# Enhancing Engineering Self-Efficacy in Community College Students Through Workshop Implementation

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Abstract

Efforts to increase engineering degree completion at community colleges often focus on recruitment, academic performance, and persistence. However, an often-overlooked yet crucial factor is engineering self-efficacy—students' belief in their ability to learn and perform engineering tasks. This belief significantly influences academic success, retention, and career decisions. Higher self-efficacy can enhance motivation, task engagement, and overall achievement, and one way to improve engineering self-efficacy is through the acquisition of hands-on skills. Such skills allow students to engage directly with tasks and achieve tangible results, reinforcing their belief in their ability to succeed. While many four-year universities offer opportunities for students to gain hands-on experience through access to workshops, makerspaces, and other collaborative environments, community college engineering programs often lack such facilities. In addition to developing hands-on skills, access to these kinds of workshops can improve students' sense of belonging within the engineering community, which is equally important for success. The engineering faculty at McLennan Community College recently procured a space on campus and modest financial support to establish an engineering workshop, complete with basic hand tools, work benches, 3D printers, safety equipment, and a small study area. This study examines the impact of launching a new engineering-specific workshop on community college engineering students' self-efficacy. The analysis will rely on survey responses from students enrolled in the Fall 2024 Introduction to Engineering cohort. First, students completed a survey assessing their prior experience with tools, workshops, and hands-on engineering projects, along with the 14-question final Engineering Skills Self-Efficacy Scale [1]. This scale measures self-efficacy in three key areas: experimental, tinkering, and design. The survey will be administered again at the end of each of the following five subsequent semesters to track changes in self-efficacy based on workshop utilization for various courses' projects.

## Background

While it's widely recognized that nearly half of students who graduate from four-year universities start their education at community colleges [2], the numbers are notably lower for engineering students. Only 43% of engineering graduates have attended a community college, and just 13% have earned an associate degree [3]. Community colleges also enroll a higher percentage of underrepresented minority groups, with 57% of Hispanic/Latino students and 55% of Black/African American students attending, compared to 47% of White students. Despite their accessibility, community colleges often carry a stigma, as identified by the Community College Stigmatization Model [4], which can impact students' experiences and sense of belonging.

With backing from the National Science Foundation, the National Academy of Engineering (NAE), along with the American Society for Engineering Education (ASEE) published *The Engineering Mindset Report* [5], which surveyed the current state of engineering education and offered recommendations to "remove barriers to increase access and diversity and improve instruction leading to better student outcomes that will lead to the next level of excellence in undergraduate engineering education" (p. 18). These suggestions emphasize the need for flexibility, evidence-based teaching methods, and fostering an inclusive learning environment. Community college engineering programs provide a vital pathway into the field, broadening access for a more diverse population of students. However, ensuring these students feel a strong sense of belonging and receive adequate support throughout their educational journey is crucial. Hands-on activities play a key role in this effort, as they not only enhance conceptual understanding but also help students connect theoretical knowledge to real-world applications, fostering deeper engagement. Current research on community college engineering and STEM explores various factors that influence student success, such as course completion [6], transfer pathways [7], and classroom climate [8]. We aim to further this conversation by examining how community colleges can boost self-efficacy through the introduction of dedicated spaces for hands-on building and collaborative work.

Self-efficacy (SE) is a concept developed by psychologist Albert Bandura, who noted, "People's level of motivation, affective states, and actions are based more on what they believe than on what is objectively the case" [9] (p 2). In other words, how people think, behave, and feel directly impacts their persistence and likelihood of success. Recognizing the importance of self-efficacy in engineering, many groups have developed a way to quantitatively measure SE among students to determine how various interventions may positively impact SE for engineering students [10], [11] Other studies, such as those by [12], [13], and [14], have examined the importance of hands-on experience, particularly those provided by makerspaces, on student success, whether or not they have explicitly measured for SE. Aligning with this research, The Engineering Mindset Report by ASEE and NAE [5] recommends that community college programs "Integrate hands-on and collaborative learning pedagogies that balance student ownership and choice and effectively working with others," highlighting the importance of practical experience in fostering student success.

## Context

Up until the Fall of 2024, the engineering students at McLennan Community College (MCC) did not have direct access to the tools and equipment necessary to work on their assigned coursework for their engineering classes. While the engineering program provided a room for them to work in (henceforth called the “Engineering Commons”), this space was only equipped with a few hand tools, crafting supplies like hot glue guns, leftover raw materials, a few tables for work, and some shelves for storage. As a result, students had to determine on their own how, where, and with what to build their required projects.

However, two new spaces on campus were introduced in the Fall of 2024, providing engineering students with options they did not previously have. First, MCC established a hobbyist-level makerspace equipped with 3D printers, a laser etcher, an embroidery machine, and other small-scale tools. Open to all students during library hours, the makerspace is fully staffed, with brief safety training and on-demand instruction available for each machine. Students are encouraged to use the makerspace for both personal and academic projects. Second, the engineering department introduced a new workshop, distinct from the Engineering Commons, specifically designed for engineering students to work on their class projects. Although the workshop is modestly equipped—primarily with hand tools and small electric devices rather than large machinery—it represents a significant improvement over the previous setup.  The space includes safety equipment, hand tools (such as hammers, mallets, sockets, wrenches, chisels, files), layout tools (calipers, squares, levels), clamping tools (clamps, vise, anvil), power tools (high speed drills and Dremel tools), cutting tools (bolt cutters, saws, tin snips), and electronics equipment, including soldering supplies.  The room also has a computer with relevant software, whiteboards, and a large television screen for projecting designs.

Access to the workshop was piloted in the Fall of 2024 by allowing entry only to engineering students enrolled in Statics, a course that includes a significant hands-on project. First-year students were not granted access during this initial phase. Starting in the Spring of 2025, the workshop will be open to all engineering students, enabling a comparison of self-efficacy before and after this resource is made more widely available. Students will receive comprehensive training in tool usage and safety, and for the first time, they will have independent access to the space. Although the workshop will not be staffed, it will be monitored and recorded to ensure safety. This new system addresses the limitations of the past arrangement, which required faculty approval for a non-dedicated area and lacked a monitoring system.

## Methodology

This is a longitudinal mixed-methods study on self-efficacy development in engineering students. Participants for the study will be drawn from students enrolled in the Introduction to Engineering course, focusing on two cohorts: Cohort 2024, enrolled in Fall 2024, and Cohort 2025, enrolled in Fall 2025. Following MCC Institutional Review Board approval, surveys have and will subsequently be administered via Qualtrics Online Survey Software. All surveys have and will continue to be anonymized. Students were informed of the research's purpose and given the option to opt-out. Dual-credit students and those under 18 years old were not included.

The study is designed to examine changes in self-efficacy at the cohort level over time. While originally intended to follow individual participants longitudinally, software limitations prevent individual-level tracking. Instead, data will be analyzed in aggregate to explore trends in self-efficacy and resource utilization across each cohort over a three-year period. This approach still allows for a meaningful examination of patterns in engineering self-efficacy development and the potential impact of academic makerspaces.

The study will employ the Engineering Skills Self-Efficacy Scale [1] alongside three surveys designed specifically for this research.  The study will follow participants for three years, recognizing that many students take this amount of time to complete their degrees.

### Survey A: Initial Demographics

This survey was administered to Introduction to Engineering students before the end of the Fall 2024 (Cohort 2024) and will be administered to the 2025 Cohort before the end of the Fall 2025 semester. This survey aims to collect baseline data on students' academic and personal backgrounds, such as their majors, first-generation college student status, traditional versus non-traditional enrollment, and first-time-in-college (FTIC) status. It also assesses students' initial proficiency with hands-on engineering skills and their access to tools or workspaces. This information establishes a foundation for analyzing changes in self-efficacy and project-space usage over time while identifying key variables, such as demographic or proficiency disparities, that may influence the study's outcomes.

Survey B: Engineering Skills Self-Efficacy Scale
Developed by [1], this 14-question Likert-scale survey measures self-efficacy in three areas: experimental (five questions), tinkering (five questions), and design (four questions). The scale was adapted from a variety of sources [15], [16], [10], [17] and while other researchers have adapted the scale for additional studies (e.g., [18]; [19]), the original version will be used without modifications due to the study's small sample size. This survey will be administered at the end of each semester, starting alongside Survey A, to establish baseline self-efficacy and measure changes over time.

Surveys C and D: Project Space Utilization
The purpose of these surveys is to examine how students use the on-campus makerspace and external workspaces for their engineering projects. Survey C is administered only to Cohort 2024 alongside surveys A and B at the end of the Fall 2024, this survey excludes the MCC Engineering Workshop, as it is not yet available to this group. The data collected will help compare resource utilization patterns and identify the role of different project spaces in supporting students' academic and personal projects. Survey D includes the workshop and will be administered to Cohort 2025.

TABLE I
SUMMARY OF SURVEY ADMINISTRATION PLAN

| | **Cohort 2024** | **Cohort 2025** |
|---|---|---|
| **Fall 2024 / Fall 2025** | • Survey A<br>• Survey B<br>• Survey C (Cohort 2024 only) | • Survey A<br>• Survey B<br>• Survey D (Cohort 2025 only) |
| **Subsequent Semesters** | At the end of each subsequent semester (Spring 2025–Spring 2027), surveys B and D will be re-administered to the full cohort group to examine cohort-level trends over time. | From Spring 2026–Fall 2028, surveys B and D will be re-administered to the full cohort group to examine cohort-level trends over time. |

*A. Results: Part A – Demographics & Experience*

To date, this paper only includes data collection for the initial surveys for Cohort 2024. By the time of the paper presentation in summer, spring data collection will be available. Due to our student population, this study did not collect information on gender or race/ethnic background since doing so would make the participants too identifiable. Instead, the study focused on factors such as first-generation college status, high school graduation year, and whether or not it was the student's first semester in college.

Question wording:

- Are you a first-generation college student (select yes if your parents or grandparents did not go to college)?
- Is this your first semester in college (not counting college courses taken during high school or the summer after high school graduation, if you just graduated)?

TABLE II
STUDENT-REPORTED DEMOGRAPHIC DATA

| | First Generation | | First Time in College | |
|---|---|---|---|---|
| | Freq | Percent | Freq | Percent |
| Yes | 21 | 38% | 29 | 53% |
| No | 29 | 53% | 25 | 45% |
| Not sure | 5 | 9% | 1 | 2% |

Students also self-reported their year of high school graduation. Since this is a first-semester course for engineering students, a traditional student would take this class the first semester out of high school, going into an engineering program.

TABLE III
STUDENT-REPORTED HIGH SCHOOL GRADUATION YEAR

| | High School Graduation Year | |
|---|---|---|
| | Freq | Percent |
| 2024 | 28 | 51% |
| 2023 | 7 | 13% |
| 2022 or earlier | 20 | 36% |
| GED | 0 | 0% |

Information was also collected about students' desired major. Students were asked to select their "primary major," although at MCC they are allowed to choose more than one specialty.

TABLE IV
STUDENT-REPORTED MAJOR

| | Major | |
|---|---|---|
| | Freq | Percent |
| Mechanical | 32 | 58% |
| Civil | 9 | 16% |
| Electrical | 9 | 16% |
| Industrial | 2 | 4% |
| Chemical or Biomedical | 3 | 6% |

Next students were asked, "If you were asked to build a large prototype for a group project (more than 3 ft on each side), where would you most likely do this work?" For those indicated they would work on campus, the location specified was the makerspace.

TABLE V
LOCATION OF WORKSPACE

| | Project Space | |
|---|---|---|
| | Freq | Percent |
| At my home, in one of the living areas (like a place where I would sleep or eat) | 8 | 15% |
| At my own home workshop, garage, or other dedicated workspace (a place where I do not sleep or eat) | 19 | 35% |
| At a dedicated workspace at a family member's home or land | 6 | 11% |
| At another school (high school or college space) | 0 | 0% |
| At a workspace provided to me at my job | 0 | 0% |
| On campus (please specify location) | 11 | 20% |
| I am not sure. I would hope that one my teammates would have a good option. | 11 | 20% |

The next question was regarding tools that students had access to. First, students were asked, "Which of the following tools do you personally own? Please check all that apply." Next, they were asked, "Which of the following tools do you have access to outside of MCC by means of borrowing from a parent or relative, partner, roommate, etc.? Please check all that apply." The table below indicates which tools the students have access to, whether by owning them directly, by being able to borrow them, or by being able to access them through a combination of both.

TABLE VI
ACCESS TO TOOLS

| | Own | | Borrow | | Any Access | |
|---|---|---|---|---|---|---|
| | Freq | Percent | Freq | Percent | Freq | Percent |
| Hammer | 45 | 82% | 47 | 85% | 53 | 96% |
| Wrench (any kind) | 46 | 84% | 48 | 87% | 52 | 95% |
| Screwdriver | 51 | 93% | 48 | 87% | 54 | 98% |
| Pliers | 44 | 80% | 47 | 85% | 51 | 93% |
| Manually-powered wood-cutting tools | 25 | 45% | 37 | 67% | 41 | 75% |
| Calipers | 23 | 42% | 31 | 56% | 36 | 65% |
| Soldering iron | 13 | 24% | 18 | 33% | 22 | 40% |
| Multimeter | 19 | 35% | 23 | 42% | 26 | 47% |
| Electric Drill | 38 | 69% | 41 | 75% | 46 | 84% |
| 3D printer | 6 | 11% | 9 | 16% | 12 | 22% |
| Electrical-powered wood cutting tools | 21 | 38% | 34 | 62% | 38 | 69% |
| Welding equipment | 7 | 13% | 16 | 29% | 17 | 31% |
| Mill or Lathe | 3 | 5% | 9 | 16% | 10 | 18% |

Students were asked if they had any experience in the previous three years completing tasks in a variety of fields, with the tasks increasing in difficulty. For the purpose of summarizing this data, the student earned a score of 0 if they selected none of the tasks in a category, a 1 if they selected the simplest task, a 2 if they selected the medium-difficulty task, and a 3 if they selected the hardest task. If the student selected more than one task, the highest score was applied.

TABLE VII
SUMMARY OF STUDENT EXPERIENCE BY CATEGORY

| | | Score of 3 | | Score of 2 | | Score of 1 | | Score of 0 | |
|---|---|---|---|---|---|---|---|---|---|
| | Median | Freq | % | Freq | % | Freq | % | Freq | % |
| Computer Hardware | 2 | 20 | 36% | 11 | 20% | 15 | 27% | 9 | 16% |
| Computer Software | 2 | 20 | 36% | 11 | 20% | 18 | 33% | 6 | 11% |
| Cooking | 3 | 31 | 56% | 7 | 13% | 14 | 25% | 3 | 5% |
| Science Experiment | 2 | 20 | 36% | 17 | 31% | 6 | 11% | 12 | 22% |
| Organizing | 2 | 13 | 24% | 23 | 42% | 12 | 22% | 7 | 13% |
| Budgeting | 2 | 21 | 38% | 15 | 27% | 14 | 25% | 5 | 9% |
| Planning / Scheduling | 2 | 22 | 40% | 25 | 45% | 3 | 5% | 5 | 9% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Furniture | 2 | 17 | 31% | 20 | 36% | 14 | 25% | 4 | 7% |
| Auto Maintenance | 2 | 21 | 38% | 13 | 24% | 16 | 29% | 5 | 9% |
| Electrical | 2 | 18 | 33% | 16 | 29% | 8 | 15% | 13 | 24% |

The next table summarizes the numbers by student instead of by category,  It is noteworthy that almost every student ranked themselves at a maximum level of experience in at least one category although two students (4%) indicated a maximum level of only two or one. Although no students indicated a maximum experience level of zero, four students (7%) had a zero score as their most frequent.

TABLE VIII
STUDENT EXPERIENCE LEVELS

| | Score of 3 | | Score of 2 | | Score of 1 | | Score of 0 | |
|---|---|---|---|---|---|---|---|---|
| | Freq | % | Freq | % | Freq | % | Freq | % |
| Mode Score, per student | 24 | 44% | 14 | 25% | 13 | 24% | 4 | 7% |
| Max Score, per student | 53 | 96% | 1 | 2% | 1 | 2% | 0 | 0% |

*B. Results: Part B – Self-efficacy*

Part B of the survey was the 14-question Likert scale of self-efficacy developed by [1] Students ranked themselves most confident in the experimental and tinkering questions, and less so in the design questions. Experimental confidence had the most skewed distribution toward the higher scores, whereas tinkering and design had more distribution across all possible scores.

TABLE IX
SUMMARY OF SELF-EFFICACY SCORES

| | Experimental | | Tinkering | | Design | |
|---|---|---|---|---|---|---|
| | Freq | % | Freq | % | Freq | % |
| 6: Completely Certain | 64 | 32% | 68 | 34% | 34 | 21% |
| Score of 5 | 67 | 34% | 32 | 16% | 50 | 31% |
| Score of 4 | 53 | 27% | 54 | 27% | 40 | 25% |
| Score of 3 | 8 | 4% | 23 | 12% | 24 | 15% |
| Score of 2 | 4 | 2% | 14 | 7% | 8 | 5% |
| 1: Completely Uncertain | 4 | 2% | 9 | 5% | 4 | 3% |

Examining the same data per student instead of per category reveals that all but one student achieved a maximum confidence score of four or higher for at least one question, although slightly fewer students (35, or 88%) had a most-frequently selected confidence score of four or higher.

TABLE X
SELF-EFFICACY BY STUDENT

| | Mode, per student | | Max, per student | |
|---|---|---|---|---|
| | Freq | % | Freq | % |
| 6: Completely Certain | 14 | 35% | 27 | 68% |
| Score of 5 | 11 | 28% | 8 | 20% |
| Score of 4 | 10 | 25% | 4 | 10% |
| Score of 3 | 1 | 2% | 0 | 0% |
| Score of 2 | 3 | 8% | 1 | 2% |
| 1: Completely Uncertain | 1 | 2% | 0 | 0% |

*C. Results: Part C – Use of Resources*

In Part C of the survey, students were asked which locations they used to work on any projects. The only options for this survey were an on-campus Makerspace, their home, or a third-party workspace (not on the MCC campus). Students were asked to estimate the frequency with which they visited these locations during the course of the semester, at either never visited, visited one to three times, four to seven times, or either or more times. The question included times that the students may have visited the spaces for non-course-related builds.

TABLE XI
FREQUENCY OF VISITING WORKSPACES

| | Makerspace | | At Home | | Third Party Workspace | |
|---|---|---|---|---|---|---|
| | Freq | % | Freq | % | Freq | % |
| 0 | 14 | 33% | 8 | 19% | 29 | 69% |
| 1-3 | 18 | 43% | 23 | 55% | 10 | 24% |
| 4-7 | 7 | 17% | 6 | 14% | 0 | 0% |
| 8+ | 3 | 7% | 5 | 12% | 3 | 7% |

In addition to frequency of use, students were asked to estimate approximately how long they spent working at each location, per time visited. It is important to note that students had not been told that they would be asked about this information at the beginning of the semester, so the self-reported numbers rely entirely on the students' recollections.

TABLE XII
DURATION OF VISITING WORKSPACES

| | Makerspace | | At Home | | Third Party Workspace | |
|---|---|---|---|---|---|---|
| | Freq | % | Freq | % | Freq | % |
| 0 | 14 | 33% | 8 | 19% | 29 | 69% |

| | | | | | | |
|---|---|---|---|---|---|---|
| <1 | 9 | 21% | 5 | 12% | 2 | 5% |
| 1-2 | 13 | 31% | 11 | 26% | 6 | 14% |
| 2+ | 6 | 14% | 18 | 43% | 5 | 12% |

The students were then asked about the source of materials that were used specifically for builds specifically related to class projects. Students were asked to rank six different potential sources. The rank frequency distribution for rank 1 and 2 is in the table below.

TABLE XIII
RANK FREQUENCY DISTRIBUTION FOR SOURCING OF MATERIALS

| | Rank 1 | | Rank 2 | |
|---|---|---|---|---|
| | Freq | % | Freq | % |
| Salvaged/repurposed/upcycled from Engineering Commons | 3 | 12% | 1 | 8% |
| Salvaged/repurposed/upcycled from other sources | 4 | 16% | 11 | 92% |
| Materials provided by MCC makerspace | 2 | 8% | 0 | 0% |
| Materials provided by instructor | 2 | 8% | 0 | 0% |
| Purchased new by self or teammates | 14 | 56% | 0 | 0% |
| Purchased new by MCC sources | 0 | 0% | 0 | 0% |

Finally, students were asked if they self-funded their class projects. Of 42 respondents, 25 students, or 60%, reported having spent their own money on materials. The minimum nonzero amount reported was $15 and the maximum was $322. The average amount spent was $50, and the median was $30.

## Discussion

The data collected provides an insight into the engineering student population that the college serves and can help to guide administrative decisions as the new engineering workspaces on campus are developed. Each section can be examined independently, even without tracking students across surveys, which will be the aim of this discussion.

### *A. Part A – Demographics & Experience*

First, looking at demographics, only approximately half of the students self-identified as FTIC, although this survey was administered to a "first semester, freshmen level" course. This is consistent with looking at the year of high school graduation, where just over half the students were recent (that same year) high school graduates. In this sense, those students might be considered “traditional” college students, ready for freshmen-level engineering coursework right out of high school.

The converse is also true, meaning that nearly half the students in the Introduction to Engineering course were not following a traditional path. In addition, just under half of the population indicated that they were either a first-generation college student or “not sure.” Therefore, any spaces that are designed solely for students who are directly enrolled in engineering classes may miss a large portion of students who are still working through prerequisite courses on their way to the introductory-level curriculum. There is likely a significant population of these students who may benefit from a workspace aimed particularly at bringing them into the engineering community.

Looking at where students would complete work, only 35% of students ($n = 19$) indicated that they had dedicated space at home to work on class projects. All other students must either work in a space where they would sleep or eat, or must work in a location that is dependent upon the goodwill of another (family member, campus space, or teammates). The fact that 15% of students work in living areas suggests some may not have access to dedicated workspaces, possibly due to financial or spatial constraints at home. Students who rely on family members' spaces (11%) or are unsure of their options (20%) may lack autonomy in accessing suitable work environments, which could affect their ability to contribute equally to group projects. The 20% of students unsure about workspace options might point to a reliance on teammates not just for workspace access but also for decision-making about project logistics.

As a note, although students had indicated that they would work on large projects at the makerspace on campus, the makerspace itself does not have room for storage of any type of student project, let alone large or bulky projects, so this is not the ideal option students would like it to be. This highlights the importance of providing dedicated spaces on campus for students to work that include storage.

Tool access is also an important part of the picture when seeking how to provide opportunities to all students, regardless of background, and the information obtained from the students shows that there is a considerable divide between what some students may have access to versus other students. While nearly all students (93% or higher) had access to “kitchen drawer tools,” such as a hammer, wrench, screwdriver, or pliers, once tools got more complicated or specialized access dropped. Students did generally also have access to an electric drill (84% any access, 69% at home), and although a majority of students indicated they could get access to electrically- or manually-powered cutting tools, less than half had access to these tools at home. This dependency could pose challenges if these external networks are not consistently reliable.

Information like this informs decisions on providing workspaces for engineering students on campus. Although possession of an item does not indicate knowledge of how to use the item safely, it usually can indicate familiarity, and so we can expect students to be relatively eager to use tools such as a screwdriver, hammer, wrench, pliers, or electric drill in a workshop. Familiarity may breed poor usage habits, however, and it would be important to ensure students are well-trained in these tools. Similarly, for electrical- and manual-powered cutting tools or calipers, students appear to have the opportunity to get at least some experience but may be more hesitant to initially work with these in a workshop.

With the lower percentage of electrical engineering students, it is not surprising to see fewer students reporting access to a soldering iron or multimeter. Examining this data as a whole, although an initial response to the major distribution information when designing “hands-on” workspaces might be to look at the smaller cohort of electrical engineering (EE) majors as an indication that fewer workspace stations need to be dedicated to EE-specific tools, in fact, the opposite may be true.

While basic tool access is widespread, disparities emerge for advanced equipment like 3D printers and mills/lathes, potentially impacting students' ability to complete complex projects independently. Items such as the 3D printer might be easier to integrate into a beginning-level workshop, as opposed to the more advanced equipment such as the mill or lathe. Regardless, professors should take into account a lack of availability of those tools and avoid assigning tasks or projects that would require such equipment until they could be provided more equitably for all students.

The next important piece of information is how students may have gained hands-on experience outside of a formal classroom setting. Students reported the highest level of experience with cooking (with 56% reporting a maximum experience level). This makes sense as it is the most common human experience and most people will have some kind of access to cooking regardless of socio-economic background.

Regarding high levels of experience, other category tasks, such as Planning/Scheduling, Auto Maintenance, Budgeting, Science Experiment, Computer Software, and Computer Hardware all fell into approximately the same range of 36% to 40%, but the other categories were not far behind. Only the category Organizing fell below 30%, with only 24% of students indicating experience with high-level tasks in organizing. This is again consistent with the student population, about half of which is right out of high school and may not have had many opportunities for large-scale planning projects.

Looking at the other end of the spectrum, reporting no experience with the task category, it was interesting, although not surprising to see Electrical at the top of the list since so few students in this cohort are electrical engineering majors. More surprising, however, was how few students reported having conducted a science experiment, which was something the researchers had expected most students to have done at least at a basic level in high school science classes.

As discussed with respect to access to EE-specific tools, students may be less inclined to choose the EE major due to a lack of experience with electrical wiring and computer hardware. Along those lines, it might be important to explicitly include stations dedicated to EE-specific tasks such as Arduinos, soldering, and similar activities, as well as to provide more training on these kinds of tasks so as to reduce a possible barrier to entry.

Also important to note is that nearly all students ranked themselves as having had the highest level of experience in at least one category. That said, 31% of students ($n$ = 17) had a mode score of one or zero, indicating that many students are coming into the program without a broad array of hands-on skills or experience.

*B. Results: Part B – Self-efficacy*

Perceived self-efficacy is a measure that will be captured throughout each student's progress through the semesters as an engineering student. Although students seem reasonably confident (with a score of four or higher) in Experimental tasks, they seem to be a bit more hesitant in the Tinkering and Design categories, which requires a score of 3 or higher to capture 85% of the population. Design is the only category where the plurality of students do not rank themselves with a top confidence score of 6, which makes sense since the students likely have little formal training in what actual engineering design entails. Again, looking at mode and max information, we continue to see the picture of students who are reasonably confident, with only a small number ($n$ = 5, 12%) indicating a lack of confidence, as evidenced by a mode score of three or lower.

*C. Part C – Use of Resources*

The final survey asked students about how they obtained resources for class projects and where they worked on projects. Two-thirds of students did report visiting the on-campus Makerspace at least once, and about one-third of those students ($n$ = 10) visited the space four or more times. Students were most likely to work on projects at home, with 81% of students ($n$ = 34) indicating they had worked on projects in their home at least once. The smallest percentage of students ($n$ = 13, 31%) reported working at a third-party workspace not belonging to them. This brings up issues of equitable access, particularly when looking at data from Part A indicating where students would be able to work on class projects. Even though most students reported working from home, based on the data reported in Part A it is unlikely that many of these students had a dedicated space in which to work.

When looking at where students obtained materials for building projects, students either purchased the materials new themselves (14 of 42 students ranking as #1) or by salvaging, repurposing, or upcycling materials from non-college sources (11 of 42 students ranking as #2). The significant reliance on upcycled or salvaged material may reflect both resourcefulness and financial constraints. While environmentally beneficial, this approach might limit the quality or precision of prototypes compared to using new materials. This again looks to equity as 60% of students reported self-funding their projects with an average of $50 spent per student who spent their own money. At a school where 70% of its students qualify for some kind of need-based financial aid, this again speaks to issues of equitable access.

## Future Work

By the time this paper is submitted, we will only have access to the initial set of surveys for Cohort 2024, as the next set of surveys will be collected at the end of the Spring 2025 semester. We aim to correlate the responses across the three surveys and conduct an in-depth analysis of initial descriptive statistics. However, by the time of the 2025 ASEE Annual Conference, we expect to have data from the Spring 2025 surveys for Cohort 2024. This additional data will enable us to track changes between Survey B, which examines students' self-efficacy, and Surveys C and D. By comparing Surveys C and D, we will assess changes in space and resource utilization. Notably, these two surveys are largely identical, except for a specific question in Survey D regarding the new engineering workshop, which was unavailable to Cohort 2024 during the Fall of 2024. We will also explore correlations between changes in usage and students' self-efficacy.

While this subsequent analysis extends beyond the 2025 ASEE Conference timeframe, we plan to continue administering Surveys B and D to Cohort 2024 at the end of each semester over the following two years to monitor longitudinal changes. In Fall 2025, we will introduce Cohort 2025 by deploying Surveys A, B, and D at the end of that semester. Similarly to Cohort 2024, Cohort 2025 will receive Surveys B and D at the end of each semester for the next five semesters. Statistical analyses similar to those performed for Cohort 2024 will be conducted for Cohort 2025. Additionally, the availability of data from both cohorts will allow us to compare their outcomes at corresponding points in time. A key distinction in the experimental setup between Cohorts 2024 and 2025 is that Cohort 2024 did not have access to the engineering workshop during their first semester, whereas Cohort 2025 will have access from the outset.

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