

# Virtual teams much? – overcoming disparate participation in a distance education construction management program

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## Structured abstract

### BACKGROUND

In an age of increasing digital workplaces and globalisation, professionals need to be able to effectively participate in and complete projects via virtual teams. Distance education not only provides students with career changing opportunities but introduces disparities in participation abilities and long distance collaboration. Teamwork has long been a desired graduate attribute but changes in student cohorts and industry requirements and expectations are forcing a bridge of the digital divide in its attainment. Exposing students to working in virtual teams is expected to better prepare them for a modern workforce.

### PURPOSE

The objective of the study was to determine the importance, utility and functionality of virtual teamwork in a distance construction management program as it relates to real world situations and identify the factors that influence student progression.

### DESIGN/METHOD

Participants in a distance education program were introduced to a simulated global virtual team environment with variations in project tasks mirroring a typical infrastructure stage gate approach ranging from financial project feasibility to concept design and aspects of project execution. Multiple scenarios were presented while virtual groups were allowed to redo presentations to the project owner as they developed and honed their project and reflected on their team performance. Pre and post surveys were conducted and project results were compared for each project team to measure improvement in team effectiveness, cohesion and ability to adapt to unknown project variables.

### RESULTS

With project participants represented by both traditional and non-traditional students, the results of the project delivered somewhat scattered results. Project teams in distance education reported anguish over aspects of team leadership, developing trust in other members' contributions, overcoming the technological challenges of geographic distribution and more importantly, vastly dissimilar career experience, led to various project team breakdowns and in a few cases, failures. Students failed to comprehend the advantages beyond qualification progression.

### CONCLUSIONS

As a result of this project, more emphasis has been placed on actual international student collaboration and teamwork on simulated global projects through the use of assessable bilateral project adjudication. Project results provide a fertile field ripe with alternative teaching approaches ready to harvest and make available to the non-traditional student cohort.

### KEYWORDS

Digital collaboration, global virtual teams, virtual teams, globally distributed collaborative learning, stage gate approach

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## Introduction

In an age of increasing digital workplaces and globalisation, students need to be able to effectively participate and complete projects in virtual teams. Effectively communicating in large and geographically dispersed project teams has become the nature of infrastructure projects across the world. Distance education provides students with career changing opportunities but introduces disparities in participation abilities and distance collaboration.

Development in virtual design technologies and methodologies in the last 10 years have surpassed previous expectations of integration and professional team incorporation and with the now very definite establishment of Building Information Modelling (BIM), the role of collaborative virtual consultants is more important (Ku & Mahabaleshwarkar, 2011). The change from the traditional professional team headed up by the architect as the principle agent for the employer has morphed into a team of professionals collaborating around instead contributing to the end goal of the employer (Yang, Shen, Ho, Drew, & Chan, 2009).

Traditional students (students entering academic programs from school at an age between 17 and 24 and studying fulltime) (Meeuwisse, Severiens, & Born, 2010; Miller & Lu, 2003) have historically taken up study in the Built Environment programs (including architecture, building design, construction management, quantity surveying and building design) through face-to-face programs however in recent years, non-traditional students (all students not classified as traditional) have started making up a larger segment of the market. As universities start focussing on distance education and utilisation of concepts such as the flipped classroom (Ash, 2012; Tucker, 2012), online collaboration using webinars (Ioannou & Artino, 2009), this previously untapped segment has potential to become bigger than the traditional face-to-face offerings (Bean & Metzner, 1985; Keating, 2006; Lui, 2008).

With the shift in the student cohort at a regional university focussing on distance education Built Environment programs, special attention has to be given to maintaining acceptable levels of student retention while achieving industry qualification aptitude requirements. In terms of distance students (not part of the definition for traditional students), educational providers have to contend with many factors that influence student success, progression and participation. Many programs in the Built Environment suffer from high attrition (some over 50% in the first year) and many have adjusted offerings to include bridging courses designed specifically to alleviate the feeling of discourse experienced by distance education students (Ariadurai & Manohanthan, 2008; DEEWR, 2002; Pienaar, O'Brien, & Dekkers, 2012).

With technological advances in construction management techniques, tools and resources, industry demands on graduates are changing as fast as the industry. As the global outsourcing of activities become more entrenched and accepted in both Australia and globally, graduates are faced with international competition for a once protected environment and have to adapt or perish.

## Background

Advances in outsourcing of project related activities have contributed to radical changes in construction project management in recent years. With an increasing number of Australian organisations (Qantas, Telstra, Westpac, ANZ etc.) opting to shift labour related operations offshore to reduce operational costs, the academic feeder for the construction industry needs to prepare graduates to seamlessly operate in a global virtual environment.

Projects are typically constrained by the three most famous resource limitations - cost, time and quality. Seeing these limitations as the sides of a triangle, with the goal of the project to achieve equilibrium, it is easy to see that if more time is spent, either cost or quality has to give and vice versa. It is understandable that project owners (employers) aim to minimise cost while maintaining a functional level of quality within the least possible time. Since the late 1980's but more so the mid-1990's (Doh, 2005), intensification on projects to rely on the concept of outsourcing components has occurred. The benefits of outsourcing are well-

known and encapsulate project variables effectively releasing management resources to focus on core activities of the project.

With the introduction and development of BIM, virtual designs provided designers and project teams with a further advantage of eliminating costly design clashes not easily identified using traditional design and project execution techniques. Although there is a perception that BIM developed in the late 1990's, it has effectively been in practice since the early 1970s and since its industry inception, has evolved from being a buzzword at professional excellence award events to being a fundamental cornerstone of the Architectural Engineering and Construction (AEC) industry (Eastman, 1974). The sector is perceived as a conservative industry and not known for lavish and extravagant advances in technologies and exotic materials but the reality is procedural and methodological advancements continue to drive the industry. With specific focus on the Built Environment in Australia, it is important to note that although Australia is in many instances considered a world leader in the development and implementation of technology, the drive for the advances can mostly be attributed to the high cost of labour. Consequently, projects in Australia are constrained in terms of resources, necessitating professional organisations and employers alike to pursue graduates with multiple skills and abilities to ensure optimum operational profitability and flexibility.

To fit into the mainstream area of project design whilst remaining cost effective, one implicit skill graduates need to possess is the ability to function effectively in teams. Teamwork has historically been a desirable graduate outcome of most educational institutions however, with globalisation and the influx of international cultures, there is a requirement for teamwork to evolve to incorporate operational status in a virtual environment. Global Virtual Teams (GVT) have been described as culturally diverse functioning in a geographically distributed environment while utilising electronic means and other technology in delivering project outcomes (Harvey, Novicevic, & Garrison, 2004). For project managers, the selection of GVT is driven by factors such as cost, expertise, current project load and previous experience in similar project scenarios, indicating that global resourcing has become a visit to the online resources supermarket while each of the GVT have a specific shelf-life and application.

The use of online platforms to provide a synchronous delivery of learning content to distance education students has transformed the higher education sector from a system where hard copy resource material was dispatched via the postal system to an engaging and collaborative environment where stakeholders interact in an almost seamless fashion. Traditional static written resource materials have been replaced by interactive videos, which can be played over and over again, and podcasts, which are transmitted to mobile devices, allowing students to utilise otherwise unproductive times including in transit on public transport and other waiting areas. Finally, the inclusion of a synchronous online environment has allowed team based assessment and learning tasks, once dreaded in terms of logistical challenges in distance education, to be easily adopted with the previous spatial limitations no longer an impediment to group activities.

The shift in the project management environment for construction projects has resulted in the necessity for students to partake in projects to prepare for the workforce. Teamwork in distance education can present challenges to students due to their geographic dispersion, employment situation and the availability of resources. Historically, distance education students in the Built Environment were required to be employed in industry and although not a requirement of all academic institutions in Australia, it is a requirement of this university. The benefit of work integrated learning has well been argued and many professional organisations require industry exposure as part of their professional licencing schemes. Working in industry exposes students to project management teams but not necessarily with the depth and width required to understand the intricacies of working in a global environment.

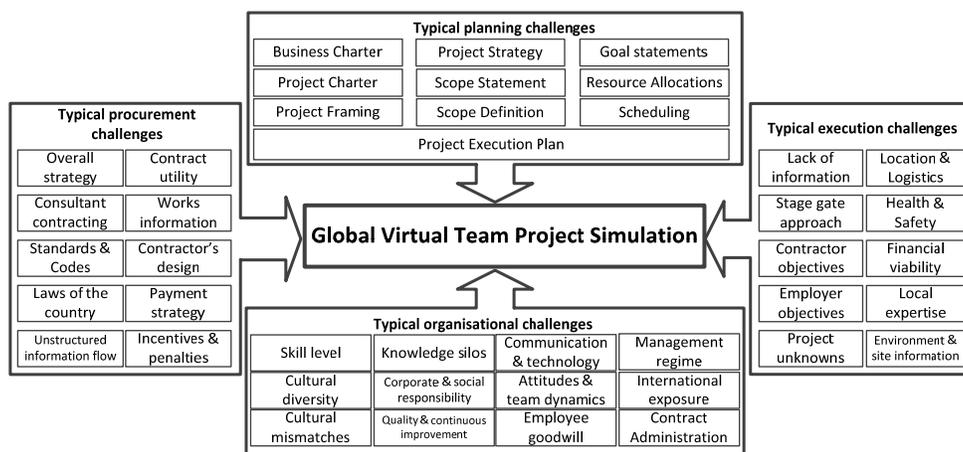
## **Simulated global virtual teams**

As barriers to international commercialisation and challenges associated with intercontinental logistics and business ventures fade, outsourcing of construction project activities has

become increasingly feasible. As technology develops to overcome temporal and spatial barriers, the benefits of increased project performance and reducing project overheads have been identified as significant factors in project profitability and timely completion. Whilst the concept of global virtual teams is not a new phenomenon, this project delivery platform is playing an increasingly important role in the globalisation of the construction industry. For example, the outsourcing of intricate design activities to countries and providers not faced with the same legal limitations as those encountered locally, can produce project savings making plans or development projects more viable.

Global Virtual Teams (GVT) are purpose made, highly organised and are engaged for the duration of the specific project (Lipnack, 1997). Concurrently, as educators identified the significance of this emerging discipline in holistic course learning outcomes, projects scenario simulation learning and assessment tasks were designed around actual projects; factors crucial to the development of the effective learning outcomes. With the benefit of actual project outcome history and hindsight, it was possible to redesign the simulations in such a way as to achieve the required outcome in relation to simulated global virtual teams (SGVT). Literature and industry experience provide insight into the most common challenges associated with GVT and by specifically reengineering the simulated projects (see Figure 1), it was possible to focus attention on these aspects. Students are encouraged to utilise all of the programs and tools available to GVT. In their simulated projects they develop not only their communication skills but also the ability to optimise cost, time and quality. As with GVT some of the major issues faced by are distance, time zones and leadership.

**Figure 1 Bridging the objectives of the simulated global virtual team project**



## Context

Built Environment students are regularly deployed in a team environment. Teamwork activities in face-to-face learning environments can easily be established with the use of in-class role plays or scenarios where students have to participate in different project oriented roles, replicating industry conditions. The effectiveness of teamwork in education has far reaching benefits in terms of graduate readiness. In the absence of work integrated learning environments, graded team activities can be seen as an alternative to, and preparation for, working in a project management oriented sector. Operating in a virtual synchronous environment allows the graduates to allocate specific time frames to the activities promoting functional success in the operational aspects of the project team.

In this distance education program, where 95% of the cohort is employed full-time, additional time management skills and challenges exist. Since the introduction of online lectures and the flipped classroom model (Tucker, 2012) in 2010, various time slots have been used to ascertain the best possible time for distance students to interact synchronously. Online

activities (non-compulsory) have been conducted between 7am and 11pm on weekdays while certain activities have been conducted on Saturdays. No activities run on Sundays unless it is student initiated.

To date the ungraded non-compulsory activities attendance have been sporadic at best, with students reporting difficulties in attending online lectures due to personal circumstances including work or family related activities. Online synchronous activities offered during office hours or during the traditional lunch hour (12pm-2pm) have also attracted limited attendance, with work related obligations rather than family commitments providing barriers. Of interest, daytime (12pm-2pm) online training to existing industry practitioners has been a regular feature of the School of Built Environment since 2012 and the ratio of attendees to accredited members is similar to that of student participation. Similarly, online participation in continuous professional development webinars presented to industry practitioners on the last Wednesday of every month between 5pm-6pm has seen a marked increase in take-up indicating that this time slot is more accessible for industry practitioners.

With students in the distance education cohort located all over Australia, North America, Europe and the Far-East, it became necessary to extend the offering to beyond the norm of the flipped classroom or posted (online or otherwise) resource material. With the transition of hardcopy printed resource material to fully online Built Environment programs late in 2010, lecturers were confronted with two different cohorts of students. One cohort (previously enrolled students) were used to receiving only printed resource material, having little to no interaction with lecturers and students and were happy with the ultimate flexibility that the primitive distance education model offered. They enrolled in the distance education program based on convenience and their personal ability to manipulate the academic program in to a vehicle that could take them where they want, when they wanted. The second cohort (new students enrolling in the programs for the first time) did not know what to expect and was happy to receive whatever resource material was made available. This cohort later became instrumental in setting the standard for the delivery of online programs in the Built Environment, demanding the same service level in all courses that they experienced in the group of pilot courses. An unintended consequence of the new student service level expectation was that some lecturers were left behind in their teaching methodology leading to unbalanced course offerings. Training provided failed to overcome resistance to change for lecturers with a number of staff performing poorly in satisfaction and consistency surveys.

## **Methodology**

The CQUni Built Environment offers three main disciplines with qualifications in building design, building surveying and construction management. The disciplines share a common first and second year of study allowing students to elect their discipline after completion of the initial two years. Currently the building design students represent the largest group (47%) followed by building surveying (28%) and construction management (25%). Due to the complexity of the experiment, only 25 students in their final year of study were included. The selection limited the project to students in the construction management discipline. Industry practitioners were invited to participate in the design of the virtual projects to ensure that it reflected the current economic environment in the industry as well as the level of technical difficulty associated with globally outsourced infrastructure projects.

With the low number of available qualifying students, participants were deployed to three functional project teams. Team were selectively created ensuring members were from different geographic locations and possessed varied project experience. Typical professional team project roles (project manager, design team, cost engineer, construction planner etc.) were identified by the course coordinator in conjunction with the industry practitioners to ensure participants had to fulfil multiple roles. Teams were allowed to self-select a project manager based on experience, functional project knowledge and other team self-defined evaluation criteria. Self-selection occurred for other identified roles. The effectiveness of the project manager selection criteria formed part of the overall project execution and

performance evaluation. Participants received project information packs with relevant information including a brief from the client and broad project outcome parameters. Multiple variations were introduced while project design information to the groups was appropriately throttled to simulate known GVT related issues concerning team communication, leadership, trust and cultural differences. In order to emphasise spatial dispersion between groups members, groups were not allowed to form naturally, instead groups were created reflecting a wide range of geographic, skill and personality types; thus reflecting the reality of the existing workplace. In all three of the groups, students from both the east and west coast of Australia were included while the third group had a student residing in Canada. Each team was provided with a 24/7 synchronous online collaboration platform (in the form of an online webinar including online collaboration tools) where information could be shared, designs discussed and outcomes achieved in a real time but geographically dispersed environment. Access to the online collaboration platforms was restricted to individual team members to simulate a protected data environment. The course coordinator and industry practitioners were able to access team rooms to observe and record the operational functionality and cohesiveness of the team members and the team. Teams were allowed to engage consultants for any project activities not specifically included in their scope of work. External consultants were able to join the online environment on an "as needed" basis. Industry relevant design budgets were allowed however teams had to report on all expenditure.

The main purpose of the SGVT project was twofold in so much that students' technical performance and knowledge had to be tested and that the aspects associated with GVT can be simulated as part of an extended capstone learning project. Technical performance, project logic, project execution and functionality were some of the main factors teams had to address and these aspects were evaluated by industry employers and practitioners invited to partake in the project on a voluntary basis. Clients were encouraged to use the same management and communication styles that they would use in a typical project exposing participants to an aggressive and highly competitive project environment.

### **Basic project design**

Three projects were compiled ranging from commercial construction projects to infrastructure projects. All projects were based on actual projects completed in the last ten years. To add variation to the project execution, not all projects were to be constructed in Australia forcing participants to engage in cultural and geographical research before engaging in project design and execution activities. Originally, projects were designed around functional stage gate approach management systems with each team challenged in terms of concept, viability, design functionality and discipline clashes, project execution and operational aspects of commissioning. Operation and Maintenance (OM) did not form part of the project. Experience demonstrated the original project plans had to be truncated considerably to fit within the constraints of the course and term duration.

### **Outcomes and discussion**

A distinct outcome from this pilot project was the confirmation that distance students rarely engage in a synchronous fashion unless it is an explicit requirement of the course or a gradable activity. Project participants participated in 77% of graded activities while the number for ungraded activities dropped to 16% in week three from 29% at the start of term. A subsequent survey of 295 students into the use of audio visual synchronous online collaboration tools supported the findings with 91% of the respondents indicating that they will only participate if the activity is graded. 82% reported that they would view subsequent recordings. The outcomes from this project and engagement data, recorded since the inception of the full online environment at this university in 2010, reveal the level of engagement from distance education students has an indirect correlation to the amount of time left before the submission date of the next assessment item.

A consequence of the online delivery and increased student engagement model was the loss of flexibility for distance students. Historically students enrolled in the built environment

programs because of the lack of contact and interaction but now students enrol because of on demand contact and interaction. There still exists a portion of the cohort who prefers not to engage with lecturers or other students. These students find the increased requirement for online synchronous participation challenging. In most cases, online participation requirements or graded teamwork activities were met with resistance and accompanied by student complaints. Surprisingly students rejected the departure from total student isolation.

The use of SGVT aimed to encourage formal and informal student collaboration and engagement while developing identified industry graduate learning outcomes have provided insight into Built Environment student capabilities and capacity to adapt to changing evaluation regimes. Simultaneously exposing students to aggressive industry project conditions and discussions and assigning industry practitioners as virtual clients responsible for the evaluation of project outcomes forced them to overcome qualification isolation in an attempt to stimulate spontaneous engagement. Project results ranged from mediocre to functional. Industry practitioners reported that the proposals presented by the SGVT did not represent current industry standards in terms of technical performance but they did concede that actual experience cannot be taught. The SGVT provided functional outcomes albeit not profitable. Nonetheless, the learning achievements and experiences in the SGVT far outweigh the poor performing project financials.

*I am of the opinion that the way this course I am undertaking this term have been designed is quite possibly one of the best subject delivery methods I have seen, including my 3 years studying law and applied science at uni in early 2000's.*

The SGVT reported that inter-team communication challenged their perceptions of globally outsourced projects and cultural differences had to be overcome before teams could achieve tangible results. The ability to create and self-select leadership evaluation criteria catapulted students from their positions of non-committal comfort. Facing personal differences and political disparities forced them to take responsibility for both individual and team decisions. Initially, time zones impacted on cohesion and performance while non-descriptive role and responsibility allocations led to dysfunctional discipline silo's paralysing team performance. The throttling of project information caused teams to arrive at unfounded design assumptions causing unintended downstream activity clashes thus emphasising the need for cross discipline collaboration or the use of external consultants i.e. the removal of knowledge silos. The evaluation of the issues related to the functionality of the team members in the GVT were done in conjunction with lecturers.

Participants reported that the simulated projects allowed them to develop a detailed understanding of stage gate approaches for infrastructure projects, common pitfalls associated with remote projects and that role-play scenarios typically achieve better results when participants have relevant experience in the role. It was reported by industry practitioners that student performance, in terms of technical ability and execution, was acceptable for a university environment however the lack of spontaneous engagement and task vigour was below expectations. Similar to a project execution phase, the opportunity for change, in terms of student engagement, become more costly the later in the academic program it is installed. With the limited number of participants available for the execution of multiple project functions, it was not possible to exhaust a comprehensive project scenario during the twelve week term.

In most cases the industry experts fulfilling the role of the "virtual client" participated extensively in the project and provided feedback on team performance beyond the scope of the experiment; indicating that philanthropic industry participation could further scaffold graduate preparedness. The addition of industry evaluation of the projects provided project teams with sounding boards for their project execution plans and in all instances teams were allowed to revisit their project execution plans after consultation with their virtual client.

## **Recommendations**

Due to the scope and time limitation of this pilot project, only 25 students participated. In actual projects, a team can comprise between 10 and 400 or more professionals (depending on project complexity and size) providing the project with a critical mass in relation to execution capacity and capability. With only three teams participating in the project and team members fulfilling dual or multiple roles, the realistic allocation of roles and responsibilities could not occur. A future continuation of this project will include students from a leading South African university delivering built environment programs in face-to-face mode comprising a cohort of mainly traditional students. The intended interaction between traditional students (South African university) and non-traditional students (regional Australian university) could provide insight in how students with and students without industry experience or in fulltime employment interact during the execution of a global virtual project while providing a unique understanding of professional interactions between scholars providing educational programs to two distinctly different markets on different continents.

The implementation of a bilateral project outcome evaluation matrix needs to be established to measure the actual performance of the team and the project proposals. The evaluation matrix should be based on the required outcomes of industry and educational institutions in both countries allowing for cross-cultural and international collaboration between universities, researchers and students. Students will be able to interact with their international counterparts while being exposed to overseas project execution principles. Professional organisations in Australia seeking to provide accreditation to international programs have expressed interest in the next phase of the project to investigate if it could provide a suitable pathway to the establishment of articulation agreements for foreign students.

The notion of introducing forced engagement in non-traditional student distance education programs should be further investigated. Although engagement with students in a face-to-face environment can lead to improved results, research should be conducted to ascertain the long term effect of forced student engagement on the perceived flexibility of full online distance education programs. Teamwork and associated activities have long been part of graduate attributes for academic institutions and alternative approaches could overcome the resistance to engage in programs where students enrol because of the absence of such requirements or where non-traditional students do not engage readily in such activities.

## **Conclusion**

The effectiveness of online collaboration tools in both face-to-face and distance education has been well researched (Artino, 2010; Bernard, Brauer, Abrami, & Surkes, 2004; Frankola, 2001; Harris et al., 2004; King, 2010; Laffey, Lin, & Lin, 2008; Lonn & Teasley, 2009) and cannot be argued. Distance education is an evolutionary process continuously aiming at providing better results, arresting student attrition while stimulating retention. Key aspects of student attrition in first year programs has been identified as isolation, technical inability, lack of engagement and participation and personal circumstances (Croft, Dalton, & Grant, 2010). While personal circumstances remain outside the influence sphere of academics, other factors can be influenced in such a way to achieve different results. As the construction industry changes, so do the expectations of employers for graduates and students for universities. The use of GVT's in industry has changed the way construction projects are designed and executed. Physical location is no longer a constraint of project team effectiveness and savings achieved by means of outsourcing project activities easily outweigh the challenges associated with geographic dispersion. The project reflected previously identified aspects associated with real GVT projects including communication and team leadership issues.

Although this experiment in the application of SGVT in a synchronous digital distance education environment has provided valuable information about the way team members interact in normal to adverse project conditions, a continuation of this experiment is required to simulate a truly reflective SGVT in an international environment. The results from the pilot project indicated that the limitation of disciplines (i.e. construction management) had a

detrimental effect on the effectiveness of the team and impacted negatively on the overall technical outcomes of the SGVT. When considering the overall effectiveness of the simulated project, the absence of participants from other academic institutions delivering projects in similar disciplines detracted from the effectiveness of the simulation in terms of its technical, educational, cross-cultural and global reach.

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