

Integrating disciplines and community service at the Hong Kong University of Science and Technology

The project is part of the effort to engage students in the integration between their discipline and community service. In 2013/2014, a few engineering students from Hong Kong University of Science and Technology (HKUST) were given an opportunity to lead and teach a group of visually impaired students how to build an underwater robot. After completing the construction of an underwater robot, the Special Educational Needs (SEN) students were then taken to participate in a competition (亞太區水底機械人大賽) against ordinary secondary school students where SEN students won 1st runner up. Due to the success of this previous project, a flush of requests from schools with SEN students began to come in hoping their students will also be given a chance to experience building an underwater robot and to participate in a competition. The requests led to the planning of this Service Learning Course, a whole package providing HKUST undergraduate students from various schools (Engineering, Science, Business) the opportunity to

implement their knowledge into practical daily life situations, to work in teams, to serve as teachers and transfer skills of how to build an underwater robot to an identified community group (e.g. primary and secondary school students/SEN students, etc.). Moreover, undergraduate students can learn to understand the limitations on the served group and to organize a competition on underwater robot building for the served community group. The course is co-listed as ENGG2900D/ SCIE1090D/ SBMT2100H at HKUST.

Distinctive Features:

- ✔ Stressing upon commitment and engagement of all students;
- ✔ Involving a cross-disciplinary tripartite partnership among the School of Engineering, School of Business and Management, and School of Science
- ✔ Integrating community services with project works in experiential learning

Learning Outcomes (LO):

- I. To learn the skills of building underwater robot and to transfer this skill to selected group of secondary school students/ South Asian youths
- II. To understand the limitations of the served group (i.e. primary and secondary school students/ South Asian youths) especially for hearing-impaired group
- III. To learn event management skills and to execute a two-day event during the project period
- IV. To serve as teachers in teaching the served community group on how to build underwater robot
- V. To organize a competition for the served community group on underwater robot building
- VI. To participate interactively in team discussions and decision-making
- VII. To present work in both written and oral form at the end of the project

Source: HKUST (2015)

Coursework Teaching & Learning Activities:

- ✎ Pre-Project:
 - 1) Project briefing
 - 2) Course registration and enrolment announcement
- ✎ During the project
 - 1) Course meetings (Week 1-9)
 - 2) Competition briefing (Week 7)
 - 3) Competition (Week 9-10)
 - 4) Final presentation (Week 11)
 - 5) Self-reflective paper (Week 13)
 - 6) Programme and peer evaluation forms

Assessment Approaches

	Name	Learning Activities	Weight	Aligned LO	Type	Generic Skills
A1	Self-reflective paper	The paper covers student reflection, together with a minimum of six digital photos taken during the course of the project.		II. VII.	Summative	Critical thinking, Problem solving, Self-management
A2	Email reports	Two emails should be sent to the course supervisors to report on progress update.		I. III.	Formative	Communication, Critical thinking
A3	Program and Peer Evaluation Forms	Students need to fill out program and peer evaluation forms at the end of the course.		I. IV. VI.	Summative	Critical thinking, Collaboration
A4	Final presentation	Students need to give detailed oral report on the entire project and post-event recommendations.		II. III. V. VII.	Summative	Communication, Critical thinking, Problem solving

Assessment Type

Both formative and summative assessments are employed in the program, allowing for assessment of students' learning progress during the program and achievements after the service. With three out of four assessment methods focusing on summative assessment, this particularly prompts students evaluate the outcomes of their service experience.

Assessment Focal Areas

Problem solving skills: Students can demonstrate and train their problem solving skills through various ways in the course, including managing the competition and designing an underwater robot. With the self-reflective paper (A1) requiring students to reflect on their service experience with six digital photos, students are invited to analyze problems they encountered during their service and search for solutions to their problems. The email reports (A2) allow space for students to present their progress and attempt to solve problems they found. The final presentation (A4) requires a detailed oral report and post-event recommendations, also encouraging students to analyze their problem solving skills throughout the program.

Knowledge application: Students are encouraged to apply knowledge and theories they learnt in lessons into their service. In the final presentation (A4),

students can apply their knowledge of theories and concepts learnt from lectures and course meetings, to report on what they have learnt and achieved. Students can also compare theory against their service experience as they complete their self-reflective paper (A1) and email reports (A2).

Reflection: While servicing, students can reflect on their own attitudes and practices, especially towards the community. The self-reflective paper (A1) assesses students' self-reflective skills. In the email reports (A2) and the final presentation (A4), students are invited to evaluate their experience during the service, which allows space for reflecting. When evaluating the program and peer performance (A3), students can also look back on their own performance. This allows students to further reflect on their achievements and growth throughout the service.

Assessment Standards/ Sample Rubrics

Grading Scheme	Students are graded Pass or Fail. To achieve Pass grade, students must complete all tasks on time and meet the following course requirements:
	<ul style="list-style-type: none"> All students must attend all sessions listed on the working schedule of the course All team members should commit to the agreed due dates and respect the time devotion of the business partner for all interaction – punctuality and good preparation is expected Required tasks must be satisfied by both HKUST Project Supervisor(s) and School's Project Coordinator for students from their respective schools

Teacher's Stories

Professor Tim Woo, Director of Center for Global & Community Engagement, Associate Professor of Engineering Education, School of Engineering, HKUST

Professional Engagements

Woo received his BEng, MPhil and PhD degrees from the Hong Kong University of Science and Technology in 1995, 1997 and 2005, respectively, all in Electrical and Electronic Engineering. He joined the Department of Electronic and Computer Engineering at HKUST in 1997 and is now an Associate Professor of engineering education. He has been very actively involved in developing teaching innovations. Besides leading different experiential learning courses, he encourages and mentors students in applying their engineering knowledge to contribute to the wellbeing of the society. He is the HKUST Robotics Team Supervisor, and the Founding Director of the Centre of Global and Community Engagement at HKUST. He has received 3 teaching awards including the University Grants Committee (UGC) Teaching Award 2015.

Motivation

Woo believes that interaction between students and the society is important, and that hands-on approach is preferable. He said *"Often, underprivileged people don't have access to resources that aren't necessarily financial – like opportunities, for example. What they want the most is not for us to give them extra help or special services, but for people to treat them like everyone else, as equals"*. He hopes to encourage students to explore ways to contribute outside the classroom walls and bring improvement to the society through interacting with the community.

To enhance professional exposures of his students, Woo also facilitates external professional bodies (e.g. Hong Kong Institute of Engineering) to reach

engineering students on university campus (Teacher Interview, April 2016). He actively disseminates news of external competitions and encourages his students to take up these challenges (Teacher Interview, April 2016). He wants to include students of different strengths, not only the academically strong ones, but a full range of students at varied levels of academic performance to sign up for the external competitions, to challenge themselves, to get to know the community (e.g. the routine activities of an NGO), and to make meaning of the engineering works (Teacher Interview, April 2016). Woo said in a newspaper interview that *"most robot competitions [usually see] robots on land, male competitors and top-ranking students; I wanted to break all three stereotypes, so the center started its own competition; we chose underwater robotics, and encouraged females and students of all levels to take part"* (SCMP interview, 14 June 2017).

Challenges

There are difficulties in motivating students of average academic performance to participate in and take up challenges in external competitions (Teacher Interview, April 2016). Moreover, involving different disciplines as a co-listed course requires frequent communication and mutual understanding between departments. Meanwhile, there are also primary and secondary school students joining the program. This results in more workload for coordinators of the course, to contact and liaise with all parties involved. Resources and funding is also a challenge, as the project requires not only manpower but materials and money. With the allocated resources, there is then expected 'return on investment (ROI)' imposed by the university senior management, and the course coordinator needs to demonstrate awards and positive competition results from students; however, the coordinator desires that the students can get to enjoy the process rather than the results (Teacher Interview, April 2016).

Teachers' Side of Stories

☑ Mr Wong (left), teacher from Po Leung Kuk Horizon East Primary School: *'I am pleased that our students had the opportunity to cooperate and solved problems together with others. Most importantly, they learnt to respect and show acceptance towards others.'*

- ☑ Mr Cheng (right) and Miss Cheung (left), teachers from SAHK B M Kotewall Memorial School: *'Apart from learning basic skills in robots making, students showed their creativity and potential, integrate and cooperate with each other to solve problems.'*
- ☑ *"I used to think that designing robots was just for fun and for the competitions. Now I can see that engineering was not only (for) boosting machine performance but could*

also really make a difference in society...”
(former project participant)

- ✔ *“I enjoy doing something that we like. It is where our passion lies. Working with a bunch of kids who share the same interest in robotics design is quite fun.”* (student focus group)
- ✔ *“One or two workshops cannot do much to the community. Something in a long-term will be needed. GCE can foster interest in learning robotics design in the community.”...“If time allows, I will be willing*

to take more responsibilities in designing materials and organizing workshops. It will be more fun.” (student focus group)

- ✔ *“Developing the ORCA (a new robot design) has also required the team to cooperate and trust each other heavily. To bring out our brightest ideas, and to attain the highest efficiency. With such as friendly, innovative, and hardworking atmosphere, EPOXSEA (the name of a sub-team of the HKUST Robotics Team) is a force to be reckoned with”.* (project participant, video, 2016)

Featured Video

- ▶ Robot Design Contest 2014 <https://youtu.be/egkJ42dfHCg>
- ▶ HKUST Robotics Team <https://youtu.be/qep1lvFzrVE>
- ▶ HK Robocon 2017 <https://youtu.be/aEG5RblmQPo>
- ▶ HKUST ROV team <https://youtu.be/O5F7kZcGwAl>

References

- South China Morning Post (2017). Hong Kong academic combines technology and community service for a winning formula. Last accessed on 3 Apr, 2018, at <http://www.scmp.com/news/hong-kong/education-community/article/2098322/hong-kong-academic-combines-engineering-and>
- The Hong Kong University of Science and Technology (2017). HKUST Underwater Robot Competition promotes STEAM education to youngsters from a wide spectrum. Last accessed on 3 Apr, 2018, at <http://www.ust.hk/about-hkust/media-relations/press-releases/hkust-underwater-robot-competition-promotes-steam-education-youngsters-wide-spectrum-2/>
- The Hong Kong University of Science and Technology (2015). Underwater Robot Community Engagement Project. Last accessed on 3 Apr, 2018, at <http://advise.science.ust.hk/sites/default/files/SCIE1090D%20Course%20Outline.pdf>

Websites

- HKUST Robotic Team website: <https://robotics.ust.hk/>
- Facebook group: <https://www.facebook.com/ustrobotics>
- YouTube Channel: <https://www.youtube.com/user/ustrobotics/>