with a faculty member in Science. In the College of Science, undergraduates can take up to 6 research credits (applied as science major elective credits; some majors allow an additional 3 credits to replace an elective lab). The majority of science students conduct research with science faculty (75%), but an additional 3% do research in Engineering and 22% in liberal arts (primarily Psychology).

Prior to fall 2024, if an undergraduate student wanted to participate in undergraduate research, they would have to identify and contact a faculty member to see if they were willing to advise them. This involved looking up faculty on the College webpage and cold emailing them or relying on networking. Then, beginning in fall 2024, an undergraduate research matching platform was introduced such that faculty would post research opportunities, undergraduate students could apply for up to 3 positions, and faculty would select from among those applicants. The students selected by the faculty would receive registration overrides allowing them to register for undergraduate research for credit.

Figure 1 shows an example posting, which includes a description of the project as well as the qualifications for the project (majors considered, class rank, courses/experience, number of credit hours). There is an indication if the position is for credit or pay, the number of positions open, and the number of applicants so far. Faculty have a several-week window of time to post projects and students have approximately 1 week to apply. Faculty must select from among those who apply, but can carry out their own process for selections. Some faculty conduct interviews or invite students to join a lab meeting to meet them but others do not. The system is initially blind, where faculty do not see applicants' names; however, they can change their status from “applied” to “reviewing” and see the full information from the applicant.

AME: Engineering Education

Variety of projects focused on engineering education which will include defining research question(s), conducting a literature search of other related research, analysis of data collected, preparation of a paper. Some potential topics relate to the longitudinal data analysis in the following areas:

- Engineering Major Discernment
- Engineering Careers Courses
- Engineering Retention
- Program Assessment
- Analysis of Engineering Summer Experience Survey
- Undergraduate Research and who participates
- Women in Engineering

Name of research group, project, or lab: [redacted]

Logistics Information:

Project categories
Aerospace and Mechanical Engineering
Civil & Environmental Engineering & Earth Sciences
Computer Science & Engineering

Student ranks applicable
Sophomore, Junior, Senior

Student qualifications
Students must have taken a course in probability and statistics

Hours per week
1 credit / 3-6 hours

Compensation
Research for Credit

Number of openings
1

Contact Information:

Mentor
[redacted]

Name of project director or principal investigator
[redacted]

Email address of project director or principal investigator
[redacted]

Figure 1. An Example Posting from the Matching System

The College of Engineering required all positions to be posted, while the College of Science made it optional for faculty to use the system. The objectives of introducing a formal approach for research matching included:

(1) Uncovering the hidden curriculum to ensure all students have access to apply for undergraduate research opportunities
(2) Enable multi-disciplinary research (cross-departmental / cross-college)

This study examines how using a formal matching method impacted these objectives.

Literature Search

A review of prior studies on undergraduate research experiences focused on the success of undergraduate research experiences, challenges, graduate school predictors, and the process for selecting participants.

Successful Undergraduate Research Experiences

Prior to participating in a research experience, students reported stereotypical views of faculty mentors as scientists with an expectation of extensive 1:1 mentoring and working on a team rather than individually [1]. After participating in undergraduate research, students reported experiencing varying levels of guidance from their mentors. Many undergraduate students worked with graduate students and indicated it was a positive experience overall. Additionally, those who had the opportunity to work on a publication or attend a conference stated that these experiences positively contributed to their overall research experience [2]. Undergraduate research experiences have been recognized as a high-impact educational initiative, and there are calls to expand opportunities and access [3]. An undergraduate research experience allows students to contribute to the construction of knowledge as well as help build community within a research group [4]. The reported best practices for undergraduate research experiences in support of their development as emerging researchers surround projects that have a clear societal impact and offer opportunities for discovery, dissemination, and student self-regulation [5].

Studies have looked at how students self-identify as researchers. For example, studies have reported research identity being linked to personal character traits and completion of research-related tasks [6-7]. Working on an independent research project and presenting findings were linked to identity as researchers. The acknowledgement of mentors and other lab members further contributed to their identity formation. Faber and Benson (2015) suggested that research experiences incorporating problem-solving and communication are meaningful for student development [7]. Finally, cognitive development and personal growth from situated learning in a community of practice has been reported to support professional identity development [8].

Challenges with Undergraduate Research

A potential challenge for successful undergraduate research projects is a mismatch in expectations between students and faculty in terms of time commitment [9-10]. There is a need to define by the number of credits being earned and the number of hours per week expected for an undergraduate research experience for credit as well as the final deliverables. Another challenge can be a mismatch in the view of the role that undergraduate researchers should be primarily labor vs. full lab group contributors [11]. Further, undergraduate research experiences are embedded within a learning system shaped by national policy, institutional leadership and culture, as well as interactions with faculty, graduate students, and peers. [12]. Finally, variability in the quality of mentoring received is a critical factor in the outcome and positivity of the experience overall [10].

Undergraduate Research as a Predictor for Pursuit of Graduate Studies
Broadly speaking, several prior studies have sought to define what a successful undergraduate research experience in engineering involves both for students who are graduate school-bound and those who are not. While some students engage in undergraduate research to gain practical engineering experience, many use it to evaluate their interest in pursuing advanced degrees. Prior studies indicate that these opportunities are often pivotal in shaping students' decisions regarding graduate school.[13-16].

Eagan and associates (2017) conducted a longitudinal study of STEM students and reported that having an undergraduate research experience had a significant influence on intention to enroll in a STEM graduate program. Further, participation offers academic socialization, further encouragement towards an advanced degree, and development of a science identity. Those who reported greater mentorship experiences through their undergraduate research were also more likely to indicate intention to continue their studies. Prior experiences and interest in continued graduate study are critical to understand; those who already had intentions to pursue STEM graduate study were found to be more likely to have that interest reinforced by participating in an undergraduate research experience [17].

Jiang and Loui (2012) also indicated the influence of family and advisors was also a significant predictor for future graduate studies [14]. Ro, Lattuca, and Alcott (2017) indicated self-assessed leadership skills were a positive predictor, while teamwork skills were a negative predictor [16]. This is indicative of the autonomy associated with independent research. A multi-institutional study from 2018 investigating the factors that contribute to student's decisions for pursuing graduate study reported that self-efficacy is the clearest influence in graduate school intention [18].

Selection of Participants
Due to the positive outcomes of participating in undergraduate research, more opportunities are needed [3], but consideration as to how participants are able to find and access research opportunities is required. A qualitative study involving engineering professors and students reported that student interest and enthusiasm for a project are critical factors to be a good researcher. Additionally, it was recognized that students have to be assertive and proactive in order to get a job in a research laboratory. This is a concern for implicit bias and unintentional exclusion; the authors suggest strategies to promote inclusion [19]. A prior study indicated that altering recruitment methods for undergraduate research as the method by which faculty select undergraduate researchers varies widely, and unintentional biases against certain demographic groups is possible [19]. Finally, principal investigators (PIs) expect a demonstrated level of interest in their research before selections, but caution that this could be exclusionary for underrepresented students [20].

Bias against female students at research-intensive universities has also been reported. Moss-Roushkin (2012) conducted a randomized double-blind study that asked faculty to rate the applications of students for a laboratory manager position. Each "applicant" was randomly assigned either a male or female name, and faculty rated the applicants who had a "male" name to be more competent than an identical "female" named applicant. This finding held regardless of the faculty member's gender. The study also used a standardized instrument to examine some of the preexisting biases against female students. Collectively, these results of biases against women and underrepresented students indicate a need for approaches that maximize fairness and opportunity for all students [21]. The current study does not specifically focus on bias, but rather on evaluating a method to ensure all students are aware of the undergraduate research opportunities available and have an opportunity to be considered and are not reliant on networking.

Methods

The current study began with a pilot in fall 2024 during which the College of Engineering tried one platform (Edusourced) and the College of Science tried an adaptation of the MUSER system developed by faculty at Duke [22]. After the first semester matching process, the students and faculty were surveyed; the students reported appreciation for having any type of system while faculty indicated a clear preference towards the Muser system because of the simplicity of the system. Muser only matches students to faculty research (and nothing else), so it was easy to use/navigate. The Muser system has been adapted for use at the studied institution and the system is called STRAND (Student Research at Notre Dame) and has been utilized by both the Colleges of Engineering and Science since spring 2025 [23]. Figure 2 shows the timeline of this process.

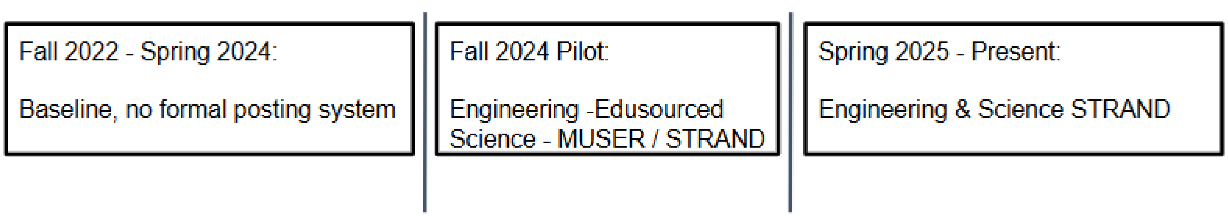

Figure 2. Timeline for Introduction of Research Matching Platform

Using institutional registration records, an analysis of student participation by college, program /department, degree progress, gender, ethnicity, and first-generation status are reported. Additionally, the policy difference between Engineering (required) and Science (optional) are considered in the number and percentage of student participants. Analysis of undergraduate students enrolled was completed by aggregating responses over multiple semesters for both before introducing a research matching platform and after. Statistical comparisons were made based on the two-sample, unpaired t-tests, with unequal variance (Welch's t-test). The tests were one-tailed as the matching platform was thought to increase participation [24].

Results / Discussion

The results of this study are rooted in how participation in undergraduate research was changed by introducing a formal posting system. The results are pre (fall 2022-spring 2024) vs. post (fall 2024-spring 2025) with comparison groups by: college, department/program, gender, first-generation, and minority groups. Overall, the College of Engineering observed a 57.5% increase in the number of students conducting undergraduate research for credit compared to the previous two academic years. The College of Science did not have an increase in participation.

College

A pre and post-comparison was conducted by each of the Colleges of Engineering and Science. Table 1 compares the 4 semesters prior to introducing the matching system to the 2 semesters since the system has been in place. There is a statistically significant increase in participation in the College of Engineering, while the difference for the College of Science was not statistically significant. In addition to the policy difference, a difference may be that the College of Science already had a high participation rate in undergraduate research, especially among the pre-med students.

Table 1. Summary of Undergraduate Research Participants by College Pre / Post

<table>
<tr><th colspan="2" rowspan="2">Term</th><th colspan="2">Science</th><th colspan="2">Engineering</th></tr>
<tr><th># Students</th><th>Combined Avg</th><th># Students</th><th>Combined Avg</th></tr>
<tr><td rowspan="4">Pre</td><td>Fall 2022</td><td>544</td><td rowspan="4">634</td><td>175</td><td rowspan="4">200</td></tr>
<tr><td>Spring 2023</td><td>718</td><td>186</td></tr>
<tr><td>Fall 2023</td><td>559</td><td>192</td></tr>
<tr><td>Spring 2024</td><td>716</td><td>248</td></tr>
<tr><td rowspan="2">Post</td><td>Fall 2024</td><td>556</td><td rowspan="2">603</td><td>306</td><td rowspan="2">315</td></tr>
<tr><td>Spring 2025</td><td>650</td><td>323</td></tr>
<tr><td colspan="2">Ttest</td><td colspan="2">0.336</td><td colspan="2">0.00175**</td></tr>
<tr><td colspan="6">where * denotes p<0.05, ** p<0.01, *** p<0.001</td></tr>
</table>

Department / Program

A pre and post-comparison was conducted by the program of study within the College of Engineering. Table 2 compares the participation prior to the research matching system to the after the system was introduced. There is a statistically significant increase in participation for students in most programs, including Aerospace, Chemical, Computer Science and Engineering, and Electrical.

Table 2. Summary of Undergraduate Research Participants by Program Pre / Post

Term		Aerospace		Chemical		Civil		Computer		Computer Science		Electrical		Environmental		Mechanical	
		#	**Avg**	**#**	**Avg**	**#**	**Avg**	**#**	**Avg**	**#**	**Avg**	**#**	**Avg**	**#**	**Avg**	**#**	**Avg**
Pre	Fall 2022	7	7	36	48	8	11	2	7	40	49	30	28	9	10	42	38
	Spring 2023	5		41		13		1		43		30		14		38	
	Fall 2023	8		51		16		4		43		24		8		37	
	Spring 2024	8		64		8		19		70		26		8		36	
Post	Fall 2024	20	22	79	79	16	11	17	17	70	68	70	68	13	12	45	53
	Spring 2025	24		79		6		17		66		66		10		61	
Ttest		**0.029***		**0.008****		0.484		**0.044***		**0.035***		**0.0012****		0.232		0.155	

where * denotes p<0.05, ** p<0.01, *** p<0.001

Gender

A pre and post-comparison was conducted by gender within the College of Engineering. Table 3 compares the participation prior to the research matching system to after the system was introduced. There is a statistically significant increase in participation for both male and female students. The improvement is for all students; however, the evidence for increased participation is stronger for female students. As a percentage, female students are between 38-40% of the students in the College of Engineering.

Table 3. Summary of Undergraduate Research Participants by Gender Pre / Post

Term		Male		Female	
		Students	N Combined Avg	Students	N Combined Avg
Pre	Fall 2022	100	107	75	94
	Spring 2023	94		92	
	Fall 2023	100		92	
	Spring 2024	132		116	
Post	Fall 2024	157	167	149	148
	Spring 2025	176		147	
Ttest		**0.012***		**0.0036****	

where * denotes p<0.05, ** p<0.01, *** p<0.001

First-Generation

A comparison of first-generation to continuing-generation students participating in undergraduate research in the College of Engineering was conducted. Table 4 compares the participation prior to the research matching system to after the system was implemented. There is a statistically significant increase in participation for both first-generation and continuing-generation students. The average number of first-generation undergraduate research participants doubled during the studied period; this is a positive outcome given that uncovering a hidden curriculum was thought to offer benefits to first-generation students but it has helped everyone.

Table 4. Summary of Undergraduate Research Participants First Generation Pre / Post

Term		Continuing Generation		First Generation	
		Students	N Combined Avg	Students	N Combined Avg
Pre	Fall 2022	160	183	15	17
	Spring 2023	172		14	
	Fall 2023	178		14	
	Spring 2024	223		25	
Post	Fall 2024	273	281	33	34
	Spring 2025	289		34	
Ttest		**0.0018****		**0.00373****	

where * denotes p<0.05, ** p<0.01, *** p<0.001

Minority and Majority Students

A pre- and post-comparison was conducted based on minority status, comparing students from historically underrepresented groups with majority groups (including Asian) within the College of Engineering. Table 5 compares the participation prior to the research matching system to after the system was introduced. There is a statistically significant increase in participation for both majority and minority students.

Table 5. Summary of Undergraduate Research Participants by Minority Pre / Post

<table>
<tr><th colspan="2" rowspan="2">Term</th><th colspan="2">Majority</th><th colspan="2">Historically Underrepresented</th></tr>
<tr><th>Students</th><th>N Combined Avg</th><th>Students</th><th>N Combined Avg</th></tr>
<tr><td rowspan="4">Pre</td><td>Fall 2022</td><td>128</td><td rowspan="4">152</td><td>31</td><td rowspan="4">33</td></tr>
<tr><td>Spring 2023</td><td>143</td><td>30</td></tr>
<tr><td>Fall 2023</td><td>146</td><td>28</td></tr>
<tr><td>Spring 2024</td><td>190</td><td>42</td></tr>
<tr><td rowspan="2">Post</td><td>Fall 2024</td><td>215</td><td rowspan="2">223</td><td>55</td><td rowspan="2">58</td></tr>
<tr><td>Spring 2025</td><td>230</td><td>61</td></tr>
<tr><td colspan="2">Ttest</td><td colspan="2">0.0049**</td><td colspan="2">0.00446**</td></tr>
<tr><td colspan="6">where * denotes p<0.05, ** p<0.01, *** p<0.001</td></tr>
</table>

Research Across Colleges

A goal of the program was to increase cross-disciplinary research, both between the Colleges of Science and Engineering as well as across departments within the Colleges. While data on the department level is not yet available, the cross-college data are shown below in Table 6. The assessment is to see where students are conducting research, within their home college (engineering students with engineering faculty for example) or outside of their college (engineering students with science faculty). In the platform's first year, Engineering saw substantial growth in internal research participation, yet cross-college placements with Science faculty were unchanged. There was an observable increase for Science students working with Liberal Arts faculty.

Table 6. Summary of Undergraduate Research Participants Between Colleges Pre / Post

Term		Science Students - Science Faculty		Science Students - EG Faculty		Science Students - Liberal Arts Faculty		EG Students - EG Faculty		EG Students - Science Faculty	
		N	N Avg	N	N Avg	N	N Avg	N	N Avg	N	N Avg
Pre	Fall 2022	445	567	18	24	131	141	168	188	13	24
	Spring 2023	661		22		152		170		33	
	Fall 2023	469		25		114		187		17	
	Spring 2024	694		31		167		226		34	
Post	Fall 2024	434	499	23	27	185	194	330	329	13	20
	Spring 2025	564		31		202		327		26	
Ttest		0.255		0.299		**0.0119***		**0.00085*****		0.31100	

where * denotes p<0.05, ** p<0.01, *** p<0.001

Conclusions

A formal matching platform promotes more equitable research access, but its success depends on mandatory faculty-wide implementation. Results show that the College of Engineering, where platform use was required, experienced a 57.5% increase in the number of students conducting research for academic credit compared to the previous two academic years. The increases were statistically significant across 5 of the 8 degree programs and all student groups, including men, women, first-generation and continuing-generation students, as well as underrepresented minority and majority students. The College of Science, which had access to the system but did not require its use, did not observe a significant change in research participation. One consideration is that the College of Science initially had a much higher rate of student participation in undergraduate research for credit, so there was less opportunity for growth overall. Finally, a goal of the program that has not yet been achieved is increasing multi-disciplinary collaboration across colleges (and departments) – this is a growth opportunity for the future as more students and faculty become aware of the opportunity. Multidisciplinary projects also face challenges in credit distribution, specifically in reconciling requirements between the sponsoring faculty's department and the student's academic program.

The matching platform is well-received because it offers a clear roadmap for students, opening up previously obscured institutional pathways to everyone. Students were surveyed about the platform, and 85% of responses were positive, 7% neutral, and 7% negative. Students do not complain about the system even if they aren't selected for a research position. Faculty initially were unhappy about having to adhere to a defined timeline for posting positions and making selections. After using the system for 2 semesters, there are few complaints. To reduce unnecessary administrative burdens, the policy was modified such that the system was only required for faculty to post positions for initial matching / new positions, and any student continuing after one semester could continue without having to reapply/repost.

Future

Using a formal platform for posting and applying for undergraduate research positions is still in early stages; time will help both students and faculty gain awareness and comfort with the system. Throughout that time, the authors will continue to collect data on the participation of both students and faculty. Time also allows for focus on enabling cross-disciplinary work, specifically reviewing the policies surrounding how credit is applied if it is not granted from the home department. There are also differences by department in terms of the deliverables due at the end of an undergraduate research credit semester (writing a paper, poster, presentation, etc.), how the credit is applied (technical elective, department elective, or free elective) and the number of undergraduate research credits allowed are all requirements which can be made more consistent to enable multi-disciplinary work. The procedural approaches for credit overrides could be incorporated into normal registration processes once all units use a consistent approach. The matching system used by the Colleges of Engineering and Science could be used by all academic units; therefore, research opportunities from other units could also be brought online. Finally, the current study does not specifically focus on bias; future work will consider the selection process.

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