Informed planning, design, and evaluation of flexible engineering labs

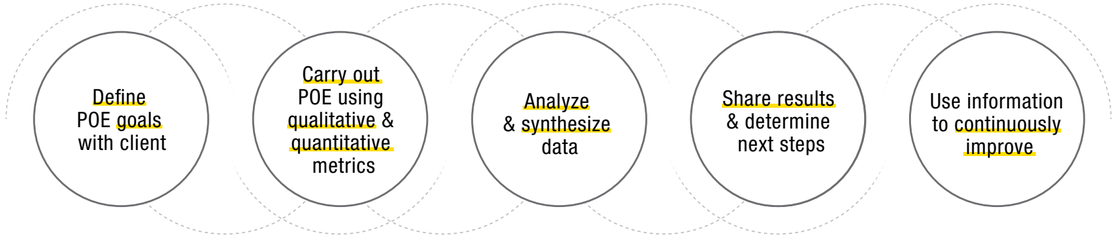
NORTHWESTERN UNIVERSITY

TECHNOLOGICAL INSTITUTE A-B ADDITIONS

CONTENTS

APPROACH

We believe it is our responsibility as architects and planners to promote the health, well-being, safety, and productivity of users of the buildings Flad designs. Just as we plan, detail, document, and monitor the construction of our projects with great care, we also approach evaluating our buildings after delivery with careful attention to provide the best possible outcomes for our clients. For this performance assessment, Flad utilizes a post occupancy evaluation (POE).



WHAT IS A POE?

A post occupancy evaluation is defined as “the process of systematically and rigorously evaluating buildings after occupancy and providing feedback for improvement” - Preiser, Rabinowitz, & White (1988).

WHY CONDUCT A POE?

Conducting a POE is a mutually beneficial activity that allows clients, building occupants, and firms to:

- Measure how well the building meets established guiding principles and overall project goals
- Promote a culture of continuous improvement and ongoing learning
- Identify opportunities for improvement
- Inform and enhance future facility designs
- Foster a high level of engagement by hearing directly from building occupants

EVALUATING AN EVER-EVOLVING COMMUNITY

Northwestern’s Technological Institute is one of the largest academic buildings in the world and houses the Robert R. McCormick School of Engineering and Applied Science. The Center for Robotics and Biosystems, a part of the McCormick School of Engineering was completed in 2019 and occupies 12,000 square feet for specialized, collaborative research and teaching labs. In addition, it has achieved LEED-NC Silver certification. Flad’s post occupancy evaluation (POE) provided a thorough performance assessment, validation of occupants’ real needs, and recommendations for continuous improvement.

THE CENTER FOR ROBOTICS AND BIOSYSTEMS

Laboratory facilities were designed for a wide range of uses, supporting multidisciplinary research and instruction. Spaces include labs for specialized research in materials science, civil and environmental engineering, chemical and biological engineering, bio-integrated electronic devices, and robotics and biosystems. These spaces provide opportunities for collaboration and learning.

Laboratory facilities overview video >

Three-Story Atrium
A multipurpose space used for social gatherings as well as to fly drones using installed drop-down barrier netting.

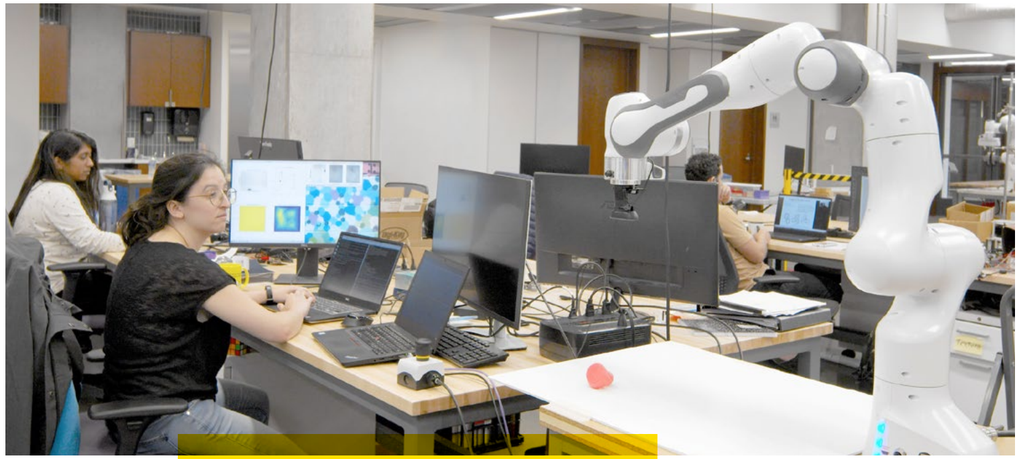
Robot Zoo
A collaboration space for researchers and students to test their work with mobile robots, SwarmBots, and other specialized equipment.

Makerspace
A space equipped with latest technology for building prototypes. The space houses 3D printers, laser cutters, soldering equipment, and more. Other flex spaces used for collaborative and individual work.

Graduate Student Workspace
Computer workstations adjacent to the Robot Zoo, to allow graduate lab students to collaborate, program, and work independently.

SwarmBot Laboratory
Dry robotics lab with prototype equipment for a principal investigator within the Center for Robotics and Biosystems, graduate students, and researchers.

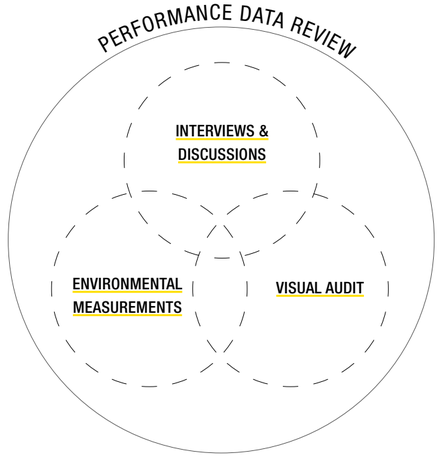
Robotics Class Lab
Computer workstations with transparency and direct access from Atrium and Robot Zoo. Instructional space for masters-level students in the computer engineering program.



A CUSTOMIZED EVALUATION

Flad's POEs are customized to the individual goals of each study and the information the client is interested in gathering. Project specific POE goals:

- **Observe** the type of research being carried out in the newly designed spaces.
- **Measure** how well spaces are being utilized and understand if the spaces meet the needs of the various departments using them.
- **Evaluate** current layout, adjacencies, and flow in order to identify any deficiencies.
- **Assess** existing interior conditions, furnishings, and tools and technology.
- **Analyze** the adaptability of spaces for the evolving nature of research being conducted.



DATA COLLECTION TOOLS

Ethnographic research was conducted to collect qualitative data. The data was broadly categorized using relevant criteria. A rating scale was implemented to quantify the data collected and draw insights.

- Virtual interviews with faculty
- On-site discussions with graduate students
- Temperature, light, and sound measurements
- A time-lapse video
- Photographs
- On-site observations and visual audit

EVALUATION CRITERIA

UTILIZATION
Design effectiveness in relation to occupant type and intended function of space

ENVIRONMENT
Ambient factors such as temperature, lighting, and sound

LAYOUT/FLOW
Location, adjacencies, configuration, flow, and flexibility of spaces

FURNISHINGS
Comfort, seating density, surface types, and storage in spaces

TOOLS/TECHNOLOGY
Existing tools, power, and connectivity

INTERIOR CONDITIONS
Material and condition of flooring, ceiling, walls, windows, and doors

INCLUSIVITY
Physical, cognitive, and cultural aspects of space

AREAS EVALUATED

Wing A

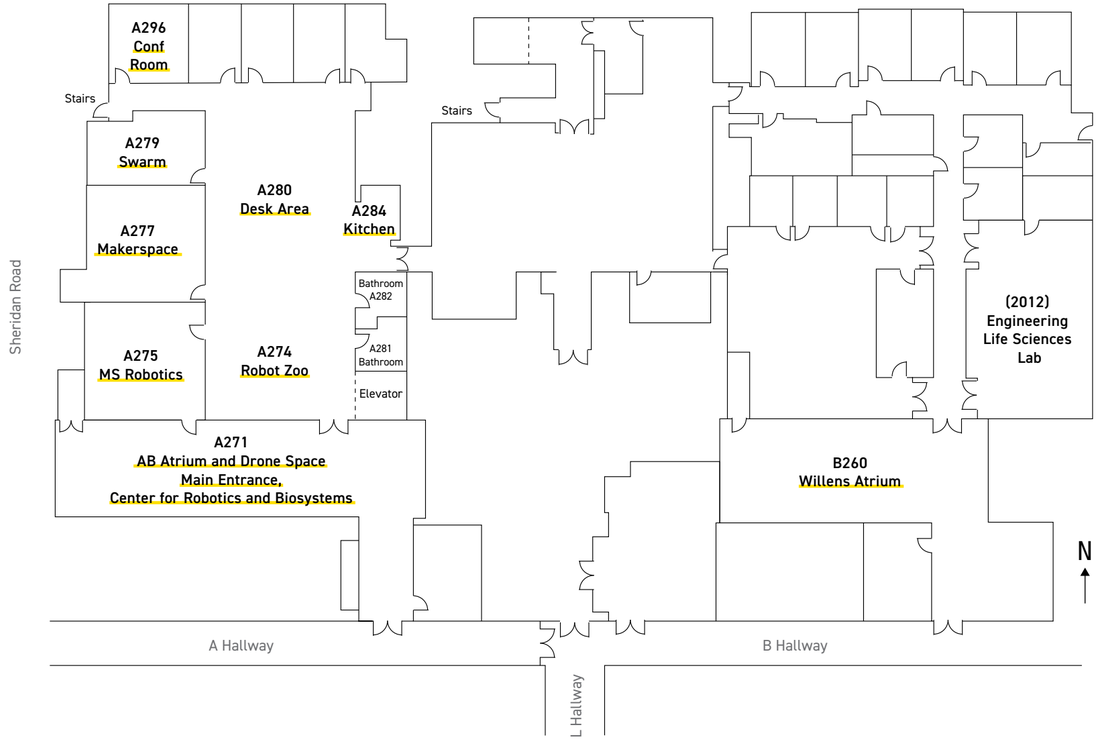
- A271 Atrium
- A274 Robot Zoo
- A280 Desk Area
- A275 MS Robotics Classroom
- A277 Makerspace
- A279 Swarm Room
- A296 Conference Room
- A284 Kitchenette

Wing B

- B260 Willens Atrium
- 2012 Engineering Life Sciences Lab

RATING SCALE

Points	Rating
5	Exceptional
4	Very Good
3	Satisfactory
2	Less than satisfactory
0-1	Unacceptable



We like that our students can flow between spaces and are not confined to walled rooms.

The noise in the Robot Zoo is the biggest drawback of that space.

The MS Robotics space has been great for the community and our MS program.

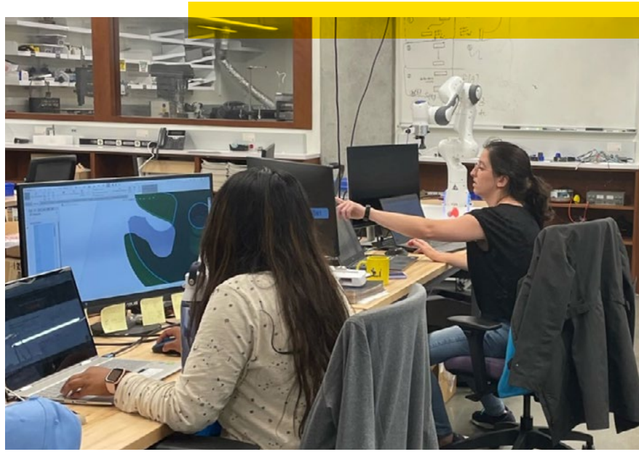
I imagined the Kitchenette to be a great congregation space where students would have interesting conversations over their research, but that did not happen.

The flex nature of the space has made a big difference to what the students are able to do as they collaborate with other labs as a natural byproduct of sharing a space.

The Makerspace is also very valuable as it is used by a lot of people, not only from our lab, but students coming in for projects. The space is always staffed by a technician, which encourages people to come in and exchange ideas.

The conference room has been a great addition, but the AV system there does not work efficiently.

The Swarm Room is a great space to experiment with smaller, fragile prototypes.



We wish the lighting in the Robot Zoo and desk area could be turned on independently from each other and prevent light interfering with our robot sensors in the Robot Zoo.

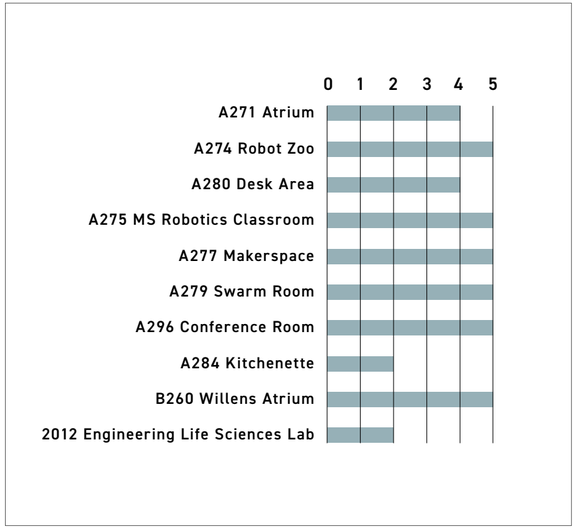
The Robot Zoo is shared by students from 4-5 labs and is great for collaboration.

We would prefer if the kitchenette were located away from the desk area to avoid disturbing students working there.

It would be nice to have some quiet work spaces not accessible to visitors.

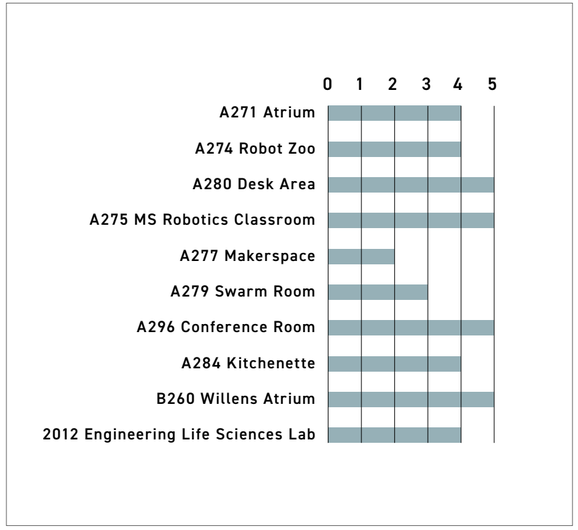
KEY FINDINGS / SITE OBSERVATIONS

Rating Scale // 0-1 Unacceptable | 2 Less than satisfactory | 3 Satisfactory | 4 Very Good | 5 Exceptional



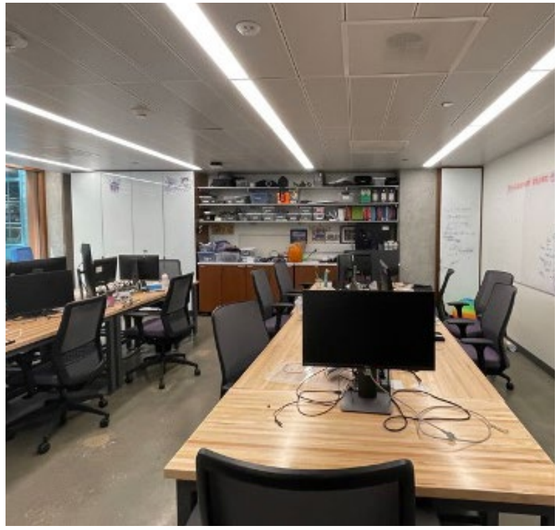
UTILIZATION

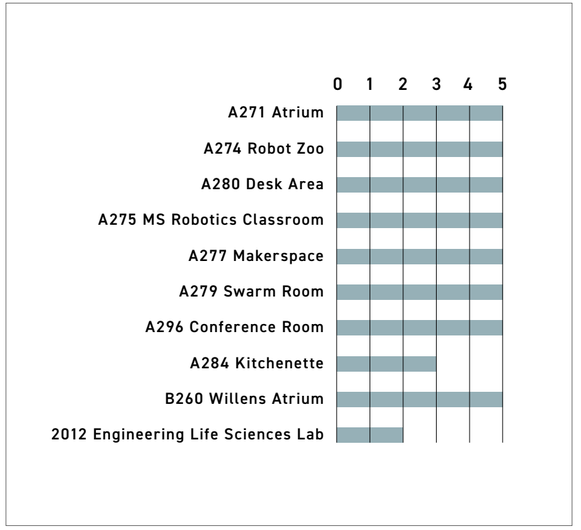
Utilization and design effectiveness scored an overall positive rating. The flex nature of spaces allows a wider variety of functions ranging from study group meetings to testing robots and hosting public events after hours. Incorporating dedicated work spaces is essential for focused work.



ENVIRONMENT

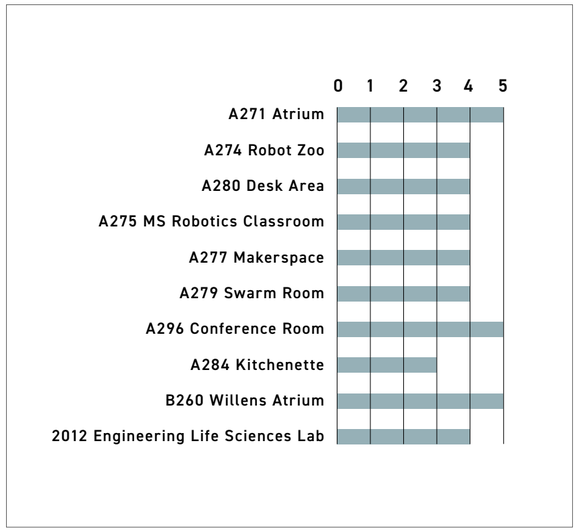
Good quality lighting, optimal temperatures, and sound measurements contributed to creating comfortable learning environments. Rooms with specialized equipment should take into consideration factors such as instrumentation noises, lighting levels, and solder fumes that affect ideal working conditions

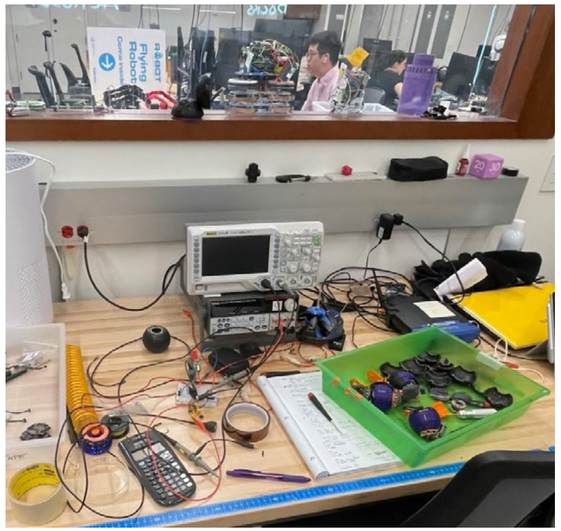




LAYOUT / FLOW

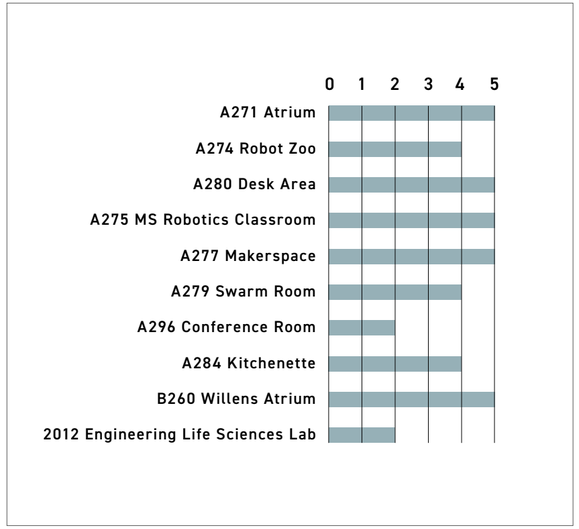
Well-designed layouts and the flex nature of spaces offer adaptability as the nature of research evolves over time. Separation of informal collaboration/interaction hubs from heads-down work areas is desired for better space functionality.

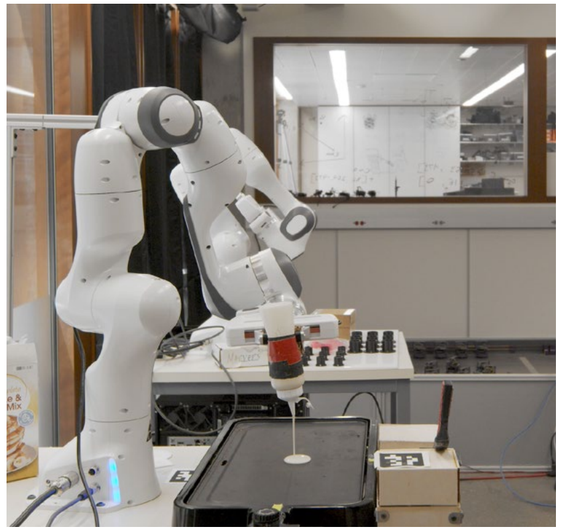




FURNISHINGS

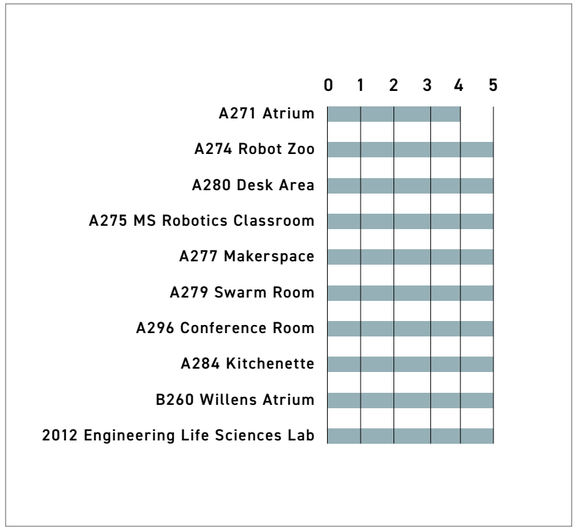
Incorporating target user group feedback in furnishing shared collaboration spaces is desired in order to enhance the student experience. Providing multiple storage options for specialized tools and equipment can increase design effectiveness.

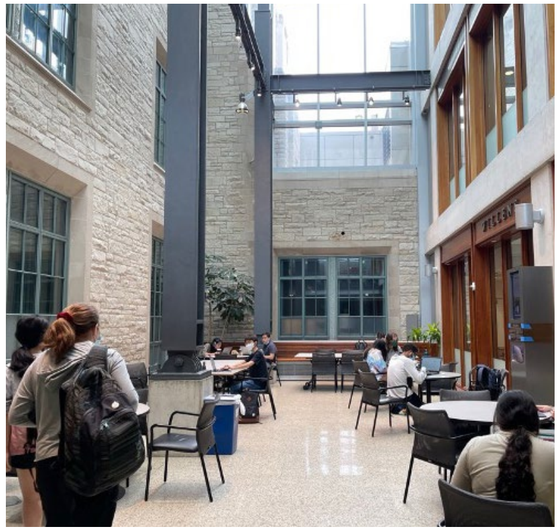




TOOLS / TECHNOLOGY

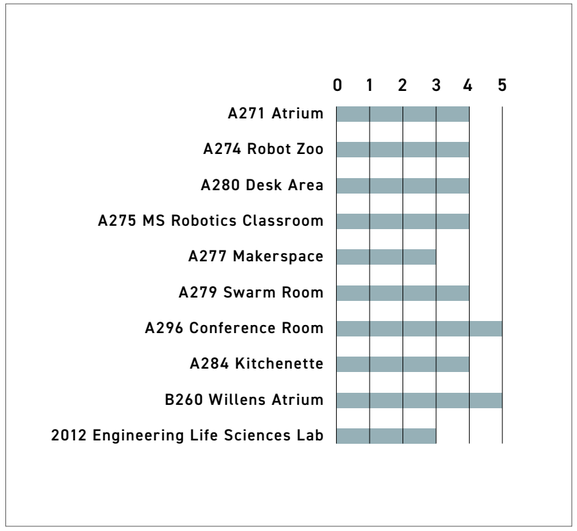
Strategic and innovative planning to account for the ever-evolving nature of technology and computational needs is critical for creating continued positive user experiences.





INTERIOR CONDITIONS

Using durable finishes that are necessary for robotics and engineering research work contributed to effective and functional interior conditions. Increasing connectivity by incorporating glass partitions between spaces received positive feedback.

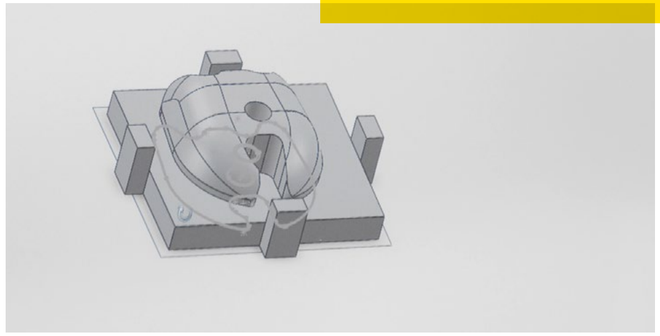


INCLUSIVITY

Spaces continue to be used by a diverse range of students and faculty; therefore, designing environments that take into account the needs of the neurodiverse community is desirable.

FUTURE INSIGHTS & RECOMMENDATIONS

- *Importance of end-user engagement in the planning and design process from all stakeholders: faculty, staff, and students*
- *Maximize flexibility of spaces to accommodate evolving research needs*
- *Provide open spaces with easy access to power for robotics/engineering project space*
- *Allow easy access to environmental controls to customize environment for research needs (e.g., lighting)*
- *Assess the impact of Science on Display in research spaces – when it is beneficial and when it may be disruptive to researchers and students*
- *Identify public vs. private areas during design process and associated access needs (i.e., card readers, elevators)*
- *Plan robust yet flexible furnishings and finishes to withstand the wear and tear that robotics and engineering research requires*
- *Provide multiple types of storage, including benchtop storage for small computer/robot hardware as well as associated tools*
- *For student respite/break and informal collaboration, provide spaces that are comfortable and allow students to customize/decorate*
- *Open and transparent, yet designated spaces for work vs. testing can be valuable to encourage collaboration/interaction*



DATA-DRIVEN PLANNING & CONSULTING

Flad offers a broad range of planning and consulting services, from helping clients define their overall strategic vision to providing technical expertise for highly specialized laboratory and medical environments. Our data-driven approach to planning includes leveraging space utilization studies, pre- and post-occupancy evaluations, data visualization tools, and our robust benchmarking database. We also provide consulting services to support teams through process improvement and change-management activities.

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