INTERNATIONAL MULTIDISCIPLINARY LEARNING: AN ACCOUNT OF A COLLABORATIVE EFFORT AMONG THREE HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

Requiring students to complete their course assignments in partnership and in collaboration with students from other institutions is not commonplace teaching pedagogy. Even less so when they transcend disciplines and international borders. This Paper presents a brief account of an ongoing collaborative effort between Ryerson University, Coventry University and Loughborough University to inculcate cross border communication and teamwork skills to their Built Environment undergraduate students by way of having them work collaboratively on joint project assignments. It describes its scope and organisation and summarises some circumstantial and anecdotal observations of participating students' inclination and disposition to working inter-institutionally. In an industry where cross disciplinary interactions and exchanges are the norm and where contracting parties to the project can frequently be across international divides, it is imperative that its professionals be trained in cross border teamwork skills.

KEYWORDS

Collaborative Learning, Built Environment, Construction Management.

1. INTRODUCTION

This student and faculty collaboration was prompted by two reports from The Royal Academy of Engineering, United Kingdom. The first is titled "Educating Engineers for the 21st Century" (RAE, June 2007). The report took the stance that today's business environment demands that engineers must have "the ability to work in globally dispersed teams across different time zones and cultures." We surmise that the profession of engineers in this RAE report embraces all Built Environment (BE) professionals and in particular construction project managers and coordinators, whose background and training are commonly in related disciplines such as architecture and construction project management.

Today's Built Environment professionals and stakeholders need to be acutely aware of an increasingly globalised world where few economic borders remain. An economic "one-world" has bearings on procurement of goods and services in the BE industry as it can take away work that traditionally was viewed unmovable or "un-outsourceable" as well as creating new opportunities where there otherwise would be none. A good example is the growing use of offshore detailing firms for all manners of shop drawings and drafting services. These highly price-competitive detailing firms are largely located in Asia where a near half-day time difference oftentimes adds to their already competitive edge.

If they seek to lead the industry tomorrow, today's BE professionals must look beyond construction site boundaries. They must concede that they no longer have to sit in adjacent cubicles to get the work done, but more importantly they must learn not to. Advancements in information and communication technology over the last two decades have largely eliminated that need to. Tele-conferencing application tools such as Skype and GoToMeeting are nearly as physical as one can get to – minus the physical handshake. All manners of documents, drawings and renderings can be transmitted across the globe in mere seconds. Then there's also the largest single form of communication in existence today – emails. Plus the modern telephone where a trans-Atlantic call can be made very inexpensively and oftentimes for next to nothing using one of the

bewildering numbers of Apps available. Use of some of these comes with concerns and trepidations but it is not the intent of this paper to discuss them.

In its second report "Engineering Graduates for Industry" (RAE, February 2010), the academy apprised that academia must supply graduates with skills that ensure their "employability" meaning graduates with personal and interpersonal skills, communication skills, self-management skills, and skills in the application of information technology. Being fully equipped with mainstream technical knowledge and skills is no longer sufficient for today's industry demand. None of these employability skills are more needed than in the BE industry. Few undergraduate curriculums in architecture and engineering schools have room for all of these skills. Most were learnt on the job, some painfully.

What these all point to is a necessity for the BE professional to surpass an ability to engineer and to manage the complexities and uncertainties that are characteristically inherent in construction projects. To the best of our knowledge, there is currently a dearth of endeavour in BE professionals' training programs where these two RAE's advices are taken heed. Work in this regard started in 2011 with 37 Architectural Science students from Ryerson University in Canada and 32 Civil Engineering students from Coventry University, United Kingdom. Loughborough University, United Kingdom joined the collaboration in 2013, involving to date a total of 182 students from the three institutions. The intent of this paper is to share our experiences with educators our approach to address the two issues raised in the two RAE reports and outline what we circumstantially and anecdotally observed in the classrooms. It should assist other BE educators who may wish to implement similar collaborative projects in their own institutions.

2. PROJECT SCOPE AND ORGANISATION

This faculty and student collaboration stemmed from Coventry University winning a research grant from Hewlett Packard in 2010 to develop new and novel approaches to science, technology, engineering and mathematics (STEM) education. In its first year, 4th Year Architectural Science (Project Management Option) students from Ryerson University worked co-operatively and collaboratively with Coventry University's 3rd Year Civil Engineering and Civil and Structural Engineering students on a year-long Design-and-Build project. Each project team consisted about equal numbers of students from each institution. The project brief was developed jointly by faculty instructors and took into considerations the institutions' course requirements. At the end of the joint project assignment, each student was required to go online and assess the effort and contribution made by other team members using the Web-PA system. This confidential assessment returned a factor which was then used to adjust their earned final grades.

In its second year, the project was changed to an A&A (Addition and Alteration) work to an existing academic building where unfettered access was available only during prescribed periods. It was felt that an A&A work as such would be more thought-provoking and challenging such as in designing, planning, scheduling and executing the work. Besides, it would require them to do some serious thinking around the context of the building project, including local building regulations and health and safety considerations for users of the building whilst it is being upgraded. The same project was used a second time in 2013 when Loughborough University brought to the collaboration its first group of 24 Final Year Construction Management students followed by a second group of 28 MSc Construction Management students in early 2014.

Project team composition thus closely fulfils the criterion for "globally dispersed teams across different time zones and cultures" except that the cultures of Canada and the United Kingdom are not generally recognised as significantly different. The teams, comprising architecture, civil engineering and construction management students are furthermore multi-disciplinary and to a good extent typifies project teams in the real world. Work was to be responsibly and equitably divided among the team members and was expected to be carried out in a coordinated industry manner.

At the beginning of each academic semester, a faculty member from Coventry University would fly into Toronto to brief and take questions from Ryerson University students just so that students from both institutions received the same information and directions. This took place without fail since 2011 when the collaboration began, up till and including last year when Loughborough University joined. Further and additional briefings were conducted using Skype and latterly using GoToMeeting.

At team level, leadership was rotated every four to five weeks among the team members. The Team Leader is assisted by a Team Manager, whose main responsibility is to schedule and keep records of meetings, thus enabling the team leader to focus on coordinating team members' progress and performance on their assigned sections of the work. At the succeeding leadership change, the manager assumes the role of team leader. At all times, we ensure that the team leader and the manager were not from the same institution.

Each team identified itself as a company and prepared an initial proposal in response to a project brief developed jointly by faculty members. A well-thought proposal must include a design proposal to meet the client's requirements, a set of specifications, a schedule and a preliminary cost estimate. Faculty members, in addition to advising and directing the teams, also doubled as clients. The assignment ends with a presentation to client and would typically include a reasonably detailed sets of architectural and structural drawings, a more definitive set of specifications, a revised cost estimate, a construction schedule and a method statement taking into consideration health and safety considerations, and for Academic Year 2012/13 a sustainability report on the proposal.

Until 2013 when a grant for the project became available from the Higher Education Academy (HEA), United Kingdom, students communicate largely using Skype and emails. All manner of drawings and documents were deposited in Dropbox for further work. During the first year, the work was supported by a Hewlett Packard grant and students were encouraged to use HP Virtual Room communication software. The grant also made available use of HP laptops to Coventry University students. In 2013, GoToMeetings became the primary means of communication and work among students from the three institutions. This desktop sharing service allows the students to work together for their architectural and structural designs with 3 dimensional Building Information Model (BIM) in real time with synchronous audio and video. The funding from HEA has permitted a higher level BIM collaboration to be implemented in this initiative. BIM has recently become the key requirement of building design and construction around the world.

3. CIRCUMSTANTIAL AND ANECDOTAL OBSERVATIONS

Working with geographically distant team members presented the students with some challenges and did require some changes and adjustments to the way they would normally do their work. The observations made here are largely based on casual conversations with the students and discussions among the students themselves over the years. At the time of writing this paper, work is ongoing to gain an understanding of some of the underlying reasons and motivations. We have, earlier, published those that we have conclusions (Soetanto et al, 2012; Soetanto et al, 2014; Soetanto et al, 2014). This paper does not intend to discuss them.

3.1 Time Difference

Time wise, the United Kingdom is ahead of Canada by 5 hours which effectively means that when the Canadian students start their class hours (invariably after lunch time), their United Kingdom team members would likely have been tired out from a full day at school. A 5-hour time difference is significant in that it effectively leaves only a common 3 work hours from a typical 8-hour work day. Canada moves to Daylight Saving Time typically 2 weeks earlier than the UK and a resulting time difference of 4 hours sometimes caused confusions with scheduled meeting times. But for the most part, the students managed well such as agreeing on days and times for meetings and for working together. Weekends seemed to be a popular choice of days when most have no classes to attend.

3.2 Multidisciplinary Aspect

In contrast, it was the multi-disciplinary aspect of the collaboration that seemed to be more difficult for the students to deal with. Whilst we observed numerous constructive discussions among the architecture and civil engineering students as to what works and what doesn't, we also observed that at times they find it hard to come to terms that each discipline has particular strengths (and weaknesses). For example, the architecture students have on a number of times lamented on their counterparts' lack of design aesthetics and drafting skills. Another issue which sometimes cropped up relates to common knowledge that all the students would

be expected to know by then but have yet to be taught or in the process of being taught – such as use of drafting and scheduling software.

3.3 Team Members Preference

There is little doubt that if they had a choice most of the students would prefer to team up with friends and with those they knew in the class. In this collaboration, students first formed "sub-teams" of their choosing from the class - typically of two to three students. Faculty members then randomly ascribed one sub-team from each institution to form a project team of seven to eight members. Thus, they do get to work with a few team members they know but with more they do not - a situation most Built Environment professionals will find themselves in the real world. It is not clear to us why this would be so and we conjecture that familiarity, perceived reliability or otherwise, competence or simply just plain chemistry may play a part. When asked late into the project, most valued their experiences of working in an international multi-disciplinary team.

3.4 Team Interactions

On the whole when the students learned that they would be required to work with students from other institutions, about half of them displayed some unease - such as what their team members from the other institutions might be like in terms of technical competence, diligence, work ethics and responsibility. These trepidations either diminished or get exacerbated into the project. Over the three years, about one in five or six groups did not get passed their disagreements and differences - consistently about work below expectations or not on time, ineptness on the part of some individuals, unreliability, not attending meetings and, in a few instances, non-participation or apathy. But for the majority, team performance and cooperation were as best as be expected and the quantity and quality of work produced were very good.

Referring to the other groups of Coventry students who were not participating in this international collaboration, one testimony suggested that working with distant partners online was in fact sometimes better than working offline. Some students have also mentioned that they work harder as they are representing their university and don't want to be seen in a 'bad light' compared to other institutions. With other supporting evidence, it could be concluded that successful collaboration is very much dependent on the professional work ethics and trust. The impact of mediating technology is not critical if the team has strong work ethic and trust (Soetanto et al. 2014).

3.5 Us and Them

Whenever work was not progressing as planned, the "us and them" differentiation or discrimination would come into play with little hesitation that the culpability rests squarely on "them". Notwithstanding being reminded time and again that there is no "us" and "them" in a team, this mindset persisted. Over the years, we have not had one single complaint where a student placed the fault or shortcoming on the team member from his or her own class. This distinction between us and them embraced issues such as design and drafting skills, ability to write and structure a report, or simply "we are doing more work than them and it's not fair". What was also noticeable over the years was that students tend to rate their contributions higher than those of their virtual team members in terms of quality and quantity.

3.6 Recognition and Fair Play

Notwithstanding the "us" versus "them" mindset that permeated, students were also quick to give recognition and acknowledgement to their virtual team members and this was commonly reflected in the end of project *Web-PA* peer evaluation that was also used to adjust their earned grades. Over the years, we have also heard frequent complimentary and admirable comments from students about some of their virtual team members. Likewise, they are also quick to castigate those whom they felt had not lived up to their expectations. They would also not hesitate to use the confidential peer evaluation process to rate them negatively. Deemed "free loaders" appeared to be the worst categorisation.

4. ONGOING WORK

Work is continuing with the collection and analysis of student experiences and the issues encountered - both students interaction-related and technology-related. The findings will be used to develop a guidance of effective practices for international student collaboration in a real-time online platform. Experiences, cases and lessons learnt will feature in the guidance.

An online *BIM-Hub* is currently under development to assess approaches, practices and technologies to support this international student collaboration, concurrent with its use as a platform for student virtual collaboration. When fully completed, it will encourage a community of learning among HE academics and their students through open discussion forums in relation to issues such as experiences and practices. The *BIM-Hub* will also provide limited access to interested external parties, support a range of social media popular among students and will be supported beyond the life of this project.

5. CONCLUSIONS

Increasing international collaboration in the Built Environment industry obliges its professionals to have "the ability to work in globally dispersed teams across different time zones and cultures". This skill set embraces skills to interact and to work with counterparts from distant lands employing appropriate communication technologies, which no doubt enhance their employability in the industry.

In addition to their (design and technical) program requirements, this collaborative effort among our three HEIs provided our students an opportunity to learn and practice team work skills in an online environment across geographical and time zones divide. The multi-disciplinary team environment challenges them to a range of issues that are not uncommon in the real world. And they also get to acquaint themselves with the industry practices of another country. We are of the view that as BE educators we have an obligation to inculcate these skill sets in tomorrow's Built Environment professionals.

ACKNOWLEDGEMENT

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