

<b>TITLE OF REPORT : Collaborative International and Community-Based Learning in Engineering Education</b>
--

NAME : Steven Wayne Collins, PhD, PE

AFFILIATION : University of Washington Bothell, Bothell, Washington

DATE: 25/03/20

### Background

University of Washington Bothell (UWB) and Ehime University in Matsuyama, Japan, have been collaborating on an annual study-abroad course in sustainable energy since 2012. After UWB launched its new undergraduate major in Mechanical Engineering in the School of STEM in 2014, responsibility for the course shifted to the School of STEM, and since then the course has been managed as a collaboration between the engineering programs at our two campuses. At the same time, UWB and Ehime have each been piloting new approaches in engineering education, including project-based and community-based learning, and deeper integration of ethics and sustainability into the curriculum.

With this background in mind, Ehime University's Dean of Engineering invited me to extend and deepen our study-abroad collaboration to include comparative study of best practices in engineering education being applied at our respective institutions. To support this next phase in the development of the Ehime-UWB partnership, Professor Nakahara Masaya, Chair of the Department of Mechanical Engineering at Ehime, and I applied for the Japan Society for the Promotion of Sciences (JSPS) Bridge Fellowship. With the support of JSPS, I was able to spend one month at Ehime University from 22 November to 21 December 2019.

### Activities

My primary activities at Ehime University consisted of daily meetings with Professor Nakahara, Professor Itagaki Yoshiteru from Material Sciences, and to a lesser extent other engineering faculty to learn about the recent restructuring of Ehime's undergraduate engineering curriculum. Of particular interest was the new community-based learning (CBL) project, which is being piloted this academic year but is expected to become a required element in the curriculum in two years. I explained versions of my own CBL courses and the lessons I have learned from teaching them over a three-year period at UWB. I learned that Ehime has partnered with the City of Matsuyama on projects in which engineering students improve a park across from a train station and equip a

residence owned by the city with energy-efficient heating and air conditioning systems. I found impressive both the level of commitment by Ehime's faculty to implement CBL across the engineering curriculum and the engagement by local government with the university and its students. I am looking forward to learning about the results of this first iteration at the end of the academic year. In between meetings, I spent considerable time studying the curriculum by reviewing 2018 and 2019 versions of the Ehime College of Engineering's Rishu no Tebiki (Course Guide) and related materials to familiarize myself with the new changes as well as compare curricular structures with those at UWB. To learn more about the background of higher education reform in Japan, I acquired articles and documents on the general state of higher education in Japan, especially the situation at the national universities that, like Ehime, are restructuring to focus on serving their local communities and surrounding regions.

I also had several opportunities to work with undergraduate and graduate students studying engineering at Ehime. On one such occasion, I was invited to conduct a project-based learning class on sustainable energy to an audience consisting of 29 undergraduate and graduate students, and 4 international students. After giving an overview of Japan's current energy situation, the students were divided into small groups to debate possible directions for Japan's energy transition, with Ehime faculty serving as facilitators. After about 20 minutes, students reconvened and presented their findings to the entire class, in English. In addition, I coached Professor Nakahara's graduate students on preparation for an upcoming international conference at which they were to present their research. The experience afforded an excellent opportunity for me to learn more about Ehime's research and graduate instruction in sustainable energy. I had many other less formal, often spontaneous, exchanges with faculty and students that enriched my understanding of daily life in an engineering school at a Japanese national university.

Professor Nakahara and I were joined by Professor Itagaki to plan the next offering of the UWB study-abroad course on sustainable energy. An important new component of the course involves Collaborative Online International Learning (COIL). Specifically, we plan to create activities in COIL that enable Ehime and UWB students to become acquainted before the UWB students go to Japan as well as debrief after the UWB students have returned to the US. Our work culminated in a trial that used Zoom to connect a classroom at Ehime with my engineering students in the US.

At the end of my stay, I had the opportunity to make a short trip to Osaka on 18-20 December to visit Professor Fujioka Katsunori. Currently Dean of Students and Professor of International Studies at Osaka Sangyo University, Professor Fujioka was formerly on the faculty at Ehime University, where he provided support for engineering students in the subject of English, ethics,

and society. Professor Fujioka and I had worked together in the past on linking concepts from contemporary Japanese philosophy and linguistics to engineering ethics, so this was an occasion to reconnect and discuss the current situation of higher education in general, and in particular engineering ethics. I extended an invitation to Professor Fujioka to visit UWB in near future, where we hope to continue the conversation.

Finally, I had the chance to assist Prof. Nakahara in developing materials for a project-based learning activity involving plastic bottle hybrid rockets. The activity can be used in middle school and high school science classes, as well as in mechanical engineering courses at Ehime.

### Results and Next Steps

Through one month of total immersion in Ehime's College of Engineering, I came away with a greatly enhanced understanding of engineering education in Japan. I was able to experience daily university life, work with students in the classroom, interact with faculty, learn about the challenges facing universities and engineering programs in Japan, and share ideas and strategies for implementing best practices in curriculum and pedagogy. In addition, we were able to plan the introduction of COIL methodology in this year's study-abroad sustainable energy course and pilot an online conference between students at Ehime and UWB.

As a next step, I was expecting to welcome engineering faculty from Ehime for a one-week stay at UWB in early March. Unfortunately, their visit was canceled because of the coronavirus outbreak. I am now exploring options for returning to Ehime for a one-week stay in late June or early July to continue with our planning. In the meantime, I am writing an article on engineering education in Japan based on my work at Ehime and will look for opportunities to share the results of our collaboration at a conference or symposium. Perhaps the most valuable outcome is the large number of highly motivated students from UWB who signed up to participate in this year's study-abroad course (at this time we have 17 applications for 14 slots!) after hearing about my work at Ehime under this fellowship. Through JSPS's generous support, I am able to inspire a new cohort of American engineering students eager to experience Japan!

Daily Life in Japan

Every weekday I enjoyed the 12-15 minute walk to my office at Ehime University. On the way, my favorite resting place was the Soseki Tea House on the south side of Matsuyama Castle.



Ehime University is a beautiful campus, especially in autumn when leaves are changing and the air is crisp and cool. Here is a view from a window near my office in the Engineering Department, looking toward Matsuyma Castle at sunset.



Professor Nakahara and I made a day-trip to Imabari and Oshima Island. Here are photos from that trip (Prof. Nakahara with Imabari Castle in background, me at observatory in Kiro-san Park on Oshima Island, with Inland Sea and Kurushima-Kaikyo Bridge in background).

