Exposing American Undergraduates to *Monozukuri* and Other Key Principles in Japanese Culture, Design, Technology and Robotics

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Abstract. Exposure to varied cultures and related design principles has the potential to impact designers in a positive way. However, despite the potential for cross-cultural experiences to influence designers, American undergraduate liberal arts colleges do not typically include these topics as part of the standard computer science curriculum or as part of their general education requirements. We present a case study in exposing undergraduate students at an American liberal arts college to Japanese culture, technology and design through an immersive three-week course that includes two weeks of study in Japan. Through this cross-cultural course, students learn about Japanese culture, technology and design with an emphasis on the way these three areas are interrelated.

Keywords: Cultural differences · Developing HCI expertise and capability worldwide · Education · *Monozukuri*

1 Introduction

Exposure to varied cultures and design principles has the potential to impact designers in a positive way. For example, Steve Jobs took an approach to Human Computer Interaction and design that was heavily influenced by the time he spent in Japan and by his study of Japanese culture [4]. However, despite the potential for cross-cultural experiences to influence designers, American undergraduate liberal arts colleges do not typically include these topics as part of the standard computer science curriculum or as part of their general education requirements.

We present a case study in exposing undergraduate students at an American liberal arts college to Japanese culture, technology and design through an immersive three-week course that includes two weeks of study in Japan. Through this cross-cultural course, students learn about Japanese history, language, culture, technology and design with an emphasis on the way these three areas are interrelated. The course was offered in January 2013 and again in January 2015 with a third offering scheduled for January 2017. The course is co-taught by the co-authors, which allows us

to combine experience with computer science, human computer interaction, design, and robotics (first author) and Japanese language, Japanese culture and Japanese history (second author). The most recent offerings of the course includes a multi-day on-campus orientation, approximately two weeks on-site in Japan, and an on-campus follow-up component.

The Japanese concept of *monozukuri*, which literally means "making things," [3, 5] serves as the central theme of the course. *Monozukuri* is one of the key concepts that inspire product manufacturing in contemporary Japanese industry. The concept implies the spirit or determination to produce excellent products and the ability to constantly improve the products. The spirit of craftsmanship has been the driving force behind traditional art and craft-making throughout Japanese history. In contemporary society, it is one of the foundations for the production of products from cars to robots to video games. As such, the spirit of *monozukuri* can also be seen in small items commonly found in a regular household as well as in Japanese civil, industrial, and technology design projects.

Each offering of the course enrolled students from multiple majors, although most students in the course had prior course work in computer science and/or Japanese language or culture. For example, of the 25 students who enrolled in the course in January 2015, 18 were computer science majors and 12 had completed courses in Japanese language, history, and/or culture. There was some overlap between these groups, such that 7 students had studied computer science as well as Japanese language, history, and/or culture. Only two students had no prior academic background in any of these areas.

2   Course Organization

2.1   On-Campus Orientation

The course began on-campus to provide all students, regardless or prior coursework, with background related to design principles, robotics (including introduction to programming Scribbler robots), Japanese history and geography and their influence on Japanese culture, and basic Japanese language. Students completed several readings on these topics, which were also discussed during class sessions. Additionally, each student spent time identifying a topic to write about in a final paper that would explore how the Japanese principle of *monozukuri* is manifested in an area of interest to the student. The time in Japan spanned about two weeks and included several destinations that provided students with the opportunity to study *monozukuri* in various contexts. The major destinations and themes are described in the remainder of this section.

2.2   Three-Day Homestay in Itakura

We began our time in Japan with a three-day homestay in a small town called Itakura where the students learned about Japanese design and culture in daily life, and participated in activities at Toyo University's Itakura campus as well as cultural activities including a tea ceremony and traditional Japanese dance and Taiko music. Through the

homestay, the students could see how common household items were designed and could consider aspects of Japanese daily life, including the art of hosting guests, through the lens of *monozukuri*.

2.3 Tokyo Visit

After departing Itakura, we moved to Tokyo for a five-day visit that focused on the design of modern technology, including a one-day city overview, a visit to the National Museum of Emerging Science and Innovation, and a full-day visit to the department of Advanced Robotics at the Chiba Institute of Technology.

Along with the homestay, the visit to the Chiba Institute of Technology (CIT) was a highlight of the course for most students. The visit, which included significant inter-action with CIT students and faculty, took place at two locations. First, we stopped at the CIT Skytree Town Satellite Campus to visit a robotics showcase that is jointly spon-sored by CIT and the Future Robotics Technology Center (fuRo), a research lab affil-iated with CIT. While visiting the joint CIT/fuRo showcase, we participated in hands-on demonstrations of robotics technology, including a demonstration of, and chance to drive, the disaster response robot that was sent to the Fukushima disaster area in 2011.

From the Skytree Town Satellite Campus we continued on to CIT's main campus in Chiba Prefecture where we visited the Department of Advanced Robotics. We were welcomed to the department with a presentation about Japanese robotics in general, and the work that is being done at CIT in particular. The welcome was followed by an extensive and fascinating series of small-group laboratory demonstrations by various CIT faculty members and students. Our students were amazed by the wide array of highly advanced technologies we saw, as well as by the design process that the research teams followed. At CIT, students also learned how Japanese roboticists conceive of robot-making within the context of Japanese culture and society. For example, the students learned that Japan's aging population has influenced roboticists to consider ways that robots can be used in healthcare. The students also learned that the Japanese have pioneered the notion of kansei engineering, which means that emotions and affection are incorporated into products and services [1]. This approach to engineering was reflected in the demonstrations that the students saw at CIT.

The CIT visit culminated with a Presidential reception that included a wonderful dinner and the opportunity to play traditional Japanese games with our hosts. This event once again exposed our students to the role *monozukuri* plays in hosting guests in Japan as well as to principles of game design.

2.4 Nagoya Visit

We departed Tokyo for Kyoto, but stopped in route for a one-day visit to Nagoya where we learned about industrial development in Japan through a visit to the Toyota Commemorative Museum of Industry and Technology as well as the Noritake Museum. During this part of the course, students focused on understanding how

companies have used iterative design philosophies to adapt to changing conditions and to take advantage of new opportunities.

At the Noritake Museum, we learned about the history of Noritake and the approach the company takes to designing and crafting ceramics. Much of the Noritake Museum was designed as a working exhibit, which allowed us to watch craftspeople carrying out the various stages of the ceramics design and production process. While Noritake is best known for designing and manufacturing china and tableware, the company has more recently moved into high-tech areas including the design of circuit substrates and engineering ceramics [2].

Next, we visited to the Toyota Commemorative Museum of Industry and Technology. Toyota originally started out as a textiles company [6] and the museum visit showed how the company had moved through a series of technological improvements to continually innovate with regard to the process of continuously producing higher quality materials. The museum then traced the company's path into the automotive industry, and showed how Toyota more recently became an innovator in producing environmentally friendly cars, as well as in using advanced manufacturing techniques such as robots. These themes gave the students another opportunity to think about *monozukuri* and also connected nicely to the robotics demonstrations we had seen previously at CIT.

2.5   Kyoto Visit

Our stay in Tokyo was followed by a four-day visit to Kyoto to study traditional Japanese craftsmanship, in part through visits to several city highpoints. Specifically, the group visited the Golden Pavilion, Nijo Castle, the Imperial Palace, the Heian Shrine, Sanjusangendo Hall, and the Kiyomizu Temple. Exploring these important historical areas, and thinking about how they were designed, gave students the chance to think about *monozukuri* in a historical and cultural context. For example, a number of these historical sites housed traditional Japanese gardens whose design was influenced by Zen philosophy. In contemporary times, the design of products, both inside and outside of Japan, including Apple products, has been influenced by similar principles [4].

2.6   Hiroshima and Miyajima Visit

During our time in Kyoto, we took a day-trip to Hiroshima to learn about the potential negative consequences of design and technology. We began this visit at the Hiroshima Peace Memorial Museum, which the entire group found to be incredibly powerful, meaningful and important. While the message of the museum was the central focus of our visit, we were also able to think about the crafting of the museum displays from the vantage point of *monozukuri*. From the museum, we moved to the Itsukushima Shrine in Miyajima, which we were fortunate to see at high tide. This site also afforded several opportunities to consider design from a cultural and historical perspective.

3   Student Paper Topics and Conclusion

During their time in Japan, students made periodic on-line journal entries, further developed ideas for their final papers, and took photographs to incorporate into their papers. Upon return to campus, students participated in a debriefing, demonstrated what they learned through a final examination, and completed their final papers. Students wrote on topics including:

- The Influence of *Monozukuri* in Japanese Technology
- *Monozukuri* and its Effect on Commercial Japanese Restrooms
- *Monozukuri* and the Influence of Hospitality on Japanese Design
- *Monozukuri*: The Creation of a Modern World With a Historic Foundation
- *Toyotazukuri*: Evolution versus Revolution
- *Monozukuri* in the Creating of Living Spaces and Household Products
- *Monozukuri* in Design and Industry: Innovation by Adaptive Repetition, Inspiration and Tradition
- *Monozukuri*: The Wabi Sabi Influence On Presentation in Japan
- Domestic Design: How *Monozukuri* Affects Personal Relationships in Japan
- *Monozukuri* and the Changing Face of Buddhism

While many of the students chose to relate *monozukuri* directly to technology and design, some students opted to explore other topics. However, when taken as a set, these papers clearly demonstrated that students had learned a lot about the significant impact culture can have on design and the importance of *monozukuri* in Japanese culture. One student summarized the course this way: "I learned so much about Japanese culture, technology, and design, and about how they are all intimately linked together" while a second wrote: "the trip increased and established open mindedness to other cultures, basic Japanese fluency, and new ways of approaching design challenges."

Based on the paper topics and content, as well as on student feedback, we believe this course was successful in helping students understand the impact that culture has on technology and design. We also believe that the course was successful in helping students understand the importance of considering cultural differences when designing products and services.

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