Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #45561

Bridging Cultures and Advancing Robotics: A Joint Program on Human-Robot Interaction Through Multicultural, Interdisciplinary Learning

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1 Abstract

Japan is one of the leaders in the world in the field of robotics. They are strong in many sectors of robotics including: space, manufacturing, service, security, education, and healthcare. Japan also has a long history of research and development in robotics, both in industry and academia. While Japan focuses on deep technical development, the United States tends to focus on applied robotics education, research, and development. To provide a graduate level, immersive, learning environment, we developed a joint program between The University of Washington (UW) and Shibaura Institute of Technology (SIT) to offer students an in-depth exploration of emerging trends in the Japanese robotics industry, focusing on the development of next-generation service robots. The program aims to enhance students' technical competence and cross-cultural collaboration skills in the field of Human-Robot Interaction (HRI) . Through this two-week intensive course on Human Robot Interaction (HRI), and a project-based learning approach, students gained a comprehensive understanding of how robots sense, navigate, and interact with their environment, in diverse settings such as healthcare and logistics. The course provided an interdisciplinary and multicultural perspective on technology, business, and design aspects of robotic applications, highlighting differences between North American and Japanese practices. Additionally, the course was co-taught by robotics faculty from UW and SIT, plus the graduate students from UW were paired up with graduate students from SIT in project teams culminating in a hackathon learning experience integrating: human-centered design, design thinking, and technical hardware/software development. Students were also exposed to real-world deployments of robots in a variety of environments such as: cafes, service, and manufacturing company visits. Technical learning was achieved through interdisciplinary groups of students working together to ideate, develop, test, and iterate robotic solutions to using ROS 2, Turtlebot3 robots, as well as a variety of sensors to study human-to-robot interaction plus robot-to-human interactions. To our knowledge, this was the first time a joint program on HRI has been offered with novel curricular design including an interdisciplinary approach to the relatively new field of HRI, including the in-depth exploration and analysis of potential business cases plus user-centered design. Through this multicultural, interdisciplinary (faculty and students), project-based, experiential learning environment, students with little-to-no technical backgrounds were able to use ROS 2 with the Turtlebot3 robots with a multimodal sensor approach (audio, visual, biofeedback) and which the

curricular design is transferable to courses and universities beyond UW and SIT, providing a model for integrating technical skills with hands-on learning in the field of Human-Robot Interaction (HRI).

2 Introduction

Human-robot interaction (HRI) is a rapidly evolving field of study that explores the ways humans and robots communicate, collaborate, and coexist[1,2,3,4,5]. While advancements in robotics have been made globally, there are distinct cultural, technological, and societal differences in the approach to HRI between Japan and the United States.

In Japan, robotics is deeply embedded in the national consciousness and has been a part of the culture for decades[6]. Japan's approach to HRI often emphasizes harmony and companionship. Robots are seen not just as tools but as potential partners in daily life, enhancing human experiences, whether through personal care robots, social robots like Pepper[7], or robots integrated into entertainment and service industries. The country's robotic innovation has been shaped by a combination of technological leadership, a strong tradition of automation, and a societal interest in creating robots that can form meaningful relationships with humans.

In contrast, the United States has largely focused on robotics with an emphasis on practicality, efficiency, and utility[8,9]. American HRI tends to be more task-oriented, with robots designed to assist in industries such as manufacturing, healthcare, and defense[10,11]. The idea of robots as companions or social entities has been slower to gain traction in America[12] compared to Japan, where emotional connections with robots are often considered. However, the United States is still at the forefront of developing advanced robotics technologies, particularly in AI, autonomous systems, and human-machine collaboration for professional and industrial uses.

This contrast in approaches highlights how cultural values, technological priorities, and societal needs influence the design and application of robotics in both countries. Understanding these differences provides insight into the emerging global direction of HRI and how robot design and function might evolve to meet human needs in different cultural contexts.

Based on this gap, we developed a new interdisciplinary course to address the following:

1. Advancement of HRI: By focusing on next-generation service robots, this program addresses the growing demand for robots that can work alongside humans in real-world environments like healthcare, manufacturing, and logistics. The students' exposure to HRI, a key aspect of robotics, directly contributes to the development of robots that can effectively understand and respond to human needs. This is especially crucial for the aging population in countries like Japan, where service robots can provide assistance in elderly care and healthcare settings.

2. International Collaboration and Cultural Exchange: The course fosters cross-cultural collaboration between students from Japan and the United States. Students not only learned technical skills but also gained an appreciation for the different approaches to robotics in each country. Japan's deep technical expertise and the U.S.'s focus on applied robotics education complement each other, offering students a unique cross-cultural perspective.

The joint program is a model for international educational collaboration, promoting global understanding and strengthening international ties in robotics community.

3. Hands-on, Project-Based Learning: The course's emphasis on project-based learning and experiential education allowed students to develop both technical competence plus practical problem-solving skills. By working on real-world robotics projects with diverse groups, students gained a comprehensive understanding of the design, implementation, and evaluation of robotics systems.
4. Development of Interdisciplinary Skills: The integration of diverse fields such as engineering, business, design thinking, and human-centered design ensured that students were well-rounded, capable of addressing not only technical but also societal, ethical, and business considerations in robotics. The interdisciplinary approach helped students develop a holistic view of robotics and its applications, preparing them for leadership roles in robotics research and development. In several interviews conducted with development engineers responsible for creation and development of HRI models at several companies, most indicated that they had not been formally trained in interaction design or other related fields, and instead tended to use their personal judgment when developing interaction models.
5. Educational Model for Other Institutions: The curricular design, including the integration of HRI, interdisciplinary learning, and project-based methodology, creates a model that can be replicated at other institutions beyond UW and SIT. This can expand opportunities for students globally, enabling them to engage with cutting-edge robotics education and gain skills necessary for future careers in robotics.
6. Boosting Innovation in Robotics: Exposure to cutting-edge robotics research, including the use of ROS 2, Turtlebot3 robots, and multimodal sensors, places students at the forefront of technological innovation. The course encouraged creativity and innovation as students work together to develop solutions that are user-centered and applicable to real-world challenges.
7. Contributing to Global Robotics Leadership: By equipping students with advanced skills and international experience, the course helped nurture a new generation of robotics learners who are able to understand a problem space and potential robotics solution from a variety of different perspectives, creating a more effectively designed solution to meet the needs of users.
8. Real-World Impact on Society: The focus on service robots for applications in healthcare addresses pressing societal needs. For example, robots can ease the burden on healthcare workers, assist care for an aging population, and improve service efficiency. This program contributes to the development of these life-improving technologies that can have significant social and economic impact.

This program represents a forward-thinking initiative that not only advances technical education in robotics but also contributes to global collaboration, innovation, and societal well-being, laying the groundwork for future developments in robotics and human-robot interaction.

3 Interdisciplinary TECHIN599: HRI in Tokyo Course Description and Structure

The curriculum for the **TECHIN599: HRI in Tokyo** course was co-designed and developed with faculty at Shibaura Institute of Technology (Tokyo, Japan) and the University of Washington (Seattle, WA) . To our knowledge this is the first global, multi-institutional, course in Human-Robot Interaction. The course integrated human-centered design, technology, and business themes in applied robotics projects for an interdisciplinary approach to robotics. Unlike traditional robotics courses which are generally offered and developed in siloed departments (Electrical Engineering, Mechanical Engineering, Computer Science), this course integrated an interdisciplinary approach through both faculty and students. The schedule included:

- 8 hours per day of class time, each day Monday to Friday
- Visits to local robotics companies such as Mujin and Kawasaki
- Robotics research lab tours
- Daily graded student written reflections
- Group presentations with real-time feedback from faculty, staff, post-docs, and graduate students

3.1 Learning Objectives

- Understand the foundation and methodologies used in HRI.
- Assess current trends and capabilities of service robots and their employment in a variety of environments.
- Compare approaches for HRI design and development in the United States and Japan.
- Practice development of a robotics solution for a healthcare-related application, and understand technical, business, and legal challenges of doing so.
- Predict challenges in adoption of new robotics solutions, including technical, design, and physical limitations.
- Recognize key challenges and opportunities as the service robotics sector develops, and see potential for new opportunities in other fields.

3.2 Assessment

To evaluate and assess student progress and course content effectiveness, daily reflections and assignments were used. The student submissions were evaluated to assess the level of student understanding of the key topics and inform future curriculum design improvements. Some examples of the assignments include the following topics: Robot Concept Design, Interaction (human-to-robot plus robot-to-human), and User Centererd Design.

Overall goals of the curriculum were to allow all students, regardless of prior familiarity with service robotics, HRI design principles, or technical backgrounds to improve their knowledge and develop the skills to evaluate various aspects of service robotics deployments as well as identify the current limitations.

While it was not expected that students with little-to-no technical background would become highly proficient at the highly technical nature of developing and programming robotic solutions, it was reasonable to expect that these students would improve their understanding of the field.

3.3 Student Demographics

12 students from the University of Washington were accepted and participated in the program; the majority (9 students) had no prior experience with autonomous robotic systems or the Robot Operating System (ROS). The cohort consisted of the following demographics:

- 12 students (4 female, 6 male, 2 undeclared)
- 5 undergrad, 7 graduate students
- National Origin: United States (8), Mexico (1), Canada (1), China (2)
- Majors included: Human-Centered Design Engineering, Computer Science, Electrical Engineering, Information Management, Biology, Technology Innovation
- Professional work experience: 0-10 years

3.4 Grading

The course was graded as follows:

- Participation 15%
- In-Class Activities: 45%
- Individual Assignments and Quizzes: 20%
- Final Hackathon Project: 20%

Student teams worked together to design, create and test a Human-Robot Interaction model for Healthcare application. Student teams will define the specific purpose and test functionality of the prototype plus iterate the design based on user feedback in an intensive hackathon format.

Students had several class sessions available to research, develop, and test their proposed solution. UW and SIT faculty and staff were available to assist with facility usage during these times.

The Final Hackathon Project was designed to integrate the concepts taught sequentially through the course into an applied, open-ended project. Student teams presented their final projects to the class, plus faculty, staff, post-docs, and presentations addressed the following topics:

- What is the proposed application (Robot Task)?
- What is the Robot platform and what is rationale behind the design decisions?
- What are the sensors used and what data is collected?
- What is the predicted business market for the application?

- What are some major predicted barriers to successful deployment?
- What would next steps be to continue development on this application?

HRI Goals:

- Who are the intended users of the robotic solution?
- How much human oversight is there?
- How does the robot interact with users?
- Which modalities of interaction did you try to use and why? Also, what were the results?
- What was the user feedback?
- How did you incorporate the user feedback into your final robotics solution?

Real World Limitations:

- Does this solution exist in some form?
- Do you think there's a real market for this solution?
- What might be some of the legal or infrastructure barriers to adoption?

4 Considerations for curriculum design

The HRI education program at Shibaura Institute of Technology (SIT) aimed to establish a structured approach to standardized and interdisciplinary HRI education through technical training, design methodologies, and collaborative problem-solving. The curriculum at SIT was designed to balance technical foundations with creative problem-solving and interdisciplinary collaboration.

4.1 Progressive Learning Pathway

The program was intentionally structured into two phases to ensure that students built a strong foundation before engaging in higher-level interdisciplinary tasks:

- During the technical foundation phase, students were introduced to robotics fundamentals, such as ROS 2 pub/sub architecture and SLAM implementation. These topics were taught through guided, step-by-step exercises, enabling students to execute basic tasks like using TurtleBot for environment mapping. By focusing on these foundational principles, the program ensured that students understood the mechanics and constraints of robotic systems, which are critical for informed design and practical problem-solving.
- The subsequent HRI-specific collaborative phase utilized this technical foundation to explore complex human-robot interaction scenarios. Students learned to connect technical solutions with user needs, transitioning from executing predefined tasks to developing customized solutions that integrated both engineering and design considerations.

4.2 Integration of Technical and Design Knowledge

The program recognized that effective design in HRI requires a deep understanding of the systems being developed.

- Technical Knowledge: Students gained hands-on experience with core robotics functionalities, such as autonomous navigation using SLAM and real-time interaction using the EmotionAPI, a custom module developed by SIT labs. These experiences provided students with concrete examples of how technical systems function and respond to user inputs.
- Design Principles: Building on this foundation, the program introduced User-Centered Design (UCD) to teach structured workflows like user research and iterative improvement. Design Thinking (DT) encouraged students to approach problems creatively and focus on user feedback, ensuring their designs were technically feasible and user-centered.

4.3 Focus on Collaboration

Recognizing that HRI projects often require interdisciplinary teams, the curriculum emphasized collaboration between technically proficient SIT students and design-focused University of Washington (UW) students. This was particularly evident during the Hackathon, where:

- SIT students applied their technical expertise to implement real-time systems, such as emotion-based robot interactions and fall detection functionalities.
- UW students contributed user insights by designing testing protocols and providing feedback on usability and interaction flows.

The program highlighted the critical role of cross-disciplinary teamwork in integrating technical knowledge with design innovation to address the complex challenges of Human-Robot Interaction (HRI). By emphasizing both technical foundations and design methodologies, the structured approach bridged the gap between engineering feasibility and user-centered innovation. This interdisciplinary focus ensured that students developed the skills needed to create effective HRI solutions while contributing valuable insights toward establishing standardized frameworks for HRI education.

4.4 Backgrounds of SIT Students

The participating SIT students brought a diverse range of technical expertise and specialized knowledge to the program. However, their limited exposure to user-centered design principles and challenges in English communication were significant considerations during team composition. These considerations ensured that students could leverage their strengths while addressing key areas for improvement through collaboration.

4.4.1 Technical Expertise and Specialized Knowledge

Proficiency in Robotics Platforms Approximately half of the SIT students had prior experience working with robotics platforms, particularly ROS 2 and its pub/sub architecture. This expertise allowed them to act as technical leads within their teams, facilitating tasks such as implementing SLAM for TurtleBot and integrating pre-developed APIs, including the EmotionAPI, into the final system. To maximize productivity, these students were distributed across groups, ensuring that each team had at least one member with advanced platform-related knowledge to support their peers and the overall project execution.

Knowledge of Physiological Signals and HRV Integration Some SIT students possessed specialized knowledge in physiological signal processing, specifically in analyzing Heart Rate Variability (HRV) data. Their expertise was essential for integrating emotion-based interaction capabilities into HRI prototypes. By understanding the relationship between physiological data and user interactions, these students enabled their teams to implement the EmotionAPI effectively, allowing robots to adapt their responses based on real-time user signals.

4.4.2 Gaps in Design and Communication Skills

Limited Exposure to User-Centered Design While technically proficient, most SIT students had minimal prior experience with user-centered design methodologies, such as Design Thinking or iterative prototyping. This lack of exposure presented a learning opportunity during the program, as students were introduced to key principles of empathizing with users, defining problems, and developing testable prototypes. By collaborating with UW students, who had stronger backgrounds in user-centered design and testing, SIT participants were able to address this gap and enhance their understanding of interdisciplinary teamwork.

Challenges in English Communication Many SIT students faced difficulties in English communication, particularly in expressing ideas during discussions and presentations. This was identified as a key challenge during the program, as effective collaboration with UW students required clear articulation of technical concepts and design ideas. Despite these challenges, the program provided a platform for students to practice their communication skills in an international setting, gradually improving their confidence in cross-cultural interactions.

4.4.3 Strategic Team Composition for Collaboration

To effectively address both technical and communication challenges, SIT students were strategically paired within their groups and with UW participants. This approach ensured balanced skill sets and fostered interdisciplinary collaboration.

Internal Team Balance Within SIT groups, students were paired to create complementary skill sets. Each team included one student with strong programming or robotics expertise and another with proficiency in physiological signal analysis. This internal pairing allowed students to support one another, ensuring that technical challenges such as integrating EmotionAPI or implementing SLAM on TurtleBot could be tackled collaboratively. By distributing expertise evenly, teams were able to maximize their technical output during the Hackathon.

Cross-Cultural Pairing with UW Students When integrating SIT students with UW participants, additional factors such as academic year, design experience, and project roles were carefully considered. This cross-cultural pairing balanced technical development with user-centered design insights, leveraging the strengths of both groups. Furthermore, it provided SIT students with invaluable opportunities to improve their English communication skills, particularly in articulating technical concepts and contributing to interdisciplinary discussions. This dynamic collaboration also encouraged UW participants to adapt their design approaches to accommodate technical feasibility.

By intentionally composing teams that addressed both skill gaps and communication challenges, the program facilitated a unique learning environment. SIT students not only contributed to technical development but also improved their interpersonal and cross-cultural communication skills. This intentional team composition serves as an example of how structured, interdisciplinary programs can enhance both technical and interpersonal competencies, providing a robust framework for HRI education.

4.5 Feedback and Observations from SIT Participants

Feedback from SIT students revealed significant insights into the program's impact:

- Positive Attitude Shifts: Students reported transitioning from passively completing tasks to actively contributing ideas during team discussions. This shift was attributed to the collaborative structure of the Hackathon, which required ongoing communication and problem-solving.
- Skill Development: Many participants noted that the program deepened their understanding of robotics fundamentals and introduced them to new methodologies, such as Design Thinking, which they found particularly valuable for solving complex problems.
- Challenges in Team Dynamics: Some students expressed concerns about the varying skill levels among team members, which occasionally placed additional pressure on more experienced developers. This highlighted the need for improved workload distribution and enhanced communication strategies within interdisciplinary teams.

These observations underscore the value of incorporating structured collaboration and feedback mechanisms into HRI curricula, ensuring students develop both technical and interpersonal skills.

4.6 Conclusion and Implications for Standardized HRI Education

The SIT program demonstrated how a structured, interdisciplinary curriculum can address the challenges of HRI education. By combining technical foundations with user-centered design and fostering cross-disciplinary collaboration, the program provides a model for developing standardized guidelines. Future improvements could include:

- Expanding opportunities for skill balancing within teams.
- Introducing workshops focused on interdisciplinary communication.
- Providing real-world engagement with end users to refine design solutions further.

These insights contribute to the broader conversation on establishing standardized HRI education practices, aligning with the success of related fields such as Human-Computer Interaction.

Outcome Evaluation authentic assessment practices based on key words and phrases were developed in order to in order to ascertain and measure student outcomes and achievement of learning objectives, as well as other key areas as suggested by other works such as [13]. By constructing rubrics to evaluate progress towards learning objectives, and analyzing student feedback, other key areas of knowledge and skills can be assessed as they apply to successful project-based learning outcomes.

Some of these areas include:

Intercultural communication factors Communication Styles and Goals Teamwork and Collaborative Styles Problem Solving Approaches Contribution of prior knowledge and skills

1. Intercultural communication factors

Since this program is a collaboration between Universities in Japan and the United States, with students hailing from not only these two countries, but also several others, there were likely to be a number of intercultural communication factors stemming from the complex environment and need to establish and communicate context effectively. Given the complex dynamics of each 3 to 4 person team where in some cases students hailed from 3 or even 4 different countries and cultures, overcoming this challenge to establish norms was viewed as a crucial factor for success.

Evaluation Method:

Students were asked to describe successes and challenges in working with their teams, and common communication aspects were derived from their descriptions.

Results: The most commonly identified aspects from student descriptions were language barriers, and reluctance to directly contribute ideas or suggestions. In one example group where only one Japanese student was included, the group did not note particular challenges beyond the need to utilize translation tools.

2. Communication Styles and Goals

In addition to communications styles determined by cultural and environmental factors, differences in communication styles as influenced by environment and personal experience of students should also be evaluated, as there is frequently observed to be communication tendencies adopted by engineering centric students as compared to those in other disciplines and fields. [14]

Evaluation Method: Students were asked to describe their team activities, and frequently identified aspects were evaluated as recurring themes.

Results: The most common aspect of communication and goal setting identified by the University of Washington students was that in most groups the Japanese students typically offered input much later in the development process, instead of during the planning phases as most UW students tended to do. Since most of the SIT students were from purely engineering backgrounds, some of the communication methods used in engineering may have also played a factor in this type of communication, though insufficient data was collected to be able to draw a conclusion in this area.

3. Teamwork and Collaborative Styles

Related to intercultural communication factors discussed above, the establishment and development of effective teamwork and collaboration styles was also a key element for success, as in addition to cultural barriers, students from a wide range of interdisciplinary backgrounds also needed to develop common ground based on the skill sets they were able to contribute to the project, and form effective project planning and development plans based on the skill sets available to the team.

Results: Common observations from the UW students show that most SIT students were willing to immediately begin work on technical problems and attempting to arrive at solutions though giving much input into what the goals of the task were, and working through problems and barriers to give information after the problem had been resolved.

4. Problem Solving Approaches

Students were expected to have different problem solving approaches based on their prior experience studying at a US or Japanese University, and also affected by how long the individual student had studied at their respective universities if the student were from a third country originally. This area was evaluated by frequency at which students reported challenges in identifying and resolving problems in the design process or technical issues and the method in which these obstacles were resolved.

Evaluation method: Students were asked to describe their contributions towards a project, and aspects that could reasonably be determined to be linked to the major field of study were evaluated.

Results: SIT students were generally observed to be relatively accustomed to not entirely understanding the whole context of a problem, but relying on their generally higher level of familiarity with ROS 2 and programming to allow them to fully engage with a technical problem without consulting other students. Multiple UW students, meanwhile, noted that they were also curious to understand how the problem might affect other aspects of the development cycle, but often found it challenging to get adequate context for the technical problems that were being encountered.

5. Contribution of Prior Knowledge/Skills

One of the key tenets of interdisciplinary education is the ability to contribute an individual's prior experiences or skills to offer a range of perspectives and knowledge to enhance the development of a holistic solution, and this has been an established key tenet of Human-Computer Interaction for a number of years ([15]) For this area, final presentations and developments were evaluated against the students' existing skills or major, and clear connections were noted.

Evaluation method: Students were asked to describe their contributions towards a project, and aspects that could reasonably be determined to be linked to the major field of study were evaluated.

Results: Some UW students tended to prioritize the new content of ROS 2 programming and the User-Centered Design cycle as both of these topics were new and of interest to them, and as a result did not often activate their prior knowledge. However, most of the students were able to incorporate some of their prior knowledge, especially students in the UW's Human Centered Design Engineering program, likely due to their curriculum already possessing a balance of interdisciplinary skills. Although the course was intentionally designed to encourage students from less technical backgrounds not to overindex technical skills (since course designers and instructors did not consider it feasible for people with no prior experience or knowledge to attain a working knowledge of ROS 2/programming in a short time period), many students chose to engage with technical content as much as possible.

5 Analysis of results

Despite relatively little preparation for these specific factors in both the UW or SIT groups, both groups of students did not report major barriers to achievement of the goal and the task of the five areas listed above. This is likely due to the relatively commonplace presence of students from international backgrounds at both institutions, thus it was likely that many students may have been able to draw on their previous experiences working with international or intercultural groups. However, the data and relatively consistent feedback from students will help to identify key areas to help prepare students for these tasks in future iterations of the program in order to increase the progress towards course goals, as well as felt levels of success.

6 Proposal Towards a Model of Human-Robot Interaction Education

The success of this interdisciplinary students and their ability to positively contribute towards successful Robotics task development shows indications that like the related field of Human-Computer Interaction, interdisciplinary fields and perspectives can contribute towards the development of Human-Robot Interaction Design fundamentals.

1. Robotics Structure and Systems

Service Robotics and other systems designed to operate autonomously in the human space are a dedicated, unique set of hardware and mechanical systems, and fundamental knowledge of the basic operating principles is required. However, with the rise of many commercially available robotics with many systems already integrated and programmed, the required engineering knowledge is much lower than it has been previously.

2. Sensor Systems, Data Processing, and Structures

Understanding the strengths and weaknesses of the sensors utilized in a specific robotic platform or deployment is essential in order to begin to develop interaction models for specific tasks, and the infrastructure requirement and restrictions will be a major factor in the capabilities of an individual robotic solution.

3. User-Centered Design Principles

Services Robotics applications have a wider range of users than most other technology product, owing to the increased number of 'users' present at each stage of the robot's operation process.

Bringing established User-Centered Design principles to robotics interactions will ensure a consistent approach to developing effective models of interaction.

4. Cognitive Psychology

Robots operating in a human space and performing tasks that are human tasks will result in complex psychological interactions with robotics solutions. Understanding how humans perceive and thus form reactions to these robotics solutions is likely to be a cornerstone of how human-robotics interactions are developed.

5. Interaction Design Principles

Interacting with technology and systems designed to mimic human interaction but frequently in unfamiliar forms and with what are currently unpredictable actions indicates a need for a consistent set of interaction design principles specifically tailored towards creating a successful and predictable human-robot interaction.

7 Future Steps

Though the implemented assessment structure was able to capture some level of learning progress, there are still a number of areas which remain less quantified, and more quantitative data will need to be collected in the future to be able to consistently evaluate student progress and curriculum effectiveness from year to year.

Since the program has no technical prerequisite, student progress will have markedly different outcomes from student to student, with technical students likely to gain more technical skill outcomes compared to students who have little or no prior experience in technical areas.

Conversely, highly technical students who have not had prior experience in fundamental product development, user experience design, or business skills that may be more familiar to students from other non-technical backgrounds may find that they are able to gain a better understanding of other elements of a product development or interaction design process.

The Final Hackathon Project highlighted the importance of interdisciplinary thinking, teamwork, and problem-solving in the field of robotics. The projects not only showcased technical proficiency but also emphasized the need for user-centered design, market awareness, and consideration of real-world limitations. The combination of theoretical knowledge and practical application positions students to contribute effectively to the rapidly evolving field of robotics. The broader impact of this joint program between the University of Washington (UW) and Shibaura Institute of Technology (SIT) extends across several areas: education, cross-cultural collaboration, robotics innovation, and global competitiveness.

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