Benefits and Challenges of the China Megaconstruction Study Abroad Program

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Abstract

International travel opportunities provide undergraduate students with valuable academic experiences not typically available through traditional coursework, including experiencing cultural diversity, increasing global awareness, and recognizing similarities and differences in professional practice. This paper describes the benefits of one such study abroad opportunity recently developed (the China megaconstruction study abroad), the key elements within the course, and explains the principal lessons students learned from this experience. However, this paper also describes the challenges experienced in recruiting students to participate in the study abroad program. Despite the student perception that the program was worthwhile, recruiting students to participate in sufficient numbers proved difficult. This paper also provides lessons learned regarding student perceptions of this study abroad experience. The lessons learned in this paper will be useful for programs involved with developing new study abroad experiences.

Keywords

Study Abroad, International Travel, China, Megaconstruction.

Introduction

In an ever increasingly competitive industry, there is a greater need for developing graduates with a greater understanding of global awareness, cultural diversity, and the ability to work in international markets. One of the best ways that this can be accomplished within an academic setting is to provide opportunities for students to participate in international study abroad opportunities, thus providing students with valuable academic experiences not typically available through traditional coursework. The Construction and Facilities Management (CFM) Program at Brigham Young University recently created the China megaconstruction study abroad course as part of initiative to increase international travel opportunities for undergraduate students within the major. Part I of this paper details the development of the China megaconstruction course, the principal objectives of the course, the key elements for student experience, and explains how these were accomplished. Part II of this paper details the challenges experiences in recruiting students to participate and student perceptions of this study abroad experience.

Institutions of higher education often include within their mission, aims, purposes, or objectives some mention of preparing students to have an impact upon the world. One accrediting body for construction engineering and management programs requires that students receive a sufficiently broad education where students understand the impact of providing solutions in a global and societal context and thus produce graduates prepared to enter a global workforce.[1] There are a number of benefits that have been associated with study abroad experiences. Shuman et al.[2] indicated that students that participate in study abroad programs "are better problem solvers,

have strong communication and cross-cultural communication skills, and are able to work well in groups of diverse populations and understand diverse perspectives. Further, students who spend time overseas tend to be more adaptable to new environments and have a greater understanding of contemporary issues and generating engineering solutions in a global and social context.[2] Study abroad experiences have also been linked with helping students develop soft skills, such as flexibility, appreciation for diversity, open-mindedness, and being comfortable with international and global perspectives of engineering.[3] Student feedback indicates that an international experience becomes a pivotal point in their education, and indeed in their lives.[4]

Although other construction related study abroad programs to China have been reported[5,6], this study abroad program was unique in that it directly integrated students from a construction management program with those from a civil engineering program. As such, the China megaconstruction study abroad program became a single course in a multi-course college program. These other courses included China megastructures[7,8], China megacities, and China megawater, each course focusing on a different discipline within the context of the same study abroad trip. This integration included a culminating design project that required the construction management and civil engineering students to work together on the initial design of a skyscraper, including the tentative cost, scheduling, and conceptual design renderings. Key course elements for this study abroad program included China, mega, ideas and innovation, sustainability, teamwork and leadership, global awareness, character development, and technical excellence. These will be discussed in greater detail later in this paper.

Part I: Course Structure

The principal motivation in establishing the course was to have the students become familiar with construction processes and techniques associated with "megaconstruction," including skyscrapers, large bridges, tunnels, subways, railroads, and generally large urban cities. This also included the management of the facilities post-construction. Another important element was to introduce students with the innovation being used in Chinese megaconstruction, including many aspects of sustainable construction. The course took place during a seven week spring term. Five of the weeks were spent on campus in the classroom receiving instruction and preparing to travel. Course content during this time focused predominantly on different types of construction techniques, specific challenges faced, and innovative solutions utilized in constructing the structures, facilities, and sites to be visited within China. The instructor prepared a number of lessons for the students and introduced them to these aspects, but much of the course consisted of the students researching various topics (as directed by the instructor) and then teaching each other through presentation. This was a very effective method for helping the students learn material because they already had a great deal of motivation to learn in this course. The culminating experience, of course, was the two weeks of travel. Having participated in preparing and presenting the course content on a very active and personal level made visiting the same places that the students researched that much more meaningful to them.

The travel itinerary for this study abroad course included visiting and seeing sites in seven different cities. With the theme of "mega" being adopted for this trip, the featured sites included some of the biggest skyscrapers, bridges, cities, and other engineered works in the world, both historic and modern. Table 1 shows a generic itinerary, including the cities and principal sites visited, that was utilized during the travel portion of this course. Some of these site visits

included simply going and seeing the bridge or skyscraper, while others included an actual tour or walkthrough.

Table 1: Principal Technical and Cultural Sites Visited

City	Sites
Beijing	Beijing airport terminal 3, Wangjing Soho, Galaxy Soho, Phoenix Media Center, Linked Hybrid, New Poly Plaza, Arup Engineering Office, CCTV Building, World Trade Center 3 Building, Zhongguo Zun Tower, Hongqiao Market, Parkview Green, Great Wall, Olympic Sites, Tiananmen Square, National Center for Performing Arts, Great Hall of People, Forbidden City
Tianjin	High speed train, Tianjin World Financial Center, Eye of Tianjin Bridge, Haihe River Trip
Yichang	Bridges and tunnels along Huyu Expressway, Yiling Bridge, Xiling Bridge, Three Gorges Dam, Three Gorges Tribe, River Trip along Yangtze River
Shanghai	Shanghai Tower, Jin Mao Tower, Shanghai World Financial Center, Grand Theatre, Maglev Train, Nanpu Bridge, Lupu Bridge, Broad Pavilion, China Art Museum, Oriental Pearl Tower, Thornton Tomasetti Engineering Office, Yuyuan Bazaar, Shanghai Acrobats
Guangzhou	International Finance Center, Chow Tai Fook Finance Center, Leatop Plaza, CITIC plaza, Canton Tower, Pearl River Tower, Yajisha Bridge, Guangzhou Circle, a local factory
Shenzhen	East Pacific Center, Ping An Center, Shenzhen Stock Exchange, Shenzhen City Hall, KingKey 100
Hong Kong	Tin Kau Bridge, Stonecutters Bridge, Honk Kong Convention Center, Central Plaza, Lippo Center, HSBC Building, Bank of China Building, Victoria Peak, International Finance Center 2, The Center, Union Square, Stanley Market, LDS Temple

The final project for this course included student teams preparing the preliminary design and renderings of a skyscraper to be submitted to the Council on Tall Buildings and Urban Habitat (CTBUH) student design competition. Because of the academic experience in using BIM software that the students in the BYU CFM Program receive, the construction management students were assigned the task in producing the renderings. Although the students began this project early in the term, they finalized the project upon returning home from China. It was amazing to see the transformation in achieving a much higher level of innovation, after having participated in the study abroad. Figure 1 shows an example structure designed and rendered by one of the construction management students for the final project. This specific project was designed as a greenplex, a series of skyscrapers interconnected via skybridges and enclosed by a protective ethylene tetrafluoroethylene (ETFE) exterior. Several of these elements were observed

in a number of different buildings visited in China, and certainly provided the inspiration for this design.

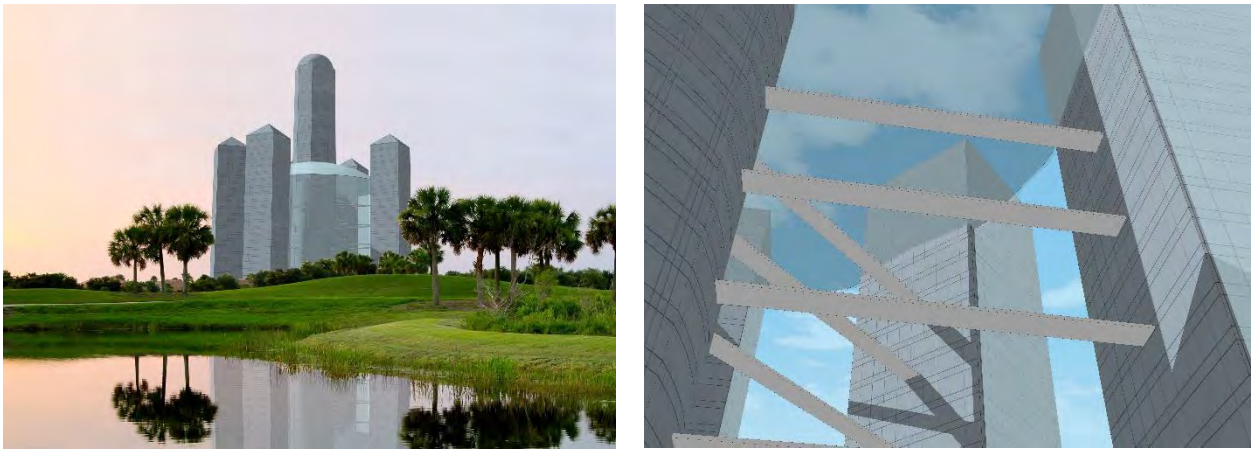

Figure 1: Example of Student Designed Skyscrapers

Key Course Elements

While the principal motivator in getting students to sign up for this course was the chance to visit China, the course itself included some key elements and objectives for providing educational components not readily achieved in other courses. This section identifies those key elements and explains how they were achieved through this study abroad course.

China

China is a fascinating country full of educational opportunities for a number of reasons. China is rich in history and culture, both ancient and modern. This is definitely an important element within the study abroad. Riding trains and busses with Chinese people is educational in and of itself for students not accustomed to large populated cities. Students were able to visit markets, restaurants, and simply experience very large modern cities. China is rapidly becoming a modern superpower in engineering and construction technology. Engineering excellence does not appear to be lacking within China, although construction execution and quality appear to be less important. Finally, urbanization in China is incredible. Tower cranes abound, not just on the handful of 100 story buildings being constructed, but the seemingly endless 30 story buildings as well. Other construction features and challenges include developing urban roads, rural mountainous highways, bridges, dams, subways, general infrastructure (sewer, water, power), and of course residential and commercial construction. There are very few places on earth where such a significant amount of urban construction is taking place within the major urban centers. For all of these reasons, simply traveling around China provides students with an opportunity to gain an appreciation for all that this country has to offer.

Mega

This is perhaps the key reason that this study abroad program was even developed. It was easy to include elements related to the design and construction of skyscrapers, large bridges, transportation systems, and other features associated with rapid urbanization, and then take the

students to see them. There could be some argument that the specific skills obtained by the students in this course may never be utilized again during their careers, not accounting for the higher level of learning available in this course. Students learned that if they can work with the biggest structures in the world, certainly they can tackle problems associated with normal every day type construction work. The format of researching the large structures before seeing them was a powerful teaching/learning experience. It is one thing to just go look at a large structure, but another experience altogether to be able to understand the design and construction features. The latter provides a much more meaningful experience. There is a feeling of awe related to the term "mega," after having actually visited some of the tallest buildings, longest and highest bridges, largest dam, biggest cities, and fastest trains in the world.

Ideas and Innovation

This course provided the opportunity to gain new understanding about a number of different engineering and construction techniques for the design and construction of these mega-structures, that otherwise would not have been available within the standard curriculum. Innovative methods associated with climbing cranes, concrete formwork, innovate materials, architectural techniques for sustainability, benefits of mass transportation systems, a greater vision for what "green construction" can actually mean, and a comparison of construction methods used in the U.S. and China. A large focus was placed on sustainable construction practices in rapid urbanization. After visiting many of the biggest cities in China, students expressed the impression that we are more the same than different.

Sustainability

Chinese design and construction of major projects have adopted many technologies that are green and promote sustainable engineering, construction, and facilities maintenance practices, including reducing pollution, congestion, smart use of resources, etc. Many of these lessons came from simply visiting green structures. At the same time, however, there was also this counter feeling of anti-sustainable practices, such as with the destruction of environmental and cultural resources with the building of the three gorges dam, or even sloppy construction practices minimizing the cost effectiveness of true life cycle integration. Many of these provided fascinating case studies for discussion on ethics, environmental practices, and of course sustainable construction. The development of the final project included a focus on people, planet, and profit, and that experience alone was a key part of the sustainability aspects of this course.

Teamwork and Leadership

Students worked in groups throughout the entire course. The group interaction and dynamics allowed for some great lessons to be learned and experienced in teamwork. The entire experience of being together as a large group of travelers in a foreign place also provided another dimension of teamwork and togetherness. Students did very little "alone" related to this class, and so teamwork was a large component of accomplishing the assignments and participation in the travel. Leadership skills were developed through the team homework exercises. Students also gained a greater sense of confidence in their abilities to interact with others, especially in a global sense. Understanding that people are all the same, are working toward similar goals, and

have similar feelings, can instill within students a greater sense of being able to interact with others, an important leadership characteristic.

Global Awareness

There is no question that this experience provided students with global awareness. Visiting cities with millions and tens of millions of people helps students gain a greater understanding of what six billion people on this earth actually means. These students are the future in designing and constructing the infrastructure in our society, and this experience hopefully helped them gain a vision of what opportunities and challenges actually await them. Flying to the other side of the world helps provide a reference for the vastness and expanse of the earth. Driving through a city and experiencing very urban traffic problems, watching farmers wade through their rice fields, seeing burial plots alongside the roadway in a rural mountainous setting, riding in an extremely crowed subway car thinking it could get no tighter only to have fifteen more people get in at the next stop, watching parents hold their child's hand as they walk through the mall, or seeing a family of three all riding a motorcycle are all small specific examples of the types of things to be seen within China that helped students realize that we as humans face similar problems and that the world, despite its expanse, is truly becoming a smaller place.

Character Development

This study abroad experience provided a number of character building moments. One specific example included visiting a factory and seeing people making everyday items that we take for granted, yet making very little. Another example that students commented on was seeing older people employed in sweeping the streets with nothing more than tree branches lashed to a stick. These are the types of things that student experienced that can help them gain an appreciation for what they have and commit to become better individuals.

Technical Excellence

Students participating in this experience were able to learn something of a technical nature that they wouldn't have otherwise without this experience. Presenting several times throughout the course allowed the students to better develop their technical communication skills. Standing in front of somebody and telling them about something you learned is much more difficult and requires a greater level of understanding and effort than simply reading something in order to regurgitate it on an exam. Visiting engineering and construction firms gave the students a chance to recognize that what they had been learning really was a portion of the way that these structures are being designed and constructed in the real world. These included technical skyscraper elements like belt trusses, outriggers, and central cores, or for bridges the idea of arch, cable stay, suspension, and long beam methods of spanning. Construction techniques associated with each of these were introduced and provided an interesting level of technical detail certainly not encountered in other courses, such as the balanced cantilevered method of construction for arch bridges or climbing cranes and concrete forms in skyscrapers.

Student Feedback

Student feedback was collected and evaluated for predominant themes and trends. The following five elements were identified as the most dominant responses, apparently having had the greatest

impact upon the students. These are identified below (in no specific order), followed by representative student comments. The few students who enrolled in the China megaconstruction class generally described their experience as life changing, and expressed mild embarrassment that they had perhaps questioned whether or not to participate. Each student spoke highly of the experience, and in several formal settings indicated that it was one of the highlights of their undergraduate education.

Chinese Construction Industry

- *When it comes to the architecture and engineering of the new China, it is world class.*
- *There are shiny new malls, sparkling office towers, expansive highways, and tower cranes as far as the eye can see. It's overwhelming.*
- *There is nowhere in the U.S. that has the same caliber of megastructure. They just go big in China.*

Innovation in Sustainability

- *China is becoming a world leader in the evolution of building design and construction.*
- *This building incorporates many unique features of sustainability, including wind turbines and solar panels to generate power.*
- *Sustainability can improve the functionality of the structure.*
- *They're pushing the limits and they're reinventing the way we live*.

Quality of Construction

- *The Chinese may know how to build a building, but they certainly don't know how to maintain them.*
- *It was hard not to notice that stair codes must have been very lax or nonexistent in some places because of the unevenness of the treads and the varying heights of risers within one flight.*
- *The level of quality is better in the U.S., but we seem to have less innovation.*

Safety

- *I rarely saw PP&E being used at construction sites and it was frightening to see workers at extreme heights not harnessed in or tied up to prevent from falling.*
- *Life safety measures are not as embedded into China's construction culture.*
- *Most of the public buildings seemed to be only 90% completed because of the lack of final detailing in the buildings.*
- *The workers live onsite in what looked to be fairly poor conditions.*

Life Changing

- *I have gained a greater knowledge and appreciation for bridge design and construction, skyscraper design and construction, designing cities to the needs of people, thinking outside the box, seeing where we can improve our building efforts, seeing where we excel in construction, and thinking of how we can help China and the world improve design and construction.*
- *This trip was an unforgettable, once-in-a-lifetime opportunity.*
- *It was a cultural and educational experience that has changed my view on the world and the industry of construction.*

Part II: Challenges with Recruiting Students

Although student feedback from the students who took the China megaconstruction course during the developmental year was extremely positive, it should be noted that recruiting students to participate proved to be very difficult. Because the group traveled and interacted with the other China mega courses from the college, it was feasible to take only a few students from the CFM program. However, to get a better understanding of why recruiting was so difficult, a survey was sent to the CFM students to explore their perceptions of the program. Approximately a third of the students from the program responded, providing sufficient response to generate a representative sample. Six simple questions were asked:

1) What is your impression of the China megacontsruction study abroad opportunity?
2) Did you consider participating with the China megaconstruction study abroad program?
3) What are the top three reasons that you chose not to participate in the China megaconstruction study abroad program?
4) Please identify all OTHER reasons (besides those mentioned in the previous question) that may have contributed to your decision not to participate in the China megaconstruction study abroad program.
5) Would you consider participating in the China megaconstruction study abroad program another year?
6) Do you have any additional comments about the China megaconstruction study abroad opportunity that may help us determine if this program should be continued in future years?

Figure 2 shows the impression that students in the CFM program had regarding the educational value associated with this study abroad opportunity. This perception is based solely upon any recruiting efforts that the students would have been exposed to. This included seminar presentations, information sessions, the college international fair, and one-on-one interactions. This response suggests that the majority of the students felt the program had educational value.

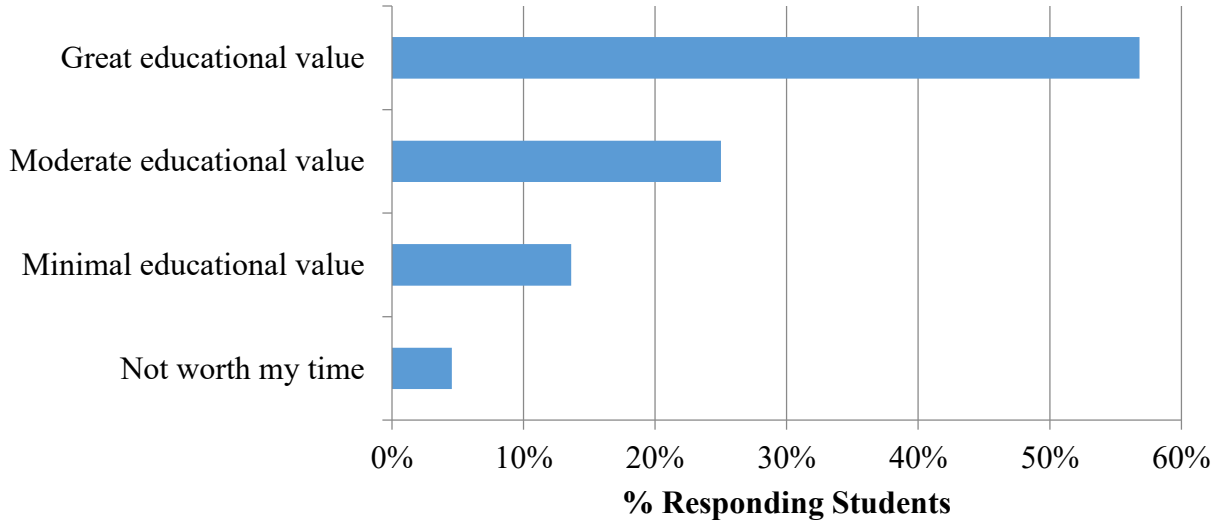

Figure 2. Student impression of the China megaconstruction study abroad program

When students were asked if they considered participating, 68% of the students replied in the affirmative. This number approximately corresponds to the percentage of students that felt the program had either great or moderate educational value.

Figure 3 shows the results for the reasons associated with students electing not to participate in the China megaconstruction study abroad program. The results from question 3 and 4 of the survey were combined into this single figure, because question 4 did not generate any additional types of responses beyond those initially identified in question 3. Further, the general proportion of responses was nearly identical between question 3 and question 4. Cost was identified as the principal barrier to participating in the program. Although the total cost of the experience (including tuition) was significantly reduced from university, college, and program supplements for study abroad opportunities, the final cost to students was approximately $3,500. Even though many of the students expressed interest in participating in the program, they further indicated the cost as being too high. It should be noted that there were a number of students that included cost related answers for each of the three principal reasons for not participating in the experience. For the sake of this data analysis, each of these was counted as a separate comment and included in the cost data shown in Figure 3. This is the only category that generated multiple responses from any single individual. However, because the students elected to put “money, money, money” as their top responses, the decision was made to allow this, thus inflating this category relative to the others.

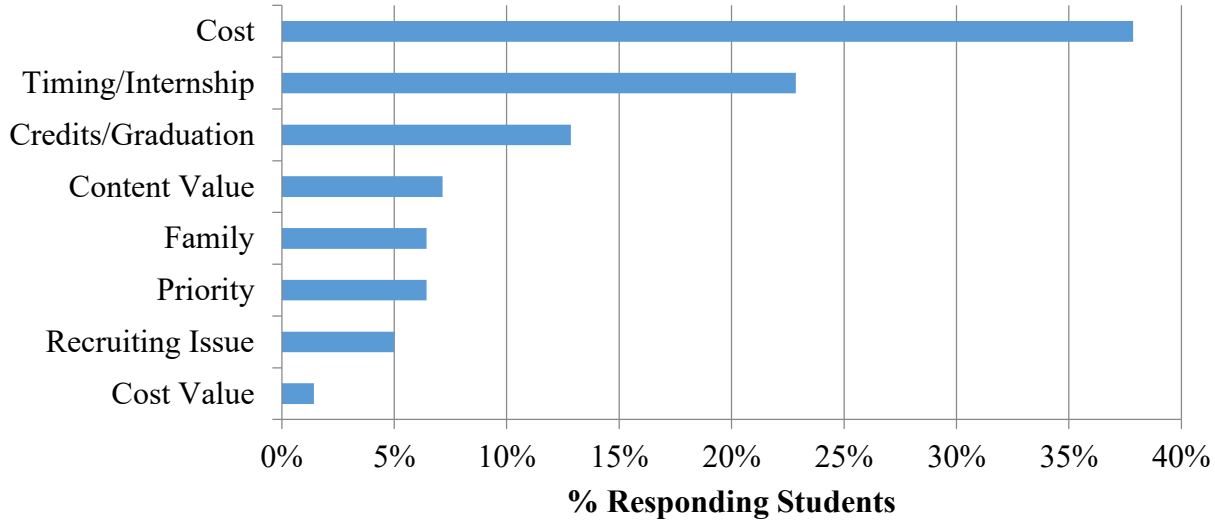

Figure 3. Reasons associated with not participating in the study abroad program

The second most common response, the need to be involved in internships and work, was said by nearly as many students as cost. The study abroad program took place during the spring term (~first of May – mid June), a time when most construction and facilities management students are participating in summer internships. There is a culture in the construction industry demanding that students have quality internship experiences (multiple, if possible) for students to be able to compete for jobs after graduation. Students were aware of this, and it was not surprising then that students were leery of trading this valuable work experience for an educational opportunity that would probably not carry nearly as much value for a future

employer. The third common theme generated by students was the idea that they would not get credit for the class. Students providing this response had already fulfilled the requirements for graduation that this course may have provided, and to participate it would have then been another class not counting for graduation. The next four responses were nearly identical in the percentage of times that they were identified. These included a general concern over the value of the content being provided in the course relative to future employment, leaving family behind (typically a spouse and/or child), not in line with current priorities (such as it was difficult to justify or seemed to just be a vacation), and finally a number of students acknowledged that they felt they just didn't know enough about it. The final response category is related to cost, but included separately because a number of respondents specifically indicated concern over the value received for the money spent.

Despite all of the potential roadblocks provided by students, the responses to question 5 and 6, provide some hope that this program may still be able to generate enough interest to continue. 55% of the students that responded to the survey indicated that they would consider participating in the program another year if it were to continue to be offered. Interestingly, students providing additional comments, generated responses related to the same eight categories shown in Figure 3, and in approximately the same proportions. This is more than likely because students carried the same theme through all of the questions answered. However, although a negative tone was seen in the bulk of the responses for questions 3 and 4, question 6 had a surprisingly positive tone associated with the answers. Further students were providing potential solutions to working around the problems. Students provided some of their best feedback here. Representative student responses included:

- *If the study abroad class was during winter semester, with the actual travel being done in the two weeks directly after finals, I think interest would increase. Then it wouldn't conflict with internships.*
- *I would love to go and am planning on it next year if it is still around. I just need to make a little more money before I can go.*
- *It seems like a great opportunity, but I chose not to participate mainly for financial reasons and timing issues. At this point in my education I need to be finishing up my classes and working in the field. I think it would be a great program to continue. I wish I had known about it at an earlier stage in my career.*

For this program to thrive, there are a number of clear obstacles that have to be overcome. It is understandable that not all students will desire to, or be in a life situation that will allow them to participate. However, there are some key lessons to be learned from the student survey responses. First and foremost, cost matters to students. The cost of this program is in line with the cost of other similar study abroad programs at BYU, and therefore not seen as being unreasonable. For students to elect to participate, the value of the program has to be demonstrated. Further, if students are exposed to the idea of the program earlier in their academic career it gives them more time to financially prepare to participate. Second, working around the spring/summer internship culture will continue to be difficult. However, two potential solutions include recruiting younger students not yet feeling the crunch to have to do an internship, and compressing the semester even further to get students out in the field. With regard to students getting credits toward graduation from participating, this too has to happen with early recruitment, so that students can schedule these credits accordingly. Although we

believe that the content has sufficient value for the students, this should continue to be evaluated. Students that feel the course content will directly prepare them for their careers are more likely to participate. Finally, as the program continues to evolve, marketing to the students, ensuring transparency in cost, value, content, etc., and utilizing previous participants to help recruit new participants seems to be of utmost importance.

Conclusions

This paper explains some of the key elements of the China megaconstruction study abroad program, some of which are not easily achieved in standard construction curriculum, especially the travel itself and the integrated final design project. As identified in the student feedback, this study abroad experience provided tremendous motivation and thus increased the student's ability to experience these key elements. Providing study abroad opportunities for construction students is an excellent way to increase their confidence, expand their global awareness, and can provide an experience that nearly each of them describe as being life changing. This paper demonstrates that study abroad opportunities are a unique teaching and learning tool and have a tremendously positive impact upon the educational experience of students.

On the other hand, despite the positive student feedback from those participating, recruiting for the program has been equally difficult. This paper has indicated that students are most concerned with the cost and the interference with internship and other employment opportunities. A number of potential strategies for overcoming the barriers of participation have been offered. For this particular international study abroad experience, it would be difficult to cut the cost down any further. It is anticipated that as some of the other barriers are overcome, that cost will become less of an obstacle for some. Another option would be to simply utilize the general concepts presented within this paper and incorporate them into a more economical part of the world. In light of the challenges with recruiting highlighted in this paper, the China megaconstruction program has been temporarily put on hold. However, with the feedback provided, we feel that we are in a position to once again offer this study abroad experience.

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