

Co-offering Engineering and Non-Engineering Courses on Faculty-led Trips to Foster Global Competence via Interdisciplinary Learning

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Abstract

ABET accreditation for engineering and technology programs expects that students consider and take professional responsibility for the impact of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors in engineering decisions. To address these objectives, the engineering professor, Dr. Yanjun Yan, taught three types of courses in the past: (1) an on-campus, first-year seminar course in project-based learning for engineering and technology students; (2) a faculty-led trip offering a single engineering course in 2018; and (3) multidisciplinary co-led faculty trips with a sports management professor in 2019 and a history professor, Dr. Gael Graham, in 2023 featuring one engineering and one humanities-based course on the same trip. During the 2023 trip, the students from Western Carolina University visited Hiroshima University and teamed up with a class of English-speaking Japanese students, led by Dr. Russell Kabir, to engage in group activities that culminated in an engineering design exercise. The entire workshop was a highlight for both groups. Research literature suggests a gap in the reporting of multidisciplinary trips and their pedagogical components. Therefore, we present a process evaluation of trip implementations to examine transferable best practices for researchers and faculty-led student practitioners. Students submitted journals and responded to an IRB-approved follow-up survey about their learning experiences. Reflective student feedback from both multidisciplinary trips indicated that engineering students deepened their understanding of chosen topics in consideration of global, cultural, and societal factors, and that the non-engineering students enjoyed the visits more than they expected and overcame initial fears about engineering-related coursework, discovering engineering practices in many aspects of their social lives. Overall, the students gave positive feedback about the multidisciplinary trips and demonstrated achievement of the learning outcomes. In the future, the authors plan to continue collaborations to further integrate the course modules and regularly evaluate the effectiveness of interdisciplinary instructional design practices.

Introduction

Engineers bear the professional responsibility to ensure that a given project benefits society by taking into account the impact of human and social factors when making engineering decisions and communicating technical expertise. Given the importance of such considerations [1], ABET accreditation criteria explicitly target them as expectations for professional readiness. In engineering and engineering technology curricula, project-based learning from freshman projects to senior capstones and human-centered design [2] are highly effective pedagogies that are integral to the curricula for all the students in the programs. To address societal factors in engineering design, an integration of engineering with humanities topics is a natural choice. Some integration is done in an on-campus course [3] with multiple case studies [4], using a

module in a first-year course [5], with virtual interactions with another institution [6], or during a semester-long course with an attached faculty-led component [7].

As a supplemental pedagogy, faculty-led trips are especially impactful when students are immersed in another culture for several weeks, under the guidance of familiar faculty member(s) from their main campus (see [8][9]). During the faculty-led trips, the students will encounter, with first-hand experiences, the differences in how things run, which often spark inquiries on what factors have contributed to those phenomena, and these factors invariably include technology, culture, history, environment, and so on. Faculty-led trips will incur travel costs, though, so not all students can afford them. However, the cohort of traveling students, upon their return to campus, can also become the change agents to share their experiences and impact the students who have not traveled [10]. Heterogeneity in the selection of study abroad programs and the effects of student mobility on later occupational status have been observed in the European context [11], and major-related differences in the academic returns of study abroad and program design factors have been analyzed in the U.S. context as well [12]. Similarly, faculty-led trips vary a lot in terms of disciplines [13], credit hours, lengths, and if coupled with global internships [14], service-learning projects [15], and others, depending on the destinations and collaborating hosts. Likely due to the variations in faculty-led trips, there is very little literature on the implementation of engineering and humanities integration during a faculty-led trip.

The rest of the paper is organized as follows. Design strategies for faculty-led trips that integrate engineering and humanities topics will be discussed. Potential challenges in implementation will then be elaborated for faculty considering, planning, or reflecting on co-led program designs. Finally, a case study, best practices, and improvement plans will be offered. The assessment data collected under IRB will be presented from the viewpoints of students and instructors followed by some concluding thoughts and future directions.

Design Strategies to Integrate Engineering and Humanities

The authors explored various course formats as explicit design strategies (i.e., project-based learning and faculty-led trips) to incorporate societal factors in engineering designs via humanities topics based on the notion that these learning environments were effective. However, these learning environments needed to be carefully planned and cultivated, and the instructors needed to be aware of the different groups of students for whom they would be applicable. A visual representation of a process model with overlapping disciplinary considerations and the role of faculty coordination is provided in the following section.

Illustrated in Figure 1 (a) for on-campus courses, implementing engineering faculty would need to consciously incorporate humanities topics into engineering in projects and other exercises in ways that activate student motivation through practical and global perspectives. A challenge for this strategy, however, is that the students may feel that the inclusion of humanities-based programming is an extra task on top of their engineering coursework that is burdensome or intrusive. Additionally, engineering faculty may need quite a bit of preparation to talk about certain humanities topics. This strategy is still broadly needed, as not all students can afford to join a faculty-led course. It takes time for the engineering faculty to figure out suitable project

topics that inspire these integrations and prepare to facilitate learning that encompasses a wide array of societal considerations.

For the students who can afford to join a faculty-led trip with engineering faculty, as illustrated in Figure 1 (b), even if humanities were not intentionally incorporated, students might be expected to encounter different practices and raise questions that could naturally lead to the discovery of a multitude of factors in engineering decisions. In this configuration, exploring humanities topics serves as a source of inspiration and rarely feels as intrusive as in Figure 1 (a). Faculty-led trips make exposure to the societal factors in engineering design easier than the on-campus courses by dint of the built and historical environment. However, the challenge remains that engineering faculty may not feel fully prepared to talk about humanities topics, and they might unintentionally continue to view and provide perspectives through an engineering lens.

Rather than a faculty-led trip that only leverages a single engineering faculty, we proposed the coordination of two professors from different disciplines in a co-expertise model that offers two courses (one on engineering and one on non-engineering) on the same trip. The entire student cohort on the single trip is expected to take both courses, and the variety of cultural and disciplinary content is a driver that pushes students out of their comfort zones. The faculty then focus on their own disciplines in the instructional design, while also experiencing new content, methods, and practices as a matter of faculty development in the process.

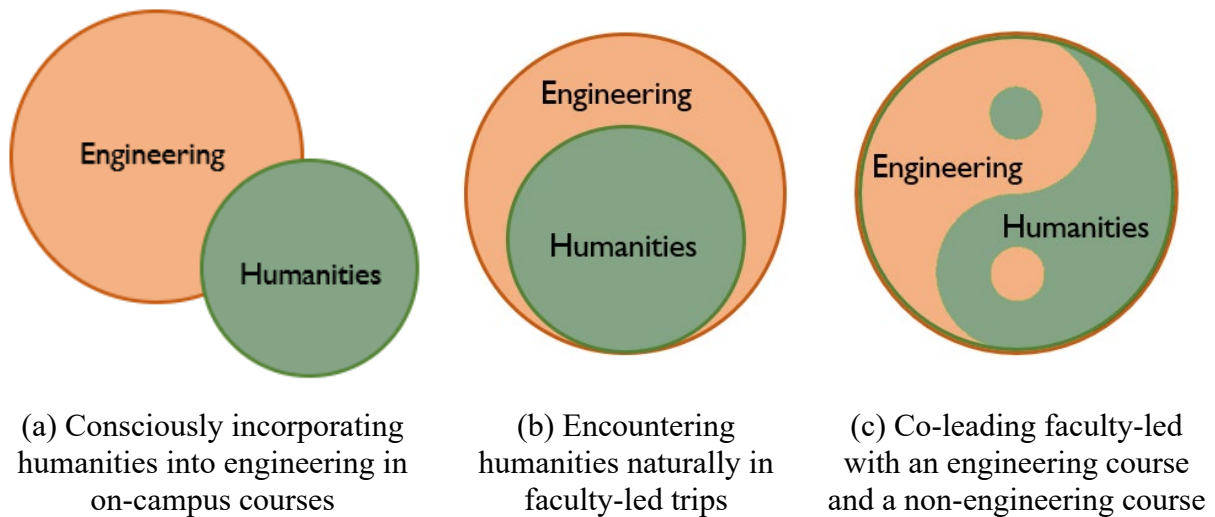


Figure 1. Strategies of integrating humanities in engineering

Demonstrating this proof-of-concept for the design strategy, this paper showcases a faculty-led trip to Japan with one engineering course and one history course from May 2023 as a case study on the implementation of the strategy in Figure 1 (c) and how it can be improved.

Challenges in Trip Design and Execution

As elaborated in [16], many issues must be considered when offering a faculty-led trip. These include: Institutional Support, Local Connections, Curriculum Integration, Course Design, Recruitment, Logistics, Collaboration, and Budget and Expense. The fishbone or Ishikawa diagram from [16] is reproduced in Figure 2 as a diagram of these issues. Further, three key

factors that are significantly different when comparing offering a two-discipline faculty-led and a one-discipline faculty-led have colored bubbles in Figure 2: Course Design takes much more deliberation than the one-discipline trip to identify coursework that could be integrated, and coursework that needs to be separate for the two courses, while Logistics can be easier than with a single instructor. The Budget and Expenses are higher for two courses with two instructors than a single course, but at Western Carolina University, taking 6 credits in summer allows the students to be eligible for financial aid, which can be a deciding factor for some students to join the trip. With more students joining the trip, the average cost for each student will drop.

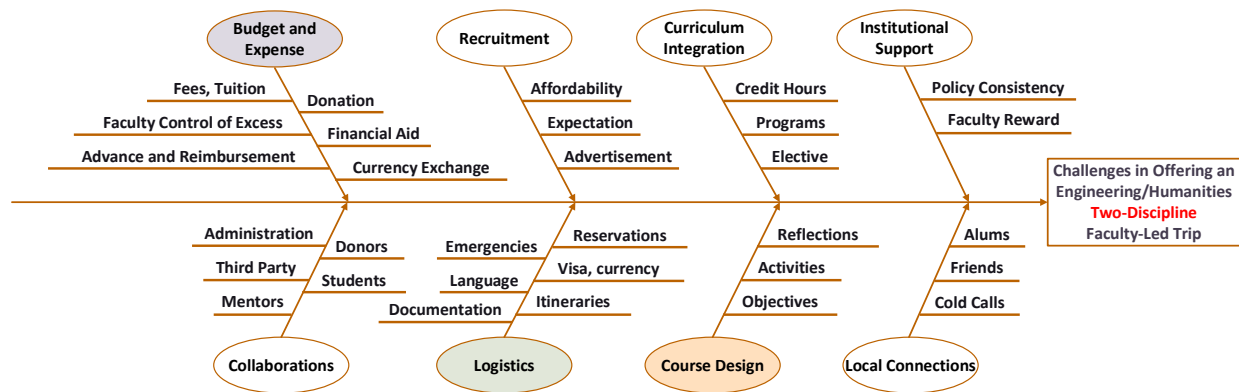


Figure 2. Issues that need to be considered when offering a two-course faculty-led design strategy. The overall diagram is cited from [16], while the key factors that are different between offering a two-discipline and one-discipline faculty-led design strategy are highlighted.

A detailed explanation for each key factor beyond the one-discipline faculty-led design is as follows.

Two Instructors from Engineering and Humanities Disciplines

When offering a two-discipline faculty-led design, having two instructors from different disciplines is critical, as they need to be willing to pair up and coordinate their teaching and logistics in trip planning, trip execution, and post-trip student assistance and assessment. Relationship-building is often organic. It would be beneficial that one or both instructors have led a faculty-led trip individually before, as the two-discipline set-up takes extra planning beyond the one-discipline set-up. Without the experience of having coordinated a faculty-led trip before, the learning curve may be steep.

Course Design

The learning objectives of the two courses in engineering and non-engineering, respectively, are kept separate and as intact as they would be taught individually, without either instructor making concessions or compromises out of perceived accommodations. Meanwhile, neither instructor needs to become an expert in the other's subject matter.

The activities throughout the trip planning, execution, and post-evaluation, however, could and should be shared with meaningful integration. A good strategy is to let both instructors pick

some attractions and intended hosts for meetings and visits as most supportive of their own course's learning objectives, and then confirm if the other instructor could find a new perspective for the other course in those activities. The goal is to push the students out of their comfort zones, and we highly encourage the students to reflect on the same experience from both disciplinary perspectives. If it is hard to integrate both disciplines in some activity but that activity is key for one course, our process-based experiences suggest that the activity should still be carried out. Typically, however, an activity meant for one discipline turned out to be enjoyed more than expected by the other discipline. Besides course-related activities, there are signature attractions in each city. Even if they are not too closely related to either course content, it is still worthwhile to check them out to understand the local cultures, which may often become the key to unlocking some unexpected observations.

Regarding course assignments and student reflections, the two courses could share some common exercises with those grades being counted for both courses, but not all assignments must be shared. For example, it is a common requirement for students to make frequent journal entries during the trip, which is a shared assignment for both courses. On the other hand, answers to questions on engineering designs and book reviews for history are separate assignments for either course, respectively.

Logistics

With two instructors leading the trip, implementation is more manageable than having a single instructor. Arguably many one-discipline faculty-led trips also have two leaders (either two faculty members, or one instructor and one chaperone), and the benefits of having two leaders are similar. An emergency may happen during the trip, such as when a student is feeling car-sick on a train and needs to get off to take a break, or a student needs to go visit a doctor, then one instructor can lead the class to their planned activity while the other instructor stays with the student in concern and handles the emergency. Meanwhile, much of the scheduling and logistical workload could be shared among the two leaders.

During faculty-led trips, students often get to talk with the instructors for an extended period. The talks can happen during walking, hiking, train rides, meals, and interstitially through some activities. This informal atmosphere cultivates authentic sharing. Both the topics of the chats and the needed time for them would rarely happen in an on-campus course. When the two instructors are from different disciplines, the extra benefit is that the students get to learn and understand the other discipline in depth and are often led to examine their observations from a different perspective.

Budget and Expense

Comparing two instructors and one instructor leading a trip, the cost-sharing for two will be higher than one. This is true whether coordinators take a one-discipline or two-discipline design strategy. However, by taking two courses in summer for credits, the students are eligible for financial aid, which can be a deciding factor for some students and an incentive in student recruitment. With more students joining a trip, the per-student cost is lower.

The class budget consists of two parts: one part is collected by the institution to be managed by the instructors on common expenditures, and the other part is out-of-pocket estimates for the students, such as flight tickets, individual meals, international phone plan, passport application fees, and some pocket money. The budget for the second part will be at a reasonable average, although the students could spend less than that practically, while other students may spend more than the budget given their personal choices. The reason we chose not to collect the flight ticket money was that the students could leave from an airport near home, they might have some family perks or credit card points that they could redeem for a flight, and they could continue with some personal travel after our faculty-led trip. As long as they get to the landing airport at our destination at about the same time as the class, it works. We still highly encourage buddy systems, and the students often take flights in groups. As to meals, several group meals are arranged from the collected budget as cultural events to let the students experience the local cuisines, but the students may have different tastes and budgets, and hence most meals are paid for by students out of pocket, while we arrange meal stops at places with variable meal options. Some students may already have a passport before they sign up for the trip, but the passport fees are included in the budget just in case some students need to use financial aid to cover the costs.

At Western Carolina University, excess funds after the trip are refunded to the students. The excess may come from favorable currency exchange rates, student group discounts that were not anticipated earlier, and so on. It is often hard to find another funding source if the actual expenditure is higher than the budget, though, so it is best to anticipate the need for a cushion when it comes to the budget in case the currency exchange rates are not as favorable as expected.

Best Practices and Improvement Plans

The student work required by the two courses on a faculty-led trip is not limited to the duration of the trip itself. Taking the example of the Japan 2023 trip, there were as many as seven pre-trip meetings. Those meetings addressed logistical arrangements and brief lectures for key concepts in both engineering and history. There were also invited talks on local cultures and past student experiences. Beyond those, the travel students needed to do some research on technical topics and our destinations, in groups, with each group being responsible for a subset of those topics. Then they reported the results to the whole class to prepare everyone for the trip. During the trip, every day was packed with activities, and the students did not have much time to do research or write reports while on the trip. Also, the trip could be tiring at times, although the students understood that they would want to experience as much as they could while being abroad. The students needed the downtime after the trip to assimilate and reflect. The post-trip assignments and reports were submitted online, and the class did not need to meet in person after the trip. Given the post-trip work time, the students could have the time for a deep reflection on their trip experiences and spend time researching the topics of their interest.

The two courses were not disjointed, either, as almost all activities were shared except one day when students went for activities out of several recommended options. The options were not categorized by courses, but simply a collection of local attractions that we could not all visit given the limited time, so the students had to prioritize them. That day was near the end of the

trip when the students were already accustomed to taking public transportation independently and every option was chosen by a few students, so the students traveled in small groups.

Besides sharing activities between the two courses, some assignments were counted in both courses' grading intentionally. Considering the Japan 2023 trip again as an example, for the history course, the most intensive assignment was a research paper due after the trip, but there was also a discussion board conversation on the assigned books before the trip. The instructor offered the students two book options. The students could choose either option to read, and they were required to read certain chapters instead of an entire book. During the discussion board conversation before the trip, the assignment setting on the learning management system ensured that students could read others' comments only after they had posted their comments. Thus, they needed to share their thoughts individually, but then they could read others' comments to deepen their thinking. Although the comments on the discussion board were brief, this exercise got the students to start paying attention to the information they needed to collect during the trip. Then, the longer post-trip research paper could allow for the critical reflection that typically completes the experiential learning cycle. The engineering course's key assignment came in the form of a learning contract. This required students to choose a topic and delivery format with the instructor's approval before the trip, so that the students knew what information to focus on collecting throughout, although the learning contract could still be revised with the instructor's permission during the trip. The two books for the history course were on the late modern period's transportation or food, respectively, where technology played a significant role. The students could use them as an inspiration for their research paper's topic, but they were free to choose other topics, too. If some students could elaborate on a topic from both history and technology points of view and substantiate the research paper much more than a report for a single course, that report could be accepted as the report for the engineering course, too. However, some students chose to submit two different reports for the two courses because their intended topics for the two courses were not too related, and two reports were welcome. Further, there were separate post-trip assignments for the engineering course with specific questions on things we had encountered during the trip, which were only for the engineering course.

Despite course design, the enrollment number is unpredictable, and the number of students could impact the delivery of the course content. In the Japan 2019 trip, there were seven students on the trip, which was a tight-knit group with a lot of interactions and reflections while on the trip. The pre-trip meetings also effectively prepared the seven travel students for the visits. Also, both instructors on the 2019 trip had led the faculty-led trips individually before the 2019 trip, and hence the combo trip progressed well without hiccups. The Japan 2023 trip was the first trip after the pandemic hiatus, and eighteen students signed up, more than we expected. We could have limited enrollment, but no students had been able to travel during the pandemic, and some of them wanted to grab the last opportunity before graduation, so we enrolled the students who appeared most determined to join. On top of the relatively large class size, one of the two instructors was new to leading the trips. With a much bigger group of eighteen travel students in 2023 than in 2019, the students could have used some more individualized attention from the instructors during the pre-trip meetings and the trip. On a few occasions, a lack of punctuality from a couple of students caused a delay in our departure from the hotel to get to our activities

and resulted in resentment from the rest of the class. The instructor needed to reiterate the expectations and potential consequences. If it were a smaller class, the students might have moved around more efficiently. Most of the regrets from the students in 2023, although nothing major, seemed to come from overlooking our instructions, such as bringing a pair of good walking shoes, doing the research before the trip to find some personal interests at our destination cities so that they could visit them at their own time, and bringing a certain amount of cash besides a credit card. It is a good practice to make a comprehensive list of our instructions and student suggestions for the next cohort of students and reiterate these guidelines until all students have confirmed that they understand the expectations.

Following the trip, students were surveyed about their experiences. This paper draws on qualitative and quantitative data from the Japan 2023 trip as a case study, where the data size is limited. Despite the small sample size, we made similar observations in the Japan 2023 trip as in paper [17] where a dataset of more than 1200 students is analyzed, which also pointed out a few other suggestions that the Japan trips had not encountered yet. The average class size in paper [17] was 25.78 students. The average duration was 3.79 weeks, with 81% lodging in dorms or hotels and 14% in host families. 79% of the instructions had a reflection component, and 93% of the faculty were from the host institution. 91% of the classes were taught in English. Note that the data from the faculty-led courses in [17] are in any format and for any discipline, and hence it is not specifically for an engineering and humanities-integrated faculty-led trip.

Paper [17] found that the number of students in a faculty-led was in negative correlation with global perspective development. The authors of paper [17] proposed that when the class size got bigger, there would be less interaction between students and instructors, and the travel student might be “cocooning” instead of interacting with the locals. In our Japan 2023 trip, the instructors felt that some students appeared to be ignorant of some of our instructions, either because they did not hear it or see it in our messages, or they were too occupied by other activities. Either way, it was likely due to the big class size.

Paper [17] also found three other factors that were negatively related to cognitive knowledge and interpersonal subscales: (1) living with a host family, (2) taking courses in English, and (3) English-speaking host country. We suspect that it was likely that many faculty-led trips in the data collected in paper [17] were foreign language courses and being immersed in that foreign language environment would have been critical for those courses. However, that is rarely the case for an engineering/humanities integrated faculty-led, as language is secondary, and English needs to be used for an English-speaking institution to keep the class focused on the content topics. If a non-English-speaking institution would like to adopt the engineering/humanities integrated faculty-led, the courses would have been taught in their native language. For the Japan trips in 2019 and 2023, hotels with individual restrooms were mostly used for the lodging, except for a short stay in the dorm of a campus. The students were accustomed to the Western-style rooms, and there were always a few students who would point out their dislike of the bean-filled pillows. Although living in a Japanese-style room, or staying with host families, would have provided more authentic experiences, not all students were ready to take on that in their first trip to Japan. Some students enjoyed the Japanese-style seating arrangement in restaurants, which

would last for a short duration and be acceptable. It is a fine balance to allow students to experience another living style without overdoing it to make them too uncomfortable for too long. The faculty-led trips last for a couple of weeks, and hence language acquisition and acculturation are typically not expected.

It is worth noting that several factors are positively related to global perspective development as reported in paper [17], such as (1) studying with home-institution faculty, (2) reflection activity, (3) in-country travel, and (4) internships. We agree with all these factors, which were also seen in our Japan trips, except the internships.

- (1) All our courses were taught by instructors on our campus, and the pre-trip meetings were important for team building and preparation.
- (2) Reflection was emphasized and journals were required. No matter the ratio of how much was done during the trip or after the trip, the students were aware that true learning was through reflection to find out “why” and “how” instead of only seeing “what”.
- (3) The Japan trips included multiple destinations such as Tokyo, Toyota, Hiroshima, Himeji, Osaka, Sakai, Nara, and Kyoto, and the students could easily see how these places were similar and different, to understand the historical and regional pieces that contributed to the advancement of technologies in Japan, which would not have been easily observed if we stayed in one city.
- (4) So far, no student has taken on an internship after our trips, and it may not happen soon (the purpose of the faculty-led is not to find the students an internship abroad, either), but some students took personal travel after the trip, which they reportedly enjoyed.

Japan 2023 Trip as a Case Study

The Japan 2023 trip occurred in late May for seventeen days with eighteen students and two instructors. Out of the eighteen students, four were female and fourteen were male. There were two African American students and one Eastern Band of Cherokee Indian member who volunteered their demographic information. The two courses are open to all students on campus, contingent on instructor interview and approval, and hence the majors of these students were a mixture: Thirteen students were in engineering or engineering technology majors (mechanical, electrical, or technology), three students were in other STEM majors (chemistry, forensics, and computer science), and two students were in non-STEM majors (education and history). The two instructors were both female and experts in their discipline: one in engineering and one in history.

A survey was administered after all grades were submitted in August and yielded four responses. As shown in Figure 3, students are overall satisfied with the trip and the course design. The reflection journals from student submissions also provided valuable information.

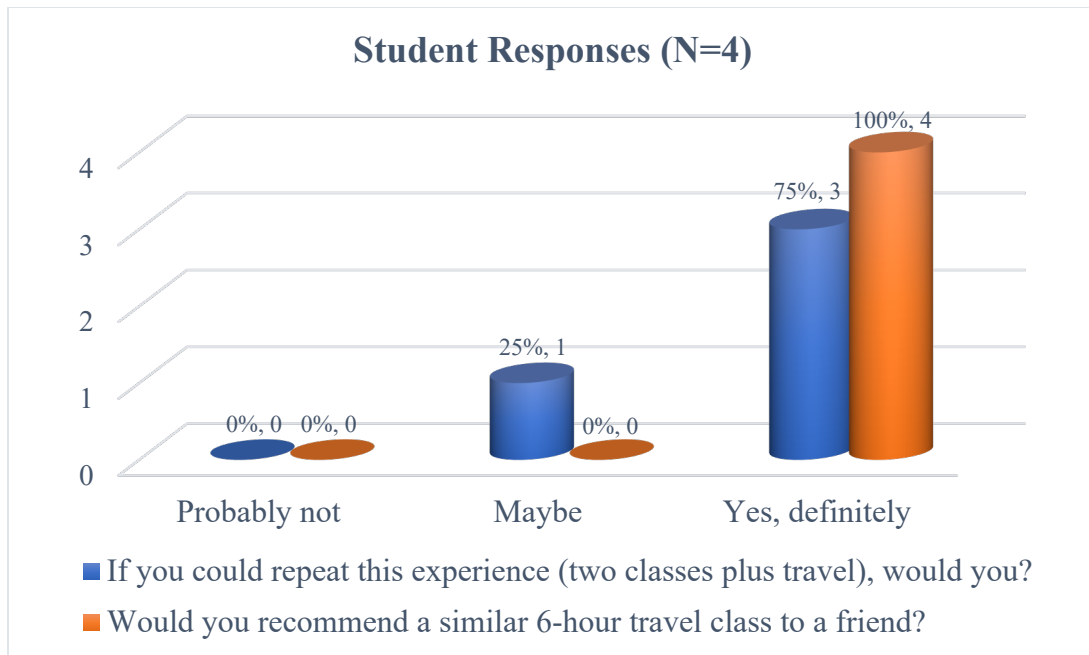


Figure 3. Overall student satisfaction

Student Reflections on the Overall Trip

Students commented on the advantages of such an engineering/Humanities integrated faculty-led trip in both the survey and reflection submissions:

- I got to learn about a new discipline that I would've never experienced outside of this class.
- This pairing encourages students to think about how very different topics are actually interrelated. Also, it guarantees that students will step out of their major into higher level classes they normally would never choose to take.
- Lots of diversity among activities
- We did a variety of activities that covered several aspects of Japanese culture (STEM & humanities).
- I can't think of any weaknesses, it's a phenomenal idea.
- Traveling with the engineering students allowed me to gain a better understanding of what it is the engineers do. I couldn't give a definition of engineering before the trip, and now I feel as though I could give some explanation, albeit probably not a very good one. I noticed that engineers seem to look at the world from the perspective of "how can things be better?" while historians focus on "how have things changed over time to be the way that they are today?" In many ways, engineers play a role in that change over time — catapulting the past into modernity.
- A better understanding of Japanese society (both modern and historically).
- It enhances the immersion you feel while in the country, being able to notice details in the architecture and engineering of Japan while also being able to think deeper about cultural differences and where they come from.

- My learning and appreciation far exceeded what I otherwise would have. Visiting Japan from two perspectives is very beneficial.
- I learned a lot more about the humanities side of Japan, which I would not experience normally (since I am STEM-oriented). Since we were usually in more casual settings than the classroom, I had great conversations with the History professor about history related to Japan and other related countries.
- I got to meet new people that I probably would've never encountered on campus otherwise. I know most of the people in my major because we always have classes together so it was fun to travel with new folks.
- It introduces you to how people in different disciplines think and work so I think it gave me perspective. It gains you friends you normally would not meet as well.
- More diversity and experiences among the class. In a trip like this, diversity is the most important, and anything that helps with that is beneficial.
- I became friends with a lot of students that I wouldn't share classes with on campus.

Students also mentioned areas for improvement:

- Because of how far along I am in my major the ENGR class did not give me any credit towards my degree.
- The only "weakness" would be that during the trip, when a choice is offered between two different options that relate to each field, students are usually most likely to pick the same type of activity each time.
- With two classes, there was a considerable amount of post- and pre-trip work that had to be completed. I think clearly listing the assignments would make it easier for students to know their expectations. The Post-Trip Questions assignments took me by surprise and took more time and research than the final papers did.

Indeed, for any student who had already completed the required credits or even graduated before the trip, the trip did not count towards their degrees anymore. This was clearly communicated up front, but a few such students still chose to travel to Japan as it was their dream destination. We still required all students to do all work and informed them that grades would be assigned, as we wanted to create an environment for the whole class to contribute to the learning, and it was not meant to be a vacation for any subset of students on the trip. The grades for all the courses that a student will have taken at Western Carolina University will show up on their transcripts when they request transcripts in the future for any purpose, and hence any transcript request after Aug 2023 will list the grades for the two courses offered during the Japan 2023 faculty-led trip.

As for the choices of optional activities, they comprised a small portion during the trip, and they did not impede the learning objectives. It would be a fine balance for the instructors to plan the required activities and optional activities.

The third suggestion could be implemented well to make all expectations clear in future implementations. The Japan 2023 trip was the first collaboration between the two instructors and the assignments were in development as the trip planning went. With eighteen students, some expectations didn't seem to reach all the students, given the class size. For future trips, many of

the assignments could be revised and reused, and expectations on them could be communicated to the students earlier in the spring meetings to help them be better prepared.

Student Reflections on the Workshop Between US and Japanese Students

One notable class activity during the 2023 Japan trip was for the class to visit Hiroshima University where the travel students and Japanese students worked in small groups of four on several tasks for almost four hours, led by Dr. Russell Kabir at Hiroshima University. A detailed outline of the instructional design of this effort will be shared in a future publication, but the authors coordinated the creation of a practical workbook for the student activities. Students at Hiroshima University prepared for the interactions with a worksheet from a workbook in development that is based on intercultural learning principles [18] scaffolded into a reflective framework [19]. Both the travel students and the Japanese students greatly appreciated the interactions and the carefully designed workshop tasks.

Travel Students' Positive Comments:

- It was very nice to meet the Hiroshima University students. They were all very kind and interactive.
- They were unique and incorporated both language and engineering. Very fun. Well done!
- Very interactive. Enjoyed walking around to other tables and talking with other students.
- The activities were easily accessible to both sets of students and engaging.
- I had a lot of fun and enjoyed the chance to communicate with Hiroshima University. However, I wish we could've moved groups to talk to more students. Fav. Activities: Bingo, Discuss experiences, Design #2
- Having a chance with fellow college students in Japan to express engineering ideas that can be understood was a very fun experience!
- All of the activities were very fun, and enabled effective communication and learning between the WCU and Hiroshima University students
- It was fun given the opportunity to meet new people and work on activities with them
- They were all very fun and a fun way to engage and interact.
- The activities in today's workshop were fun, inventive, and well-designed to create discourse among the students. The experience was well planned and conducted within a timely manner that allowed free time to talk.
- I found the activities in today's workshop great (especially the building activities). It was definitely great for getting to know my partners.
- It was very fun. The 1-2-3 was a bit confusing. The airplane/bridge design was the most fun. I greatly enjoyed meeting each of the students. Also, having groups of 4 was great.
- I think today's exercises are very useful for students with language barriers. I enjoyed engaging with the students and found the material very useful.
- I enjoyed learning about Japan from someone who lives here. The 1, 2, 3 Action! Was a little strange but the rest of the exercises were fun.

When asked about areas of improvement, the travel students said:

- Nothing comes to mind, I enjoyed it very much.

- Potentially being more organized.
- Even though this thing took a while, I wish we had more time because it was fun.
- N/A everything was well-paced
- Maybe use less complicated activities or less activities. Some of the games were difficult for the students to understand.
- More time during the challenges. Probably around 10-12 minutes more.
- More time would have been great
- Workshop was PERFECT, Sugoi!
- Maybe a new icebreaker where we share about each other.
- I might include some more conversation starts in the handout to help get the conversation started. But I do think everything went well and created a great experience for both groups of students.
- The only improvement I would suggest would be more time for the building activities.
- I think there needs to be a little more time on the building activities.
- Make a portion about hobbies where we could learn Japanese words for our hobbies.

The consistent message is that they wanted more time for interaction. The last part of the workshop was on engineering design, which might not be the most favorable topic for some students, but most activities were very well received.

The Japanese students also reciprocated such perceptions. They noted these positive aspects:

- I would have enjoyed learning about the hobbies of the students to compare them to mine. Maybe students could recommend places to visit, or foods to try.
- It was a beautiful opportunity to meet and connect with both Japanese and American students. The activities created a bond between paired discussion and group discussion, making students share their creativity, experiences, skills, and knowledge comfortably.
- I was very excited to interact with WCU students! If there's a chance, I usually talk with people who are connected to education or some other background which connected to Japan, but today I was surprised how they think against a certain problem. Their way of thinking was very practical and they were thinking proactively. And WCU's bag and card case are cool! Thank you!
- There were lots of opportunities to communicate with WCU students!
- In the activity, I was able to communicate with native speakers of English. Thanks to the everyday English lesson, I improved my ability to speak English.
- It's very fun to communicate with foreigners. I can make a good relationship with WCU students.
- Interesting. I learned they were so creative and logical. Their communication style and ours were different, but it went well.
- I felt that communicating in English is difficult, but it was fun to interact with students of WCU. I was glad to hear that they were enjoying the trip in Japan.
- I was able to experience the speed and atmosphere of real conversation in English. I could also feel that my English skills were still lacking.

- I joined the workshop from the middle because of another class, but I learned a lot of things by listening to "real" English. It was a little difficult for me to listen completely. However, I tried to do my best and its discussion was very interesting.
- Students of WCU were friendly and kind. My conversation skill is not good, but they listened to what I said kindly. Also, they are so creative. They came up with interesting ideas one after another.
- I found that the attitude towards the workshop of English speakers was very active.
- I could know WCU students' various innovative ideas from this workshop.
- WCU students have good ideas. I'm glad to communicate with WCU students.
- WCU students are very kind to us. I could talk with them freely.
- Japanese students tend to not have enough opportunities to talk with foreign people in their daily lives. So this Hiroshima University - WCU event became very good opportunity to talk with people from different cultural background and enjoy having communication.
- It was a good opportunity to talk with foreign people
- I had assumed that the language barrier might make it difficult to communicate, but we were able to understand what each other was saying and continue chatting.
- I had a lively conversation about the topic of music. My paired student plays the guitar and kalimba, and I play the violin and piano. I learned the difficulty of saying what I wanted to say in English without preparation in advance.
- There were many times when I couldn't understand what WCU students were saying, so I decided to improve my English.
- I couldn't produce any ideas about preventing disasters, but WCU students have great ideas, using the knowledges for chemistry and engineering. So, I experienced the difference in major
- I had a lot of fun today. It was interesting and stimulating for me to interact with people from different cultures. They were so friendly that I could easily become friends.
- Activities of actually creating things were interesting.

The Japanese class was mostly with English majors in freshmen or sophomore years, and hence not a lot of them had an engineering background. A common theme was that they felt that the travel students had many good ideas (supposedly for the last engineering design task), while they expressed that the experience was an eye-opener. However, they provided situational information about the region where the design was supposed to benefit and contributed to discussions on marketing the end product of the design within the context of Japan. Both groups of students enjoyed meeting peers in their age group to know what they liked. Some students added each other on messaging apps, and they are still in touch today.

We did bring some goodie bags from Western Carolina University to share with these Japanese students. It was hard to carry them when we traveled to multiple cities but hearing that they liked them made it worthwhile.

It was also good to hear that they found the travel students to be kind, patient, and understanding when they tried to communicate. The travel students felt the same about the Japanese students.

When asked about areas of improvement, the Japanese students said:

- I feel more time should be allotted to some activities that involve critical thinking. Depending on the situation or circumstance, the program can be a 2-day program or 1-day with morning and afternoon sessions.
- I found my lack of vocabulary.
- I created a cool name for the prototype. I discussed the prototype very hard with my group.
- We can try to make more ideas, even if they're unlikely to come true.
- I would like to talk with a lot of students of WCU. I talked with one person for a long time, so I wanted to talk to more students of WCU.
- I could talk about Japanese culture such as manga and anime so much, but I wanted to talk about American culture and American lifestyle more.
- I think exchanging group's opinion was a good approach. I could learn various things and this experience will make my study better. I want to use my experience in a lot of situations.
- We couldn't discuss enough in "Craftsmanship and Creativity".
- I want to improve my English skill in order to communicate with English speakers more fluently. I didn't tell them what I want to say in English. Therefore, I want to improve my English skill.
- WCU students talked to us a bit slowly to make us understand topics. That helped us a lot.
- It was a good opportunity to communicate with native English speakers. Thank you.
- We couldn't understand "Craftsmanship and Creativity" because I don't understand the contents. It was a little difficult for me. If I had explained it in Japanese, I could have talked.
- We could have a conversation, but I should have expressed my opinion more. It was mainly my American partner who was expressing opinions.
- I wanted to discuss our own country's culture with each other.
- I should have spoken to WCU students more proactively.
- I realized that I get so confused when I speak English that I couldn't remember even easy English words such as "order". It is true that I don't have enough vocabulary, but I should stay calm in order to convey what I want to say. So, I want to try to communicate in English by using easy English words.
- I have nothing in particular. Creative thinking was a little difficult for me.
- Let the Hiroshima University students give a brief summary presentation after the session.

Again, the consistent message is that the Japanese students wanted more time for interaction, too. Their comments also showed a Japanese cultural trait that they tend to reflect on what they could do, rather than expecting others to do things differently, to make the situation better, such as enlarging their vocabularies or staying calm during communication, and they tend to ponder what they could have done but didn't do at the time.

Student Perceptions of the Activities

When designing and choosing activities for the students on the trips, the authors tried to have a good blend of diverse activities, including to

- Visit factories or companies that are contemporary, such as a local branch of a global company that will show us how they adapt to the local culture;
- Visit local and unique industries that are rooted in the host country, and/or some craftsmanship, that will show us how the local culture has shaped it;
- Visit research labs or join a class at local universities to understand their educational system, learn what they are working on, and interact with local students their age;
- Visit various types of museums and signature landscapes;
- Try local cuisines, and experience various ordering systems;
- Learn to navigate independently with maps and translation apps, while taking public transportation including subways, buses, bullet trains, ferries, and so on;
- Meet local friends in customized workshops.

Many of these activities required connections with the local community, which took time and effort to build. These activities were also what set us apart from tourist trips. If a student went to Japan by themselves on vacation, they would not have the opportunity to get in touch with the local professionals to delve as deep into engineering. The students were aware of this, and they appreciated the instructors' efforts in setting up these activities.

In the students' free time, which often started in the evenings when we were back at the hotel, the students dined out together, visited nearby shops including the Anime ones, went to arcade games, Karaoke, etc. These nightlife activities were unique in Japan, and it was a precious opportunity for them to experience them.

The students shared what they felt strongly about in their reflection submissions. For example, they couldn't fathom how big Tokyo was until they saw it from the airplane above it before landing, and it was extraordinary how the locals kept the city going on time, clean, and efficiently. The Hiroshima Peace Museum touched the students to their core about humanities that they hadn't thought about much before. They were amazed by the craftsmanship such as the huge beams to support Himeji Castle, the giant Buddha statue in Todaiji temple in Nara, elegant knife forging in Sakai, and the evolution of bikes, which encouraged them by the fact that engineering design was often iterative, and we could celebrate at every step. They found many efficient designs in daily lives, such as that in some restrooms, every sink was equipped with a water faucet, a soap dispenser, and a hand-drying hot-air outlet, all packed neatly around each sink. They appreciated the overall hospitality and politeness of all the Japanese staff that we encountered. Even in the chain of fast-food restaurants, there were healthy options in Japan, and there were many local offerings on the menu that they could not find in the U.S. They were very proud of themselves for having tried new food. They were happy to have made many good friends on the trip. The non-engineering students acknowledged that despite their initial apprehension to take an engineering course, they thoroughly enjoyed the science museums and car museums more than they anticipated, and they had a lot of fun understanding what engineering was about.

Impact on Instructors

On faculty-led trips, beyond having a single engineering professor to guide the students to formulate the answers from mostly engineering perceptions, having a second non-engineering professor, and even a third professor at the local institution, as well as students from non-engineering programs, helped foster the interdisciplinary learning environment that pushed the students out of their comfort zones to deepen their studies. Besides benefits to students, having the second instructor share the teaching load and trip management was beneficial for instructors as well.

Concluding Thoughts

This paper first addressed three strategies to integrate Humanities topics into engineering education: (1) to consciously talk about Humanities topics and integrate those in an on-campus course, especially in project-based learning, (2) to lead engineering students on a faculty-led trip on an engineering course, and (3) to offer two courses (one engineering and one non-engineering) on a single faculty-led trip by two professors from the home institution (one teach each course, respectively). The extent of the engineering/humanities integration grows deeper from the first strategy to the third strategy. Still, all strategies are needed, as not all students can afford to join a faculty-led trip.

Then this paper focused on the third strategy to have two instructors co-lead a faculty-led trip and emphasized three key issues that were significantly different between a one-discipline faculty-led and two-discipline faculty-led, other than the fact that two instructors from engineering and non-engineering disciplines are needed. (1) In course design, the learning objectives for each course would still be the same as if each course was taught individually, but some of the class activities and assignments, although not all, could and should be shared, to encourage the students to learn in such an interdisciplinary environment. (2) In logistics, having two instructors share the workload is beneficial, and the students get an opportunity to talk to a professor they would not normally talk to, which was very helpful to let the students look at things from a new perspective. (3) In budget and expenses, although the two instructors' costs are higher than having a single instructor, the students could get more credits out of the trip and be eligible for financial aid in the summer, which would draw more students to share the costs, and the individual student's costs could get even lower.

The 2023 Japan trip was used as a case study in this paper, from which, the best practices were shared, and some plans of improvements were discussed. Carefully designing course activities and assignments played a significant role in fostering the student learning environment. The activities pushed the travel students out of their comfort zones enough but not too much for them to look at all observations from both engineering and history-based perspectives. Given the higher-than-expected class size, the students could have used some more attention to ensure that they remembered the instructions. Journal recording and reflections were emphasized. The trip involved multiple cities to allow students the opportunity to observe the historical and regional influences on engineering practices. The students had pre-trip meetings to get prepared for the trip, and they also had post-trip assignments and reports to assimilate their experiences.

Under IRB, a survey was administered after the grades were submitted, and the student reflections were mined for the authors to understand student perspectives on such an engineering/humanities integrated faculty-led trip. The students loved the trip overall, and both the engineering and non-engineering students felt that the integration was effective and would not have been possible in other courses or trips. In one of the activities, the travel students joined a hands-on workshop with a class of Japanese students from icebreaking to engineering design in about 4 hours. All the students were surveyed on what they liked and what they thought could be improved. Both classes of students regarded the other group as kind, patient, and understanding, they wished to speak the other group's language, and they would love to spend more time with the other group. Additionally, work to code and thematically aggregate the qualitative feedback from the workshop in Japan is planned for a future study with the team of instructors.

Overall, both the students and instructors are satisfied with the engineering/humanities integration in the faculty-led trip, and we will continue offering two courses in this structure in the future. With such intentional designs, improvement plans based on student feedback, and both instructors getting more and more experienced in leading the trips, the trip execution will become better and better. We will continue assessing student learning and sharing our findings with the engineering education community.

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