The Education of Virtual Teamwork Skills in Construction Management, Building Surveying and Quantity Surveying Programs in Australian Universities

Master of Philosophy (Building)

University of Newcastle

November, 2011

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B. Construction Management (Hons Class 1)

Statement of Originality

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Acknowledgement of Collaboration

I hereby certify that the work embodied in this thesis has been done in collaboration with other researchers. I have included as part of the thesis a statement clearly outlining the extent of collaboration, with whom and under what auspices. (See Section - 1.9)

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Acknowledgements

Abstract

Changes in business practices and the volatility of the world economy have led to the development of new business practices to suit the modern business environment. These new business practices utilise the capabilities of available technologies, principally those technologies that facilitate communication. This integration of communication technologies has led to a growing prevalence of virtual teamwork utilising online or electronic environments. Virtual teamwork has been recognised by businesses as an increasingly important tool, yet one that suffers from a lack of sufficient training. In the Construction Industry, this lack of training is problematic due to increasing Virtual Teamwork technologies, such as BIM, that require adequately trained and skilled professionals.

This research study seeks to examine whether the prevalence of Virtual Teamwork is recognised by Australian university construction programs, and if these programs are delivering graduates with the required skills for effective Virtual Teamwork. In addition, the issue of alignment between universities, industry representative bodies, and the Construction Industry, is explored to determine if the education of Virtual Teamwork skills is required in the graduate competencies stipulated by the industry representative bodies.

It was found that the growing importance of communication technologies in the Construction Industry was recognised by staff, students and representative bodies, and was reflected in the courses taught. In addition, teamwork was acknowledged as an important element of the Construction Industry, and incorporated as part of construction courses. However, the specific and unique skills required for effective teamwork in a virtual environment were not considered important by staff or the representative bodies, and did not form an explicit part of the majority of Australian university construction programs. Interestingly, students recognised the growing importance of Virtual Teamwork skills, with many noting the lack of training in these skills as common to construction programs. These findings are important because they demonstrate the gap between the trends of the Construction Industry and the education of the future professionals.

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CHAPTER 1 - INTRODUCTION

Section - 1.1   Overview of the Study

Teams, in some form, have always been a part of social interaction and business. Teams are, after all, the coming together of people with complementary skills in the completion of a task (Dube and Pare, 2003). Much research has been done into the concept and role of teamwork in a variety of industry settings, including research into the use of traditional and existing communication technologies and skills to facilitate teamwork. However, changes in business practices and the world economy have led to the development of new practices and structures to suit the modern business environment, as Lurey & Raisinghani (2001) explain:

> "In response to the resurgence in corporate restructuring attributed to corporate layoffs, mergers and acquisitions, competition, and globalisation, many vertically-aligned organizations are now focusing their efforts on designing more flexible and versatile structures to meet the demands of the changing marketplace".

It is this search for flexible, yet effective, business practice options that has led to the development and expansion of Virtual Teamwork (henceforth VTW). Recently business has responded to the pattern of de-centralisation and globalisation by introducing virtual teams (henceforth VT's). These involve team members who are dispersed, either geographically or by time, who coordinate their work through electronic media.

VTW has proliferated as part of the newly emerging business structures, designed to cope with the changes in the world business environment. As a result, much research has been conducted on how a VTW operates as part of different business settings. In particular, the construction industry has been explored as one domain where VTW is proliferating and becoming increasingly important in supporting geographically dispersed projects teams and ever-changing technological applications (e.g. Building Information Modeling, BIM) (Duarte and Snyder, 2001, Goncalves, 2005, Hertel et al., 2005, Kayworth and Leidner, 2001-2002, Sher et al., 2009). From this research it is clear that one of the key problems confronting the use of VTW in the construction

industry is a lack of appropriate training—training that ensures construction professionals are utilising VTW to its full capacity, and adapting to its proliferation and changing technologies (Lipnack and Stamps, 2000, Zaccaro and Bader, 2003).

In this study, the problem of training in VTW is confronted from a unique perspective—by examining the role of Australian University Construction Programs in supporting VTW training. With the emerging prevalence of geographically separated construction project teams, and the growing importance of information and communication technology (ICT), it is increasingly vital that graduates are practiced in the skills associated with burgeoning field of VTW in the Construction Industry.

Section - 1.2   Key Terms

In order to establish a framework for this study, and an understanding and direction for the research undertaken, it is necessary to define the key terms that will shape the research. To define Virtual Teams one must define the notion of a team, and the concept of virtuality. Literature positing definitions will be explored, in order to determine the most suitable definitions in the context of this study.

A review of some commonly referred to and often referenced definitions proposed by others has been assessed and compared, to find the most suitable definition for the purposes and scope of this study. It has been deemed unnecessary to create a new definition specifically for this study. The definitions adopted are those deemed to be most appropriate, that encapsulate the majority of characteristics and properties presented by the myriad of definitions. Therefore, the definitions forming the framework of this study are those that are the most suitable amalgam of common definitions found in the relevant literature.

1.2.1 *Team*

The terms 'group' and 'team' have traditionally been thought to be synonymous. There is, however, a difference between a 'group' and a 'team'. The recognition and examination of this differentiation is key to an understanding of the issues and challenges specific to a 'team'.

In the literature related to teamwork, there are some specific characteristics that differentiate a 'team' from a 'group.' Powell et al (2004), drawing from existing literature, concur that "the term 'team' should be reserved for those groups that display high levels of interdependency and integration among members" (p 7). Lurey & Raisinghani (2001) add to this by defining a team as a "group of people who share a common purpose or goal and interact interdependently within a larger organisational setting" (p 2). However, these definitions offer a simplistic differentiation that does not capture the full range of characteristics that differentiate a 'group' and a 'team'.

A more extensive and encompassing definition is in Dube & Pare's (2003) study, who define a 'team' as:

> "a small number of people with complementary skills, who are committed to a common purpose, set of performance goals and approach for which they hold themselves mutually accountable" (p 3).

Powell et al (2004), utilises and discusses the definition presented by Cohen & Baily (1997) who define a 'team' as;

> "A team is a collaboration of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems, and who manage their relationship across organisational boundaries" (p 241).

As explained by Powell et al (2004), the defining features of a 'team' presented and encapsulated by this definition are:

- Unity of purpose
- Identity as a social structure
- Shared member responsibility for outcomes

Powell et al (2004) saw these as appropriate to "capture traditional as well as virtual teams" (p 7). This concept of consistency of characteristics of traditional as well as virtual teams (henceforth VT's) is fundamental to this study being reported.

Through an understanding of the commonalities of these popularly accepted and extensive definitions, the characteristics that differentiate a 'team' are revealed. These characteristics provide specific challenges and required skills. Furthermore, these challenges are added to when aligned with the concept of a 'virtual' environment.

1.2.2 *Virtual*

The accepted definition of a team is broad enough to encompass all forms of team, for this reason it is important to establish an understanding of what makes a team 'virtual'. While much literature defines 'virtual teams' as opposed to 'traditional teams', very few definitively define the key term 'virtual'. Davis (2004) discusses the emergence of the term:

> "The concept of 'virtual' was created in the 1960's to describe the temporary allocation of memory used to increase power in the IBM 360 series of mainframe computers. Being virtual implies a surge in power that results from marshalling distant, disconnected resources for a short period, then reallocating these resources to other needs" (p48).

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In addition, Lipnack and Stamps (2000) explore the definition of 'virtual', exploring the root of the word and accepted general definitions, and applying it to the field of teamwork, defining the 'virtual' as:

> "The newest meaning of virtual attests to forces that have moved teams into an altogether different realm of existence- virtual reality- or, more precisely, digital reality. Electronic media together with computers enable the creation of new kinds of spaces. They are real to the groups that inhabit them, yet are not the same as physical locations" (p 16).

This is an important idea because it explores the fact that the virtual context of the teamwork is, while impermanent in nature, important to the team members and a defining feature of their experience.

1.2.3 *Virtual Team*

With understanding of the terms 'team' and 'virtual', the merging of these ideas is vital in understanding the study reported in this dissertation. As explained above, the nature of operating in the 'virtual' is unique to the era of modern technologies, and the use of 'teams' in this environment presents unique challenges and opportunities. This unique teamwork environment has been widely researched in recent years, with many definitions for 'virtual team' presented below. It is important to have a clear definition of the term 'virtual team', because this definition will lead to the exploration of the key challenges and skills required for success in this unique teamwork environment.

Dube and Pare (2003) explain that "the term 'virtual team' has been loosely defined and used by researchers in several fields of study" (p 2). This breadth of research has led to a wide variety of definitions and interpretation of VTW. A review of the literature has revealed that many definitions have recognisable common characteristics. While some research has presented their own definition, others have synthesised and amalgamated definitions based on the previous works of others.

Interestingly, while the specific terms used sometimes differ, most definitions were found to be fundamentally consistent.

For the purposes of this research it was believed that the definitions provided by Davis (2004) and Dube and Pare (2003) were too simplistic and broad, they incorporated simple elements of VTW (geographic dispersion and technologically mediated communication) but did not allow for the variety of permutations of VT's. However, the definitions presented by Lurey & Raisinghani (2001), Zigurs (2003), Powell et al (2004) and Hambley, Oneill & Kline (2007) are more comprehensive in outlining the characteristics of VT's. These comprehensive definitions were found to incorporate the different types of team member dispersion, dispersed not only by geography but by time and organisation structures, mores or attitudes. In addition, these definitions were found to provide for the differences in the composition and lifespan of virtual teams, recognising both established and swift-starting virtual teams. It was found, however, that for the purposes of this research the definition presented by Hertel et al (2005) is the most suitable; incorporating the commonalities found in the definitions of others. It defines the characteristics of a VT, but allows for the vast variety and permutations of VT's.

> "Virtual teams consist of:
> A) two or more persons who
> B) collaborate interactively to achieve common goals, while
> C) at least one of the team's members works at a different location, organisation or at a different time so that
> D) communication and co-ordination is predominantly based on electronic communication media" (p 71).

This definition provides the diversity of attributes which are identifiable in the concept of "virtual teams". Although the definition above has been deemed most suitable for this study, the exploration of the different definitions available in the body of knowledge, and the resulting determination of the most suitable, forms a vital part of the development of an understanding of the variable characteristics and challenges associated with VTW.

1.2.4 *Virtuality*

While the above provides a definitive difference between Traditional and Virtual Teams, there have been recent moves to focus instead on the virtuality of teams. As discussed by Hertel et al (2005) "instead of trying to draw a clear line between virtual and non-virtual teams it might be more fruitful to consider the relative 'virtuality' of a team and its consequences for management" (p 71).

This has resulted in an increased prevalence of management and organisational strategies to support the implementation of VT's most effectively. These strategies, however, have some trouble dealing with the multitude of team design and technological options. Instead a virtual team manager or leader needs to realise that there is no single point at which a team becomes "virtual". Managers must assess the team context and the virtuality of the teamwork practices and dimensions, in determining the best course of action suited to that teamwork situation. (Zigurs, 2003)

As explained by Zigurs (2003); "rather than thinking of a team as either virtual or not, it makes sense to think of a team as existing on a continuum of virtuality" (p 339). The more dispersion dimensions present, the more virtual the team is. An example of the changing degree of virtuality is; where the situation of an in-house team of managers who work closely together in the same building would not be classified as a VT. However, add the variable of predominant communication through technology, with little co-located face-to-face communication and it begins to move toward the virtual end of the continuum. By expanding that closely-knit team through the addition of an off-site supplier organisation, a small VT is formed. Expand the group even more with overseas consultants, and the virtuality is increased further by adding cultural and temporal dispersion, to what was primarily a situation of geographic and organisational dispersions. It is important to understand that "each type of team is different in its mix of characteristics, appropriate communication processes and best-fit choices about technology and member roles" (Zigurs, 2003, pp341). This understanding leads to a greater appreciation of the

variety of design and management choices available, as well as the diversity of skills that will be required to effectively operate in the myriad of VT structures and practices.

1.2.5 Skills

The research reported here aims to determine the key 'skills' required for effective VT participation. It is important, at this point, to establish what is meant by the term 'skills'. While simple and effective, it is problematic to think of the requirements of effective VT participation as 'skills' alone. In the area of skill investigation and application of requirement for effectiveness, there has been a movement towards the recognition of knowledge, skills and competence (or KSC). One of the key strengths of focusing on the inputs for effectiveness of these three facets is the fact that it is related to the learning outcomes, rather than the routes of learning (Maznevski and Chudoba, 2000). While the definitions of knowledge and skills are slightly more straightforward, the area of competence has been found to be more difficult to define. While all three elements are factors in professional effectiveness, it has been deemed that the term 'skills' is suitable for the context of this research and nature of the investigation of Australian University Construction Programs.

Knowledge

Knowledge is not simply a measurable manifestation of intelligence, but is rather the interaction of one's capacity to learn (intelligence) and a given situation, or opportunity to learn. This makes knowledge more socially constructed than intelligence. Furthermore, when referring to an "understanding" of a topic, it is a more holistic knowledge, which includes the processes and contexts (Maznevski and Chudoba, 2000). Importantly, knowledge is not just information, but the effective application of that information to a given context. This is why it can be difficult to separate knowledge and skills, according to Winterton et al (2005) "at higher levels, knowledge is converted to skills" (p 9).

Skills

Skills are most simply mental and physical abilities that have taken time to acquire. Skill is used to "refer to a level of performance, in the sense of accuracy and speed in performing particular tasks" (Maznevski and Chudoba, 2000). However, in the field of VTW it is important to understand that the skills being discussed are not necessarily simply physical or repetitive actions, but are the application of acquired knowledge to unique situations. It is important to understand the nature of skill acquisition and cultivation, it is a "developmental process…over time and is nurtured by reflection on experiences." (Jarvenpaa and Leidner, 1999, pp 243) Meaning that skills; the application of knowledge, is learned from exposure and reflection until it becomes a 'habit'. However, the work of Cox (1934), as discussed by Winterton et al. (2005), presents an important point: while skills are learned from experience and reflection, training can improve and accelerate the learning of skills. This was found in the research by Cox (1934), who looked at the development of physical and mental abilities in assembly operations, and found that while the learning curves between trained and untrained groups were parallel, performance was higher in the group that received training.

Competence

A definition of competence is difficult to create, as explained by Winterton et al. (2005), it is often inconsistently dependent on cultural traditions, and "epistemological assumptions", and the rationale for its use. However, generally, competence is the application of skills to a unique situation and is dependent on one's previous experiences and non-technical attributes. Epstein and Hundert (2002) explain that competence is based on a foundation of basic skills and one's moral development. Competence includes a "cognitive function" - the acquisition and use of knowledge to solve problems, an "integrative function" – the application of different fields of knowledge and skills to a situation, and a "relational function" – the application of personal morals and judgement. Epstein and Hundert (2002) explain that the establishment of professional competence is developmental in nature, is impermanent and dependent on the context in which it is developed. This is echoed

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by Winterton et al. (2005)who further explain the personal nature of competency; "competency thus captures skills and dispositions beyond cognitive ability, such as self-awareness, self-regulation and social skills" (p 14).

As the discussion of knowledge, skills and competency has demonstrated. Each element forms part of the next. As Winterton et al. (2005) state "if intellectual capabilities are required to develop knowledge and operationalising knowledge is part of developing skills, all are prerequisites to developing competence, along with other social and attitudinal factors" (p 17). In the field of VTW, this is an important concept to understand. While one may have the information available, it is the realisation of the applicability of the information to a situation that creates knowledge, the understanding and application of that knowledge effectively that forms the skills and the personal competencies involved in effectively applying knowledge and skills to a situation, that ensure effectiveness as a VT member or leader.

Section - 1.3   Research Context

The growing prevalence of VTW in the construction industry, both domestically and abroad, demands an in-depth understanding of VTW knowledge and practice. The following discussion presents a review of the existing literature on VTW, particularly as part of the construction industry and within the university education sector. Of specific interest are the skill profiles associated with VTW in this sector, and the challenges that may be exacerbated by the nature of the construction industry. In addition, existing literature on education and VTW is also examined to determine the prevalence and practice of VTW in the education sector, in construction and other educational fields more generally. The aim of this discussion is to develop an understanding of the existing knowledge on VTW, in order to identify the gaps in existing knowledge on VTW and contextualise the enquiry and findings of this research project.

1.3.1 *VTW in the Construction Industry*

The growing importance of ICT, an integral part of the virtuality of a team, in the Construction Industry has been widely acknowledged. "Vision Five" of the *Construction 2020 Vision Report* by Hampson and Brandon (2004) for the Cooperative Research Centre for Construction Innovation notes that:

> "developments in ICT have the potential to radically change…the property and construction industry" (p 20) To achieve this type of radical change, the report also recognises that "using state-of-the-art ICT tools should be standard fare in all industry education and training programs" (p 21)

This visionary report represents a broader, burgeoning recognition of the importance of adopting VTW practices in the construction industry, particularly through the practice of Building Information Modelling (BIM). The nature of work in the construction industry is predisposed to the practices and processes of VTW. According to Rezgui (2007a), the construction industry is characterised by a series of challenges and problems that can be effectively addressed through VTW, including:

> a) non co-location of individuals and teams collaborating on projects;
> b) project-oriented nature of the industry with people tending to be involved in multiple projects at once;
> c) multi-disciplinary and mobile working practices; and,
> d) temporary and short term nature of business relationships.

As Rezgui (2007a) explains; the "increasing sophistication and complexity of design and construction processes" and the "continuous introduction of new techniques and materials" (p 97), has led to the need for multi-disciplinary, swift-starting teams, who are often geographically dispersed. Indeed, it can be argued that the incorporation of ICT and VTW has the potential to change the processes and practices of building design and construction in radical ways (Rezgui 2007a).

In addition, the construction industry is experiencing changes in the modern business environment, which further justify the adoption of VTW. Alshawi and Ingirige (2003) in their study identify seven key challenges facing project management in the construction industry, namely:

- Globalisation of the marketplace
- Economic forces
- Increased project complexity
- Need for faster results
- Rapid changes to project scope to expand benefits
- New procurement practices
- Client sophistication

Many attempts have been made to address these key challenges, particularly though the use of technology. For example, Hassan and McCaffer (2002) detail the initiatives of the European Large Scale Engineering project, which sought to address these key challenges facing the construction industry, such as: the Architecture Methodologies and Tools for Computer Integrated Large Engineering (ATLAS) project, the Collaborative Integrated Communication in Construction (CICC) and Computer Models for Building Industry in Europe (COMBINE).

Clearly, the adoption of technologies and adaptation to the construction industry is important to maintaining the ongoing competitiveness and productivity of the sector. One of the most vital initiatives in technological adaptation is the development of virtual enterprises (e.g. BIM) defined as "a business structure unified by its mission and distributed goals, not its control system" (Rezgui 2007a, p 106). It can be argued that the inherent challenges of working in the construction industry are predisposed to VTW practices—the technologically supported project team is "something that the construction industry can quite easily embrace" (Cornick and Mather, 1999, pp 123). Indeed, in many ways the everyday work of construction project teams is inherently 'virtual' in that the project teams are made up of a variety of participants representing both the commercial interest of their firm and their own individual interests as professionals (Cornick and Maher 1999). The project team then comes

together to produce a deliverable, but are separated in their interests, professions and locations. BIM addresses this separation through the unification of the project team in the creation of a virtual representation of a building project throughout its lifecycle—from initiation to completion. This specific nature of virtual enterprises in the construction context leads Rezgui (2007a) to present an industry-specific definition of a virtual enterprise; "a grouping of virtual teams bound by contractual agreements that collaborate at different timeframes of the project lifecycle" (p 106).

Despite the widespread recognition and adoption of virtual enterprises in the construction industry, it is commonly noted that these enterprises are not operating effectively in this domain. Rezgui (2007a) attributes these problems to insufficient understanding of the technologies supporting VTW, which leads to a lack of motivation, trust, satisfaction and operational effectiveness. This is echoed by Hassan and McCaffer (2002) who explain that both the process 'concepts', and the technological 'provisions' are important in the success of virtual enterprises—such that "both aspects support each other – the technology will enable the realisation of the concept. However if the technology is provided without people first fully embracing the concept, the overall process will fail to be effective" (p 432). Therefore, it is vital to ensure that not only technologies are provided, but that people are educated in their application and the potential benefits of their implementation.

Detailing the barriers faced by VTW in the construction industry, Rezgui (2007b,pp 75) compiles a list of common limitations to implementation in this sector, including:

- ICT tends to be perceived as invasive in the sector and individuals need constantly to adapt to continuous introduction of new technologies emerging in the workplace
- Teamwork between distributed actors in participating companies on projects is supported, at best, by web-enabled document management systems.
- ICT systems require constant adaptation and re-configuration for new use and deployment.
- ICT tends to be application centric, dedicated to engineering functions, within specific lifecycle stages, with little full lifecycle support.

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- Project best practices and know-how are available, at best, in the form of documents stored/archives on company intranets.
- Traditional contractual practice is based on signed copies of paper documents, even when the later are produced electronically.

One of the most pervasive and common problems across these areas of implementation is training. Rezgui (2007a) emphasises the importance of training and continuous learning explaining that the benefits of the technological innovations can only be realised through "individuals at all levels learning and developing a considerable array of new capabilities" (p 110). This learning and development should extend beyond technological aptitude, and will most positively affect VTW participants if it is structured in nature, and fosters the important teamwork factors "cohesiveness, trust, teamwork and commitment to team goals, individual satisfaction, and higher perceived decision quality" (Rezgui 2007a, p 85). It is education in these non-technical skills that will support the implementation and effective use of the technologies designed to support VT interactions. The review of key challenges and required skills for VTW effectiveness, herein, echoes this point. That it is the team members and their interactions that determine the success of the team, not the technologies chosen to support these interactions. Importantly, while the technologies utilised may change, the skills required for the effective leadership, management and participation in VTW will continue. These skills are required in graduates, to enable them to function effectively in the changing construction industry.

Building Information Modelling (BIM)

BIM is a technological movement in the Architecture, Engineering and Construction (AEC) industry. As Computer-Aided Design (CAD) replaced hand drawn representations of building, so BIM has replaced CAD. The importance of BIM in the future of the construction industry has now been widely agreed and demonstrated. From Hardin's (2009) account of the *Interoperability in the Construction Industry* report; "49% of owners are demanding BIM be used on their projects, and 47% of construction industry professionals are choosing to use BIM". The process and practice of BIM in the AEC industry is comparable and consistent

with the expansion of VTW practices in other industries. It could be argued that the development of BIM is symptomatic of the same technological and sociological factors that led to the development and practice of VTW; enhanced digital communication and technological capability, coupled with increased complexity and distribution of the business environment.

While BIM can take many forms, it is defined by its capabilities and the richness of the model created. BIM involves the creation of an accurate virtual model of the construction project, and when completed, should include precise geometry and all relevant information needed to facilitate the construction and procurement of the construction project (Eastman et al., 2008). The definition of BIM posited by Hardin (2009) includes an important element; that the BIM model is designed to be shared between stakeholders in the construction process and "intends to increase the amount of communication and collaboration" (p 3). This is a recognition that the industry movement towards the implementation of BIM in intrinsically related to the established practice of VTW.

The implementation of BIM is argued to provide a vast array of advantages to the construction industry. The first is the replacement of cumbersome traditional documentation systems that have been fraught with inefficiencies and communication difficulties. As explained by Hardin (2009), productivity loss in the AEC industry in the United States (largely resulting from communication inefficiencies and inadequate coordination) has been valued at US$60 billion. The traditional system, including the use of CAD, created a vast plethora of drawings, sections and elevations. These were then passed between project team members. The difficulty arose not only in the interpretation and integration of these figures into other facets of management, such as scheduling and estimating, but also the difficulties of document control—any changes made to one drawing would have a flow-on effect necessitating change in many other drawings. This cumbersome documentation process led to widely reported inefficiencies in the AEC industry. The use of BIM is an attempt to address, and possibly overcome, these issues.

The potential advantages of BIM have been explored widely as the technology and practice has grown in implementation and popularity. While the accurate integrated model of the building is the key advantage, research has found that the implementation of BIM has led to other benefits. According to the CRC for Construction Innovation (Hampson and Brandon, 2004) other related benefits include:

- Faster and more effective processes
- Better design
- Controlled life-cycle and environmental data
- Better quality production
- Automated assembly
- Better customer service

However, while there has been much evidence put forward on the advantages of BIM, there has also been a range of difficulties identified with the implementation and application of BIM technology and processes. As explained, BIM involves the creation of a centralised database model of a project, with all stakeholders adding to and working on a centralised singular virtual model. It has been found that this practice has led to an initial difficulty in the legal relationships between parties. This is related to the ownership of knowledge, the distribution of risk, the culpability of parties for problems and the reward of parties upon completion (Maznevski and Chudoba, 2000, AIB, 2006, Azhar et al., 2008).

In addition to the new legal difficulties, there is the issue of technological interoperability. It has been found that the variety of software packages available has led to issues of file sharing. Where drawings were once accessible to all, companies are now finding the need to purchase different software packages for different projects. This is a particular problem for those supply chain companies not large enough to support an investment in the required software (Eastman et al., 2008).

Together with the issues of legality and technology, the research on BIM is also increasingly recognising the importance of the team members in the virtual project.

Indeed, many of the key challenges in BIM are consistent with those challenges found in VT literature. Hardin (2009, p 4) explains that "BIM is not just software. BIM is a process and software". This is important because it stresses the importance of the capabilities of those implementing the software, in the overall success of the project. The importance of the people implementing this technology is echoed by Maznevski and Chudoba (2000) who explain that the factors that affect the success of BIM depend on "how well and at what stage the project team works collaboratively on the digital model" (p 7).

The importance of team work not only arises as part of the project team, but also at a company level. At this level, the challenge of managing and supporting communication between parties in the project team is vital (a process which is also related to the technological interoperability issue discussed above). When implemented effectively BIM can clearly facilitate and improve communication, but getting all project team parties working together and more easily sharing knowledge can be challenging (Hardin 2009). Effective management is the key to facilitating communication and cohesion in the project team.

With the ever growing prominence of BIM and research on its implementation, the realisation of a skills shortage in AEC industry graduates is also increasingly noted. The importance of continual training for staff members in companies implementing BIM widely recognised, but so too is the development of competent graduates (Maznevski and Chudoba, 2000, AIB, 2006). Azhar et al (2008) presents a summary of a study of the UK AEC industry, which found that approximately 70% of participant companies indicated that they are using or considering BIM, and 75% of participant businesses considered applicant experience with BIM to be an advantage in employment prospects. This finding is echoed by the work of Gilligan and Kunz (2007) who also found through their survey of the US, that there is a shortage of competent BIM modellers, and that demand for them will grow exponentially.

BIM is, essentially, the AEC industry-specific interpretation and implementation of VTW practice to the unique project based business environment of construction. As such, this research project has found that the challenges faced, and skills necessary to

be successful in VTW are consistent with the difficulties and skills required for success in BIM—including technologies and technological skills as well as non-technical skills such as communication facilitation, management and cohesion. This research recognises the key links between BIM and VTW—recognising the need for better training in the core skills common to implementing these technologies, in ways that enable construction industry graduates to work effectively in the virtual business environment of tomorrow.

1.3.2 *VTW in Education*

There has been a burgeoning interest and emphasis on the importance of learning, or educational experience, to reflect the modern technological business environment of the construction industry. The CRC for Construction Innovation has been particularly active in developing education and training as a key area of construction education, with 'education and training' in ICT skills placed as Vision 5 in the Hampson and Brandon (2004) C*onstruction 2020 Vision Report.* Also, in the report by Kajewski et al. (2001); *Improving ICT Integration in Today's AEC Industry,* the importance of training and education was reiterated, including recognition of the need for "high quality online training and courseware" (p 44). This courseware needs to become "a standard method of training, thereby altering the adult learning experience in future decades" (Kajewski et al., 2001, p 44). While these studies promote professional development, the education of graduates is equally important, as they will be expected to graduate and operate as professionals in the industry.

Educational institutions are increasingly recognising the need for training in VTW, to equip construction professionals of the future with the skills required as part of the modern business environment. The current education mode commonly introduced in construction education is of 'e-learning'. A style of teaching and learning that is implemented in an online environment and heavily reliant on technology, thus providing a useful introduction to the context of virtuality.

There are many diverse versions of 'e-learning' in construction education as a result of the proliferation of communication technology. Wall and Ahmed (2007) identify one example of e-learning—a construction based simulation game that facilitates collaborative learning. From their description, this simulation game involves participants using technologically-mediated communication to solve a problem.

Although e-learning offers a useful tool for construction education, much of the literature does not address the skills required to use e-learning technology effectively, particularly as part of a team environment. As Baan and Maznevski (2008) explain, "learning the technology is not enough: a valuable training and development program also addresses the issues around communication and trust" (p 345).

To this end, it is important to identify the skills and competencies required to undertake e-learning, particularly as part of a team. The following presents the key characteristics that e-learning and VTW education programs should include (see Baan and Maznevski (2008):

- **Intact, complete groups –** the entire team is part of and is affected by complexity, invisibility and restricted communication and must develop shared understanding, trust and effective communication.
- **Blended learning techniques –** blended learning parallels the team's own processes." And by representing the actual workplace, "the transfer from learning context to actual is smoother.
- **A modular approach –** looking at sections to reflect the complexity of VT's
- **Action-learning design –** teams work together with facilitated learning processes on real-life problems, identifying practical solutions and implementing them while paying attention to skill development and learning.

Sher and Williams (2007) identify an example of VTW education that incorporates these characteristics as part of a VTW integrated project for undergraduate (on-campus and distance) students. The project was designed to replicate the construction industry, with students 'running' a construction company of their own. This research

explored the experiences of the students, discovering that the students considered collaboration in the virtual context challenging, but vital for negotiating and working in the industry. The project also addressed the issue of assessment of students' involvement to ensure a fair appropriation of marks commensurate with the effort displayed. To this end, this study utilised a mixed marking approach involving a combination of a shared group mark, peer assessment and individual marks. It was recognised that this marking approach had a "primary purpose of motivating, directing and enhancing student learning" (p 262). This is a demonstration of the exploration and addressing of a key concern in the education of VTW; the perception of fair marks reflective of effort.

Another example of VTW research in the education sphere is the work of Sher et al. (2009). Their research explored the skills required for VTW in the design stage of a construction project, as part of the education context. While this research aimed to use the education context to replicate the practices of the industry, it also presented some skills found to be necessary for effective VT participation. The research explored whether the generic skills involved in co-located face-to-face teamwork were adequately transferable to the virtual context, what unique skill requirements might be revealed, and to what extent the virtuality of the context would affect the perceived importance of different skills. The project involved putting student groups into three experimental conditions: traditional co-located face-to-face; virtual design using a shared electronic whiteboard; and, virtual design using a high bandwidth 3D virtual world. It was found that there was a "significant increase in the frequency of *shared situation awareness* and a significant decrease in *decision making* as bandwidth conditions increased" (Sher et al. 2009, p 25) This is an important finding because it demonstrates that the increasing virtuality of the teamwork context affected the running and effectiveness of the team—as the context became more virtual the team members were found to need more reassurance that they were 'on the same page'. In this context, the team tended to explore fewer options in making decisions and were content to accept an idea posited by another teammate, perhaps in order to complete the assignment.

Both Sher et al. (2009) and Sher and Williams (2007) involved determining the applicability of traditional teamwork skills to the virtual environment, and the implications of virtuality on those skills. The work of Sher et al. (2009) simply used student groups as a convenient environment to try to emulate the practices of the construction industry. The work of Sher and Williams (2007), however, explores the student experience in the use of VTW in education. Sher and Williams (2007) is significantly related to the study reported in this dissertation because it establishes the student's recognition of the inherent challenges of VTW and the relevance of VTW practices to their future in the increasingly virtual construction industry. Indeed, Sher and Williams (2007) explore a central question of this dissertation—is the growing importance of VTW skills in the construction industry reflected in the education of Australian University Construction Programs?

Section - 1.4   Outline of the Study

The key objective of this study is to examine the core techniques, skills and competencies involved in effective VTW. The research develops an in-depth understanding of the core skills of VTW from existing literature on this subject. The study then investigates whether these skills are evident in construction education curricula, and how these might be better supported as part of Australian University Construction Programs. In this research the term "Australian University Construction Programs" means the University degree programs in Australia in the fields of Construction Management, Quantity Surveying and Building Surveying. These programs are then made up of a number of courses, which will be explored and investigated. In addition, the study investigates the accreditation process adopted by professional bodies within the construction industry. The aim here is to determine if the profile of VTW skills is included as part of their accreditation guidelines and graduate requirements. This will indicate the extent to which industry bodies, universities, and the VTW field are systematised and aligned.

To investigate these issues of VTW education, the research adopts a mixed-method approach. First, the study uses synonym analysis to expose commonalities in the existing literature and research on VTWs concerning the core skills of this type of work. The literature drawn on includes theoretical debates and practice-oriented reviews of VTW and its use in the construction industry. Second, this list of skills was utilised to examine each of the Australian University Construction Programs, to determine if these skills are included in individual curriculum. This was undertaken through an analysis of curriculum documentation available in the public domain, as well as interviews and focus groups with education professionals and students. Finally, the VTW skills and competencies list was also adopted to investigate the accreditation guidelines and gradate requirements of professional bodies within the construction industry, to view the extent to which these elements of construction education and industry practice align.

The results of this research are significant as the issue of VTW education has not been extensively studied, especially in the context of Australian University Construction Programs. Moreover, the demand for better understanding of core VTW skills and training is escalating with the proliferation of BIM technologies across the construction industry—thus making the correlation of industry needs and tertiary education increasingly vital in developing capable and successful graduates. The study represents a novel insight into the implications of VTW for construction education, and the current preparedness of graduates to meet to emerging needs of the construction industry.

Section - 1.5   Research Question

Are VTW Skills identified as important in Australian University Construction Programs and are these programs delivering graduates with these capabilities?

Section - 1.6   Research Aims

- Examine the education of VTW skills in Australian University Construction Programs

- Document the alignment of Australian University Construction Programs and the Construction Industry Representative Body's Accreditation Process Graduate Competencies

Section - 1.7   Objectives

1. Establish the Core Personal and Technological Skills and Competencies of VTW from the literature of the domain
2. Examine the perceptions of the teaching and learning of VTW skills in Australian University Construction Programs
3. Determine the prevalence of VTW skills in the Australian University Construction Programs
4. Examine the inclusion of VTW skills in the Professional Body Accreditation Process Key Graduate Competencies

Section - 1.8   Project Diagram

The project diagram below demonstrates the structure and methodology of this research project. As shown, the different strands of enquiry are used to achieve the different objectives outlined above. In addition, the objectives are related to the aims of this research, exploring the education of teamwork skill and the alignment with industry. The specifics of the methodology are explored and explained further in Chapter 3; however this diagram provides a clear indication of the path of enquiry used in this research. The literature review develops the list of skills and competencies, which then form the basis of the quantitative and qualitative exploration of the education and industry spheres.
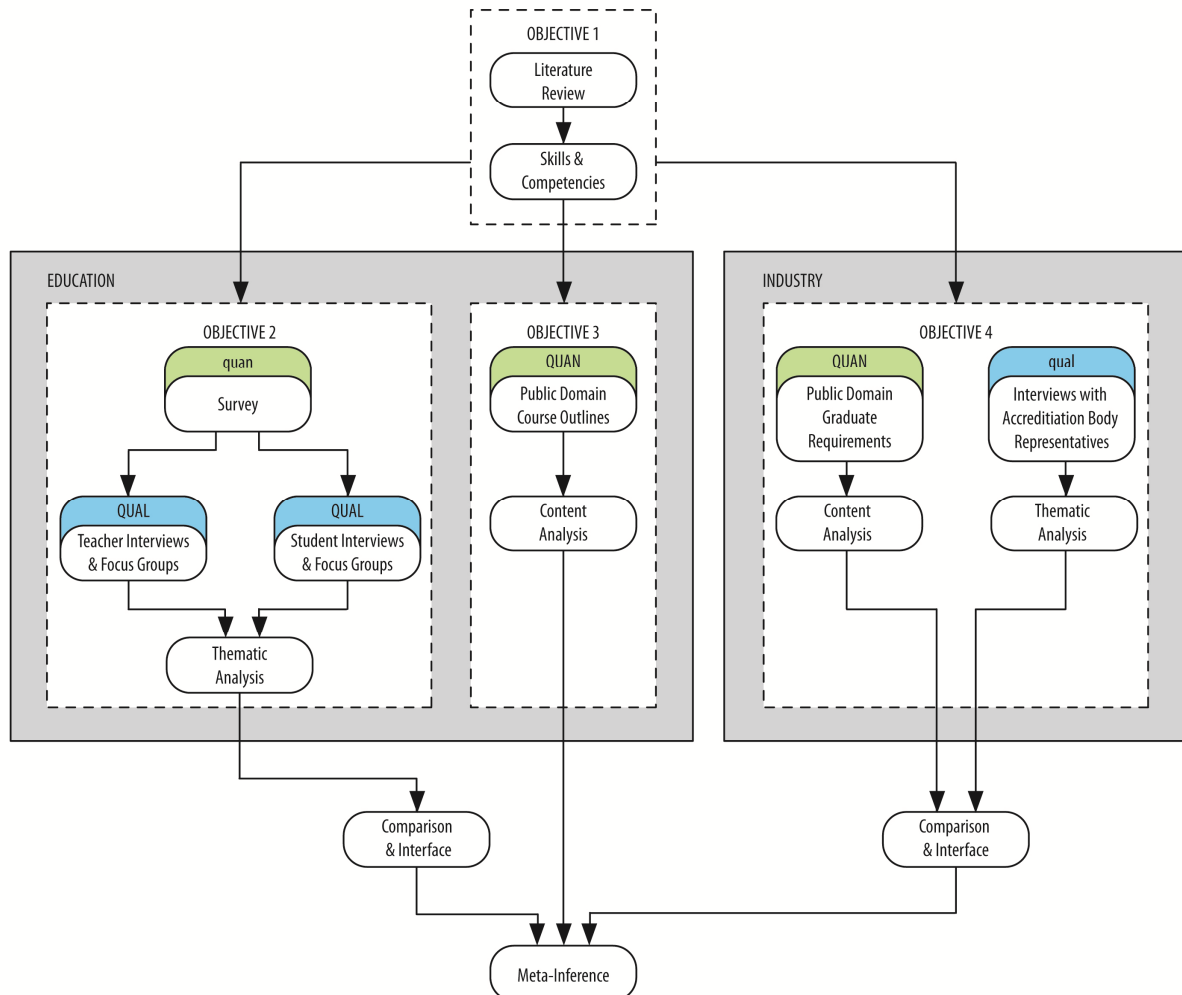
Figure 1-1 Project Diagram

Section - 1.9   Acknowledgement of Collaboration

It must be noted that the research undertaken in this study forms part of a larger study undertaken by Associate Professor Anthony Williams, William Sher, Catharine Simmons and Anne-Marie Dosen. The exploration of the area of VTW was done in addition to the larger study undertaken on behalf of the Australian Learning and Teaching Council. The larger project set out to provide a snapshot of the issues facing universities in the teaching and learning of Construction related programs. This covered such issues as staff concerns, student concerns and the accreditation process. The issue of VT education was a small facet of the study, and was based on the results of the research herein.

The collaboration and pooling of resources was limited to the delivery of the online survey and the carrying out of interviews. This was due to time and budgetary restraints, these limitations are discussed further in Section - 3.7. The content analysis of documentation in the public domain and the thematic analysis of the transcribed interviews were done separately from the larger study.

Section - 1.10   Content and Structure

This research has been structured to facilitate the achievement of the objectives and aims outlined above. This structure of the research is demonstrated in the Project Diagram in Section - 1.8, which outlines how the review of the literature will be used to determine the key skills involved in VTW, which will then be explored using a mixed methodology.

Following this introduction, Chapter 2 presents a review of the literature pertinent to the field of VTW and the construction industry. This chapter facilitates an understanding of the body of knowledge related to VTW, and contextualizes this research project by establishing the challenges, skills and competencies required for effective participation in the emerging business practice of VTW.

This chapter reviews the current body of knowledge on the key challenges and skills associated with VTW. Again, this is not always specific to the construction industry, but rather a review of the literature to identify the generic skills required for success in the practice of VTW. In reviewing this research, common skills and competencies are identified and compiled. This compilation of skills is then used in the subsequent analysis to compare the extent to which educational outcomes and industry needs align in relation to VTW.

In Chapter 3, the methodological ethos and strategies for this research project are explored, outlining the way in which the research question, aims and objectives will be explored and answered in order to establish an understanding of the education of VTW in Australian University Construction Programs.

First, the chapter establishes the research problem that needs to be addressed and explored, the research paradigm adopted and the ontology of the research methodology. Second, the mixed methodology research strategy is outlined as it is applied to examine the education of VTW skills. Based on the pragmatic research paradigm of this research, a multi-strand synchronous mixed methodology has been employed. The validity and process of this research methodology is explored and explained in this section, outlining the relationship between this particular methodology and the aims and objectives of the study. Third, the processes of participant sampling, ethical consideration and data collection are described. In keeping with the methodology the strands of research, designed to explore each objective, have been explained and outlined. Finally, the response rates achieved for the research are outlined, as well as a discussion of the limitation of this research.

Chapter 4 presents the results of the various strands involved in the methodology. These results include both quantitative survey results, and qualitative interview and focus group results. The quantitative results of the research are based on an analysis of the data available in the public domain on course structures and industry representative body graduate expectations. Also, an online survey contributed to the analysis of the education of VTW skills in university construction programs. In

keeping with the research methodology, this quantitative data was used to develop the qualitative research phase. The qualitative research undertaken in the project is then discussed, including semi-structured interviews with academics and students at each university, as well as representatives from industry bodies. These qualitative results were interpreted, and common themes were distilled from the transcriptions.

Chapter 5 presents the findings of this research. These findings were derived using the mixed method approach. This section provides a summary and discussion of the key findings in the examination of the education of VTW skills in Australian university construction programs, and in determining the alignment between the industry representative body expectations and the education of construction professionals.

Chapter 6 draws on the findings of the research to draw conclusions on the key aims and objectives of the study. These strands are explored and discussed to determine the extent to which Australian University Construction Programs are delivering graduates with the skills required for effective practice of VTW.

CHAPTER 2 - LITERATURE REVIEW

Section - 2.1   VT Characteristics, Difficulties and Skills

This section will define the key skills required for effective membership of a VT, for the purpose of exploring the development of these skills in Australian University Construction Programs. While the definitions outlined in Section 2.0 provide an understanding of what a VT is, an understanding of the key characteristics and inherent challenges associated with VTW is also outlined. By determining these characteristics and challenges in employing VTW, it is possible to ascertain the skill profiles necessary to be an effective VT member.

2.1.1 *Challenges in VT's*

Table 2.1 documents the challenges and skills associated with VTW, commonly referred to as the 'body of knowledge'. The table is not an exhaustive review, but instead identifies common themes. These themes establish the challenges and skills required for successful VT participation. Some themes are not addressed in this report, due to the fact that they were outside the scope of a VT member. These were themes related to organisational strategy and company VT implementation.

CHALLENGE	REFERENCES	FACTORS
Technology	Cohen and Gibson (2003), Duarte and Snyder (2001), Dube and Pare (2003), Hambley et al. (2007), Hertel et al. (2005), Kayworth and Leidner (2000), Nemiro et al. (2008), Powell et al. (2004), Zigurs (2003)	**Richness** **Synchronicity** **Social Presence** **Choice Selection**
Communication	Bann and Maznevski (2008), Blackburn et al.(2003), Cascio and Shurygailo (2003), Cohen and Gibson (2003), Hertel et al.(2005), Kayworth and Leidner (2000), Powell et al (2004), Zigurs (2003)	**Medium Selection** **Flaming**
Leadership	Cohen and Gibson (2003), Davis, (2004), Duarte and Snyder (2001), Hambley et al. (2007), Hertel et al. (2005), Kayworth and Leidner (2000), Nemiro et al.(2008), Zaccaro and Bader (2003), Zigurs (2003)	**Motivation** **Cohesion** **Selection** **Trust** **Conflict Resolution**
Trust	Blackburn et al. (2003), Cascio and Shurygailo (2003), Baan and Maznevski (2008), Cohen and Gibson (2003), Dube and Pare (2003), Hertel et al. (2005), Nemiro et al. (2008), Powell et al. (2004), Zaccaro and Bader (2003), Zigurs (2003)	**Development** **Trust Types** **Maintenance**
Culture	Blackburn et al. (2003), Cohen and Gibson (2003), Duarte and Snyder (2001), Dube and Pare (2003), Hertel et al. (2005), Kayworth and Leidner (2000), Nemiro et al. (2008), Powell et al. (2004)	**National** **Functional** **Organisational**
Management	Blackburn et al. (2003), Cascio and Shurygailo (2003), Cohen and Gibson (2003), Hertel et al. (2005), Kayworth and Leidner (2000), Powell et al. (2004)	**Member Selection** **Cohesion** **Conflict** **Facilitation**

Table 2-1 VT Challenges

2.1.2 *Technology*

While many of the challenges faced by VT's are also of concern to co-located teams, the difficulties inherent in a group of people coming together to solve complex problems is only exacerbated by the reliance on technology. (Bradley, 2008). The virtuality and reliance on technologically-mediated communication is a defining feature of VTs, and the reliance on technology has been found to relate directly to the

other key challenges in VT effectiveness. For example, the technology used to support the teamwork will affect communication. This effect on communication between parties in turn affects the level of team cohesion and satisfaction felt by team members (see Section 2.1.7), as well as affecting their trust of one another (see Section 2.1.5). This is why an understanding of the technological options available, and their inherent challenges and strengths, is important for VT members, so they can know what effect the technology selected will have on the functioning of the team.

It is commonly agreed that there are two major factors related to technological options that directly affect VTW: social presence and media richness (Bradley, 2008, Duarte and Snyder, 2001, Hambley et al., 2007). An understanding of these factors, and awareness of the different technological options, will lead to a better assessment of suitability and limitations for each unique VTW situation, and understanding of the skills required for their effective use.

First, social presence can be defined as "the degree to which the technology facilitates a personal connection with others"(Duarte and Snyder, 2001, pp26). It is through this 'connection' that effective communication and team cohesiveness can be achieved. The degree of social presence attributed to a teamwork technology is most commonly determined by its degree of synchronicity. As explained by Hambley et al. (2007, p 3), "synchronous interaction occurs when team members communicate at the same time (in real time)."

It must be noted that synchronous technology with a high degree of social presence – the technology best at replicating face-to-face interaction – will not always be the most suitable for all situations, depending on the constraints of the project or team structure. As Duarte and Snyder (2001) explain, "the reality is that social presence is not inherently good or bad. Its usefulness depends on what the group is trying to accomplish" (p 27). Common communication and tasks carried out by team members may not require technology with a high degree of social presence, however tasks and communication involving ambiguity, uncertainty or difficult problem solving that

need richer communication, may require technology with a greater degree of social presence. This reinforces the notion that an awareness of the degree of social presence attributed to a technological choice, and the needs of a given situation, will better facilitate an effective choice of technology.

The second method in determining the limitations and suitability of a technological option is the degree of media richness. Daft and Lengel (1986), describe a rich medium as one that allows for:

(1) transmitting multiple verbal and nonverbal cues;

(2) using natural language;

(3) providing immediate feedback;

(4) conveying personal feelings and emotions

(quoted in Hambley et al., 2007, pp 3)

This rich communication can best be exemplified through the example of a video-conference, where there is not only verbal communication, but also non-verbal cues, facial expressions and the use of diagrams. Rich communication tools thus allow for a diversity of views and the ability to synthesise these divergent views (Piccoli 2001). These characteristics can be vital for transferring meaning effectively, thereby reducing confusion and misunderstanding (Duarte and Snyder 2001).

In order to effectively select the level of communication required, technologies can be ranked according to the richness of their interactions. Piccoli (2001) provides a ranking of technological options in descending order from richest to most lean:

- Co-located face-to-face interaction
- videoconferencing
- telephone conversations
- audio-conferences
- email
- personal written documents
- numerical documents.

Co-located face-to face interaction is commonly noted as the richest form of interaction, with other technologies being placed on a continuum.

However, it is vital to note that the richness of a communication medium is also dependent on the context in which it is used—when, by whom, in what setting. As Zigurs (2003) suggests, "richness of a communication medium may be relative, depending on how well you know your communication partner, the context, the topic, and so on" (p 346). This explains why an email between friends may be an effective form of communication, yet an email between business associates may prove ineffective in communicating the intended message. This point illustrates that while media richness can be ranked, it is the suitability of a technology choice for a specific situation that will determine its effectiveness—this suitability is a vital consideration for VT settings.

This consideration of suitability is particularly important, and increasingly complex, as part of the growing technological options available in the construction industry. Due to the fact that no VT situation is identical to another, a diversity of technologies has been developed, with an even more expansive variety of companies employing variations of programs and processes. While it will be very difficult for any VT member to fully understand every technology and tool available, adequate training should be provided in a variety of technologies, ensuring that professionals are capable of adapting to new technologies, or selecting appropriate ones to adopt for their purposes. (Kayworth and Leidner, 2000) Table 2.2 presents a list of technologies grouped into the broad areas of: electronic messaging, audio-visual systems and group support systems. The synchronicity and richness of each technology is also discussed, along with social presence.

Table 2-2 Technology Factors

Technology	Synchronicity	Social Presence	Richness
Messaging			
Email	Asynchronous	Low	Lean
Voicemail	Asynchronous	Medium	Moderate
Bulletin Boards	Asynchronous	Medium	Lean

Blogs	Asynchronous	Medium	Moderate
Audio-Visual Systems			
Teleconferencing	Synchronous	Medium	Moderate
Videoconferencing	Synchronous	High	High
Electronic Display/Whiteboard	Synchronous	Medium	Lean
Group Supporting Systems			
Desktop and Real-time Data Conferencing	Synchronous	Medium	Moderate
Non-Real-time database sharing and conferencing	Asynchronous	Low	Lean
Group Decision Supporting Systems	Can be Both	Medium	Moderate
Discussion Database	Can be Both	Medium	Lean
Team Web Templates	Asynchronous	Low	Lean

The table, 2.2, above provides a succinct overview of the characteristics of the variety of communication technologies available to the VT member. As previously discussed, it is not necessary for VT members to be expert in all technological options. But an understanding of the variety of options and their inherent challenges or strengths will ensure the effective selection of a technological option to suit a unique teamwork context. It is important for VT members to have a broad understanding of the comparable characteristics of technologies, to aid the decisions regarding the suitability of options.

Technology Choice

A key part of discussing technologies in VT is technological choice. As discussed, there are three main factors upon which VT technological choices can be assessed; richness, synchronicity and social presence. Important to the successful integration of these technologies is the selection and utilisation of the most suitable options. For example, Maznevski and Chudoba (2000) found in their case study that team effectiveness was impacted by the richness of selected communication media and its suitability to the level of decision processes. According to their observations; "email, faxes and short phone calls are best for gathering information, longer phone calls and conference calls for solving problems, and face-to-face meetings for generating ideas and making comprehensive decisions" (p 83).

While each new technology that emerges may seem vastly different from others, by determining these key assessable characteristics, new technology can be placed on a number of continuums and be assessed along with existing technologies. After all, the latest technology is not always the most suitable. It is easier to deal with the constant changes and additions to the pool of available technologies, if one can establish and understand the "underlying and relatively constant characteristics by which technology might be defined"(Zigurs, 2003,pp 346). In so doing, the VT members can select the technology that is best suited to the characteristics of the team and the challenges of the tasks to be undertaken. It is important to understand, however, that the most suitable technology will be different from one VTW task or situation to another, and that more richness or social presence is not always better. (Duarte and Snyder, 2001)

Very few VT's will utilise only one technology, instead a variety of communication and information sharing technologies are utilised for different tasks and elements of the team's project. Jones et al. (2005) present the table, 2.3, below to show clearly their recommendations of technological suitability. They have divided all VTW into 3 group types and 3 communication requirements.

Table 2-3 Technology Task Suitability

	One-on-One	Small Groups (<15)	Large Groups (>15)
Routine project documentation or updates	* Project Web sites	* Project Web Sites * Audio conferences (possibly combined with meeting management software) to discuss project status and answer questions	* Project Web Sites * Audio conferences (possibly combined with meeting management software) to discuss project status and answer questions
Day-to-day organisational announcements and bulletins	* Email Updates * Phone Conversations	* Email updates * Organisational newsletters * Company or organisational portal	* Email updates * Organisational newsletters * Company or organisational portal * All-hands meetings held via audio conferencing / meeting management software

Organisational announcements with considerable new or controversial data	* Phone Call	* Audi conference combined with meeting management software * Follow-up via company or organisational portal * Follow-up via email summary	* Audi conferences combined with Web cast * Follow-up via email notification * Follow-up via company or organisation portal

Likewise, Duarte and Snyder (2001) present a table, 2.4, outlining the different common tasks performed by VT's, and then assess the most effective technology to use. Each technology category is rated as either a Good, Marginal or Poor fit, "by evaluating the amount of social presence and information richness delivered by the technology versus what is needed to perform the task" (p 28). Note, Duarte and Snyder (2001) do not discuss the importance of synchronicity.

Duarte and Snyder (2001) group the available technologies into three general types:

1. Data-only systems (such as email)
2. Audio-only systems (such as audio conferences and voicemail)
3. Video Systems

They go on to separate the common tasks undertaken by VT's into four categories:

1. Generating ideas and plans about the team's work, including collecting data to make decision about plans
2. Solving routine problems where answers already exist
3. Solving ambiguous or complex problems where routine answers may not exist
4. Negotiating interpersonal or complicated technical conflicts between individual team members or organisations

Table 2-4 Technology Task Type Fit

	TASK TYPES			
Communication Modes	**Generating ideas and Plans and Collecting Data**	**Problems with Answers**	**Problems without Answers**	**Negotiating Technical or Interpersonal Conflicts**
Audio Only	Marginal Fit	Good Fit	Good Fit	Poor Fit
Video Only	Poor Fit	Good Fit	Good Fit	Marginal Fit
Data Only	Good Fit	Marginal Fit	Poor Fit	Poor fit

Source: Duarte and Snyder (2001)

While the assessment of technologies' appropriateness have been provided above, research into the specific tasks carried out by VT's and their relationship to the unique characteristics of each technological option is limited.

Dube and Pare (2003) present the effects of technological characteristics on the function of VT's:

- "the richer an ICT, the more it facilitates shared meanings, insights and rapid understanding"(p 9).
- "asynchronous technology gives team members more time to reflect and write their answers, it is not very effective when information is urgent, because it may cause delay" (p 9).

It must be remembered that the characteristics of synchronicity, richness and social presence are not mutually exclusive. Technologies instead comprise different levels of each characteristic. However, common relationships can be found, for instance Dube and Pare (2003) explain that "most asynchronous technologies are limited in social presence and information richness"(p 9). While Hambley et al. (2007) explains that synchronous media are better suited to tasks that are more "complex and require interdependence, reciprocal communication, and feedback among team members"(p 3).

As explored above, the richest, most synchronous technology is not always the most suitable. It is important for members and leaders of VTs to be aware and understand these nuances of technology. The challenges of VTW can be either alleviated or

exacerbated by the technology used. As previously discussed, it is an understanding of these unique characteristics of technology options, which will lead to the most effective selection of technologies to support a teamwork context.

In the following sections there is a discussion of the challenges of VTW including the non-technical challenges and skills of VTW, such as communication. Key to this discussion is recognition of the interconnections of technological and non-technological challenges in VTW—such that the virtuality of the team implies all interactions are mediated or supported by the technological options adopted, and vice versa.

2.1.3 *Communication*

Core to the collaborative activity of VTW, is the sharing of knowledge through some form of communication, for the purpose of achieving a shared understanding. The distributed nature and reliance on technology inherent in a VT leads to more challenges and difficulties associated with effective communication. Powell et al. (2004) explain that to ensure the success of a VT it is necessary to "create a team of excellent communicators" (p 11). As discussed previously the difficulties associated with communication in VT's are strongly related to the inherent difficulties associated with technology and this is because of the heavy reliance of VTs on communication technologies. In order to ensure effective teamwork culture and knowledge sharing, especially as team tasks become more complex, it is necessary to ensure that frequent rich communication occurs between team members. Cascio and Shurygailo (2003) explain "research has found that frequent communication is even more important in virtual than traditional teams" (p 368).

From an analysis of existing research, Powell et al. (2004) present the key difficulties associated with communication in VTs, including:

- Time delays in sending feedback
- Lack of a common time frame

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- Differences in salience and interpretation of written text
- Assurance of participation from remote team members

As discussed previously, these challenges are all related to the VT's reliance on communication technology, therefore adding to the importance of understanding the characteristics of technology options and their effect on communication. For example, the synchronicity of the communication technology chosen affects the degree of time delay and time frame concerns, while the richness of the medium chosen affects the ease of interpretation of communication. Cascio and Shurygailo (2003) explain "by definition, a virtual team will have less face-to-face communication than a traditional workgroup. Since there is a greater reliance on indirect communication mechanisms, members of virtual teams are well advised to learn to use these effectively" (p 369).

With the growing prevalence of rich synchronous technological options of face-to-face meetings, such as videoconferencing, the issues related to communication are starting to be minimised. However, communication in a VT can be divided into two broad areas, with key difficulties and skills for each: written communication and meetings.

First, written communication has been, and continues to be, one of the most common forms of business communication. This is because it provides the sender with the opportunity to form and phrase their communication properly, and give the receiver an opportunity to store it and form their reply in their own time. However, written communication presents its own benefits and difficulties.

Due to the lack of richness associated with written communication, it is often considered as leading to the greatest communication challenges in VTs. Indeed, Zaccaro and Bader (2003) suggest that written messages are often misinterpreted, particularly when VTs include team members from different cultures.

The issue of clarity in written communication is a major difficulty to overcome. Clarity is most often affected by cultural differences, lack of social presence and lack

of communication norms (Jarvenpaa and Leidner, 1999). Davis (2004) discusses the barriers of diminished communication clarity in electronic media, and what is required of effective VT members, and concludes that "messages should be crafted after thoughtful consideration of message content and choice of communication medium" (p 53). Thus, intent and forethought needs to be part of written communication to ensure its message is relayed clearly.

One potentially detrimental result of diminished clarity is the occurrence of hostility between team members. Kiesler et al. (1984) coined the phrase "flaming", to convey team member hostility due to communication difficulties. However, more recent research suggests that such events are more common in anonymous settings (laboratory, internet chat-rooms) with short-time interaction, and with no or only restricted reprisal opportunities. Hertel et al. (2005) explains that "as soon as collaboration was expected to be longer, a common group identity was present, anonymity was lower, and/or reprisal was more likely, flaming diminished or was not observed at all" (p 82). Thus in the context of VTs, flaming should be minimised as longer term collaboration is common in these settings.

In order to ensure the minimisation of flaming, a number of team characteristics need to be fostered and encouraged, which also ensure effective use of written communication in the team. Include; stronger common group identity, lower anonymity between team members and clear reprisals for ineffective communication (Alonzo and Aiken, 2004).

In particular, common group identity, and the implicit and explicit norms that form as part of this identity, are noted as vital to ensuring effective communication as part of a team environment (Hertel et al., 2005).

The second key form of communication in a VT is meetings, which can take a variety of forms: text chat, tele-conference, co-located face-to-face, video-conference etc. The use of meetings, albeit through technologically supported mediums, is dependent on the ability of team members to be synchronously present. However, meetings are an effective way to overcome the inherent limitations of written

communication in the completion of some tasks. While synchronous meetings may not be possible in every VT situation, the ability to effectively implement and manage meetings through technological media is an important skill for VT members.

To ensure that all team members are involved in decision-making and the power of combined thought is fully utilised, meetings should make up a large part of effective communication in VT's. Using the many technologies available, meetings can take many forms and can help to transfer informal, one-on-one communication to a group forum, which frees up time and resources for all members (Cascio and Shurygailo, 2003). Indeed Cascio and Shurygailo (2003) describe meetings as "the lifeblood of virtual teams" (p 367).

It has been widely agreed that regular communication is required to ensure team effectiveness. Cascio and Shurygailo (2003) attest that regular established meetings lead to a "rhythm" in the teamwork, and a reduction in the need for written communication, with important points being brought up at the regular meetings. This reduction in the need for written communication will therefore reduce the impact of the inherent challenges associated with written communication. Furthermore, but reducing the traffic of written communication, Cascio and Shurygailo (2003) attest that when an urgent issue arises, "there is time for emails to the members of all teams, or a meeting dedicated to that issue, if the issue is important enough to justify such a meeting" (p 367). Therefore, due to the frequency of meetings, each meeting is more effective; this results in fewer ineffective communications between team-members so their workload and time is more flexible to deal with important issues should they arise.

As discussed above, the effectiveness of communication in VT's is directly related to the technology options chosen and utilised. While the technology chosen affects communication, the quality and frequency of communication in a VT flows on to affect other challenges inherent in VTW. For instance, the frequency and regularity of communication, and the level of feedback provided, improves the quality of the communication, affecting the development of trust, cohesion, cultural understanding and overall team performance (Powell et al., 2004). However, it must be noted this

interrelationship of factors flows both ways. While the quality of communication affects the development of trust and cultural understanding, the creation of a team culture that rewards regular and effective communication is also vital to team performance (Powell et al., 2004).

2.1.4 *Leadership*

VT's share many common elements with traditional team structures and the factors that influence their effectiveness. While leadership has been extensively researched and identified as a key challenge in team work settings, it has been the subject of limited study as part of VT settings (Yoo and Alavi, 2004). In correlation with the growing prevalence of the VTW, the validity of traditional leadership knowledge in a virtual context has been the subject of burgeoning research. Indeed, Zaccaro and Bader (2003) suggest that e-leadership will be the norm, and not the exception, in the field of organisational leadership.

The pivotal role of leadership in the effectiveness of a team is agreed and understood (Hertel et al., 2005, Hambley et al., 2007, Salas et al., 2005) However, the differences between traditional team structures and VT's means that the roles, demands, challenges and opportunities of leadership have changed, and effectiveness needs to be explored and redefined (Zigurs, 2003). Hambley et al. (2007) explains that "the virtual environment and its various communication technologies have created a new context for leadership and teamwork leadership within this new context has been referred to as 'e-leadership' or 'virtual leadership'"(p 1). Avolio et al. (2001) define virtual leadership as "a social influence process mediated by advanced information technologies to produce changes in attitudes, feelings, thinking, behaviour, and/or performance of individuals, groups, and/or organizations" (p 617). In the context of VTW specifically, this definition identifies a fundamental challenge, and some might argue opportunity, for e-leadership or advanced technological mediation.

Most simply, the leadership in VTW is delivered and expressed through the technology employed. This implies that effective leaders must have an understanding of the technologies available and their inherent challenges or strengths. However, in addition to required technological aptitude, the reliance on technology by both VT members and leaders affects the other pivotal roles played by team leaders. An example of such a role is the development of trust and team cohesion. This is made all the more difficult by the reliance on technology, with team leaders feeling they are the "glue" holding their precarious team together (Duarte and Snyder, 2001, pp22). It is the difficult role of the leader to establish trust in a technologically-mediated environment consisting of little or no face-to-face contact or feedback. It is challenges such as these that necessitate the development of additional skills to complement traditional leadership skills.

Studies on leadership, both in traditional and virtual contexts, identify key characteristics that are central to effective leadership. These skills can be generally categorised into four groups (Stott and Walker, 1995, Kayworth and Leidner, 2001-2002, Yoo and Alavi, 2004):

> (a) Trait: leadership and physical, cognitive and personality traits
> (b) Behavioural: actions and behaviours of leaders
> (c) Contingency: context dependent leadership methodologies
> (d) Behavioural Complexity: complex behaviours and styles dependent on all the variables of the teamwork situation

(a) Trait

Trait theory was the first systematic study of what are the attributes of a successful team leader. This theory involved the exploration of the "relationship between leadership and a variety of physical, cognitive and personality traits" (Yoo and Alavi, 2004). This included traits such as; physical appearance, intelligence and introversion/extroversion. Kayworth et al. (2001-2002) explain that "proponents of the trait theory argue that effective leaders will possess certain innate qualities or characteristics (e.g. intelligence, social maturity and breadth, inner motivation, human relations attitudes)" (p 9).

However, Kayworth et al. (2001-2002) go on to explain that while this approach of determining key factors in leadership effective has some merit, it has fallen into disfavour because "it fails to take into account actual leader behaviours as well as the contingency aspects of leadership" (p 9). The major limitation of trait theory is that it attempts to predict success or failure of a potential leader, based on predetermined characteristics. Rather than acknowledging the potential for a leader to grow, change or adapt their practices in an effort to ensure team effectiveness. (Kayworth and Leidner, 2001-2002). Furthermore, the trait theory of leadership effectiveness has been found to be flawed because "despite significant efforts by early leadership scholars, trait theories have failed to identify a specific set of individual traits that consistently differentiate between effective leaders and non-leaders"(Yoo and Alavi, 2004, pp 31). The trait theory has been built upon, with more recent effectiveness assessment theories now based more on the actions of the leader, rather than their appearance, intelligence or other measurable trait.

(b) Behavioural

Owing to the limitations identified in the trait theory of leadership effectiveness, explorations have been made into identifying the behaviours exhibited by leaders that may influence their effectiveness. Put succinctly "the behavioural view of leadership is a tradition that focuses on actual leadership behaviour as opposed to innate qualities" and research into this theory of leadership involves the observation of measurable actions of the leader, which can then be "used as a basis of comparison for leadership effectiveness" (Kayworth and Leidner, 2001-2002, pp9).

Through the 20th Century, the behaviour approach to leadership effectiveness assessment resulted in many models. Below is a chronological list of the original introduction of the commonly referenced behavioural models:

- Theory X versus Theory Y (McGregor, 1960)
- Blake and Mouton's Managerial Grid (Blake and Mouton, 1964)
- Autocratic versus Participative Leadership (Likert, 1967)
- Mintzberg's Managerial Roles (Mintzberg, 1973)

- Managers versus Leaders (Zalesnik, 1977)
- Transactional and Transformational Leadership (Burns, 1978)

The most recent behavioural school of thought is transactional/transformational leadership. The differentiation between transactional and transformational styles of leadership can be seen in their approach to relationship between the leader and the team members. Transactional leaders treat the relationship between the leader and the follower and one of exchange, gaining through offering rewards or threats of punishment. Meanwhile, transformational leadership is focused on the motivation and inspiration of the followers, to garner not only compliance but performance perhaps beyond initial expectations (Hambley et al., 2007). Transformational leaders are skilled at "increasing and broadening follower interests, gaining commitment to the goals and mission of the group/organisation, and motivating people to go beyond their self-interests for the good of the group" (Hambley et al., 2007, pp 2).

Commonly, transformational has been presented as the more effective leadership style in modern team situations. As corroborated by Hambley et al. (2007) "Both transactional and transformational leadership styles have been linked to effective performance in face-to-face teams, with transformational leadership tending to be more effective overall" (p 3).

However, the assertion that transformational leadership is more effective has not been conclusively proven in VT's. The work of Sosik et al. (1997), discussed by Hambley et al. (2007), found that transformation leadership led to "higher levels of group potency (the group's belief that it can be effective)" (p 4). However, this only led to better performance in 50% of sessions, with transactionally led teams outperforming transformational groups in the other session. Another study was presented in 1998, with the mixed results again. Finding that facets of each leadership style could be effective in different contexts, and it was a suitable mixture that would prove most effective. This is supported by Kayworth et al. (2001-2002) who explain that "In spite of its popularity, the behavioural approach to leadership still presumes one best style of leadership and fails to take into account the various

contingencies that might occur in leadership contexts (e.g. group characteristics and nature of task)" (p 10).

The key in the study by Sosik et al (1998) is that it determined that aspects of transformational and transactional leadership were found to have a positive influence on team outcomes. This idea that "aspects" of each style can lead to leadership effectiveness, depending on the characteristics of the team and situational factors, led to the development of another leadership effectiveness assessment model; contingency theory. Yoo and Alavi (2004) explain that this came about because "the behavioural theories failed to identify a clear and consistent relationship between various leader behaviours and leadership effectiveness" (p 31).

(c) Contingency Theory

The limitations of the popular behavioural theory of leadership effectiveness have led to the development of the Contingency Theory. Kayworth et al. (2001-2002) define the contingency approach by explaining that "the contingency approach to leadership assumes that there is no best style and that effective leadership depends on the fit between the leaders' variables and situational variables" (p 110). They go on to explain that "under this contingency perspective, a given manager's leadership effectiveness will be dependent on his or her particular style as applied to specific circumstances."

As with behavioural, the contingency approach has led to specific theories being presented in research. Kayworth et al. (2001-2002) present the two most significant and commonly explored:

- Path-Goal Theory (House and Mitchell 1977)
- Situational Leadership Theory (Hersey and Blanchard 1977)

While Contingency theory began to explore the idea of context influencing the effectiveness of leadership styles, it did not allow for the idea that a leader can adopt a variety of styles and skills, depending on the situation presented to them. This was found by Denison et al (1995), as explained by Kayworth et al. (2001-2002) "one

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problem with contingency based theories of leadership is that they may be overly simplistic and fail to take into account that multiple leadership styles may be applicable across a broad range of circumstances" (p 10).

The limitations of contingency theory is the recognition that "Effective team leaders show flexibility, changing as business conditions dictate" (Duarte and Snyder, 2001, pp22). This means that a theory needed to emerge that would recognise the skill of a leader to apply different styles and roles depending on the situations encountered. As quoted by Kayworth et al. (2001-2002); "most leaders interact almost simultaneously with a variety of stakeholders in multiple and rapidly changing settings covering a virtually endless list of contingencies" (p 10). This realisation led to the development of the latest leadership style assessment approach; behavioural complexity theory.

(d) Behavioural Complexity

As discussed, the development of Behavioural Complexity theory came from recognition of the limitations of the previous leadership assessment theories. The leadership of teams was found to be far more complex than originally anticipated. It was found that leaders in the modern business environment need to be capable of demonstrating and utilising a variety of complex behaviours, often "paradoxical and contradictory" (Yoo and Alavi, 2004, pp32), to ensure the effectiveness of the team.

This presents clearly the way that behavioural complexity is a combination of the work done through the behavioural theory to determine the various behaviours, characteristics and roles of leaders, and the contingency theory's recognition of situation complexities. This is supported by Yoo and Alavi (2004) who state that "no one single key behaviour affects leadership effectiveness in complex managerial situations, instead leaders need to perform a portfolio of roles simultaneously" (p 32). This is further explained by Kayworth et al. (2001-2002) as follows: "whereas earlier contingency based theories would identify the most appropriate leadership style for the given situation, this perspective recognises that the ability to perform multiple, contrasting leadership behaviours in a given situation may be a better indicator of effective leadership." (p 10)

In addition to these key characteristics of leadership, are a range of roles that are central to creating and sustaining effective leadership in teams. It must be noted that the roles expected of a leader are not determined by the leadership style adopted, but rather an identification of what is expected of a leader to ensure teamwork effectiveness. What is expected of a VT leader is constantly changing and being expanded. It is not possible to determine exactly what roles will be required of a leader in any teamwork situation. Different teams, scenarios and circumstances will require the leader to take on different roles in order to facilitate the effectiveness of the VT. The list below provides a snapshot of the wide variety of roles commonly expected of a VT leader (Duarte and Snyder, 2001, Lurey and Raisinghani, 2001, Zaccaro and Bader, 2003, Yoo and Alavi, 2004, Zigurs, 2003) . In reality the design and processes of the VT may require fewer or more roles to be carried out by the leader.

- Support of team member's socio-emotional needs
- Logistics management; allocating resources etc
- Technology selection and management
- Team members selection
- Team motivation
- Provide feedback
- Generate and foster trust
- Establish the reward system
- Manage Conflict

Interestingly, the roles and required skills outlined above directly address the range of challenges explored in this study. This is evidence of the fact that the leadership role in a VT is pivotal in the minimisation of difficulties and maximisation of VT capabilities. While this list will not be specifically tested, an understanding of the role of a leader was explored in this study, reviewing the areas of knowledge required to support the effective education of construction industry professionals. Similarly, the development and cultivation of trust between VT members is both reliant on VT factors, such as communication and leadership, and impacts upon

them. For example, effective communication in the initial stages of VTW is necessary in order to establish trust, but by the same token, trust is vital to the ongoing effectiveness of the team communication.

2.1.5 Trust

As with many of the challenges explored to this point, trust is vital to both traditional and VT's, "but its importance for virtual teams is even more critical"(Cascio and Shurygailo, 2003, pp373). Due to the inherent difficulties associated with VTW, trust is of greater important in overcoming these challenges, and impacts the other vital teamwork processes. Indeed, trust has been described as "the glue of the global workspace" (Gibson and Manuel, 2003, pp62). Studies of trust in VTs have confirmed that managers at all levels from various industries and occupations identify the need for trust, with some suggesting that it is impossible to work virtually without it (Davis 2004).

According to Gibson and Manuel (2003) trust has been found to have an impact on VT's in the following areas:

- increasing confidence and security in relationships
- promoting open and influential information exchange
- reducing transaction costs, negotiation costs and conflict
- improving team performance: goal fulfilment, quality, timeliness, and flexibility

Also, Kanawattanachai and Yoo (2002) attest that trust in VT's has the positive effect of:

- More open communication
- Cooperation
- Higher quality decision making
- Risk-taking
- Satisfaction

Development Stages and Trust Types

Trust in a traditional sense has been found to be a multi-dimensional and complex phenomenon. While trust is difficult to create in a traditional setting, in VTs it is even more difficult. Through an understanding of the types of trust, and the stages of trust development experienced by a team, team members can become more aware of the steps and processes required to ensure the development of the trust.

According to Gibson and Manuel (2003) the emergence of trust in a team situation is based on the condition of risk. They see risk as "the perceived probability of loss, as interpreted by the decision maker" (p 62). Risk has been found to be essential in the initial development of trust because if there was no risk, and tasks could be undertaken with complete certainty, there would be no need to trust your team members. The source of such risk in VTW is the "uncertainty regarding whether the other intends to and will act appropriately" (Gibson and Manuel, 2003,pp 87). This potential risk creates an environment that requires a level of trust for the team to function. Importantly, a team member only has the opportunity to gain trust by demonstrating themselves in a situation involving risk for the team.

According to Cascio and Shurygailo (2003), trust "is rooted in the belief that team members are dependable, that they will deliver what they promise" (p 373). However, this definition of has been criticised by other studies which suggest it is too simplistic and does not account for the multi-dimensional nature of trust. To address this limitation Kanawattanachai and Yoo (2002) discuss 'cognition' and 'affect-based' trust. 'Cognition-based' trust is rooted in the "calculative and rational characteristics demonstrated by trustees" (p 190). This is the trust defined by Cascio and Shurygailo (2003) above, explaining that this trust is based on team member's demonstrated "reliability, integrity, competence and responsibility" (p 373). Once team members have been found to repeatedly meet expectations, cognition based trust development is supported.

Meanwhile, 'affect-based' trust is typically found in close social groups such as families and friends. This is based on "care and concern for welfare of partners" (Kanawattanachai and Yoo, 2002, pp190). This trust is not common in work groups, especially not the swift starting nature of VT's. In addition, the technology-mediated communication common in VTW hinders the development of such deep social bonds. (Kanawattanachai and Yoo, 2002)

While Kanawattanachai and Yoo (2002) present these two types of trust, others have found trust to develop in stages, and change through the lifecycle of the team. Trust at early stages seems to be facilitated by social aspects (communication, mutual encouragement), while trust at later stages is determined by process and task-related aspects (reliability, predictability, etc) (Hertel et al., 2005). For Lewicki et al. (2008), the process of trust development follow three clear stages:

- **Calculus-Based Trust**
    - team members trust fellow workers to behave consistently in situation
    - trust is based on mutual gain from cooperation
    - don't yet trust each other to deliver on commitments

- **Knowledge-Based Trust**
    - team members have had the opportunity to interact and observe each other tasks and missions
    - know what can be expected from each team member
    - know the strengths and weaknesses of each member, and what they can bring to the team

- **Identification-Based Trust**
    - the deepest form of trust
    - recognition of similar values, goals and intentions
    - agreement on the processes and function of the team
    - trust each member to act as a representative of the team as a whole

- a feeling of identification with the team members

These stages of trust development are generally expected to occur gradually and sequentially (Lewicki et al. 2008), with the development of identification-based trust being the aim over time. As explained by Zaccaro and Bader (2003), identification-based trust is critical to VTs because as members are dispersed, they may all be responsible for representing the team, and so trust in their abilities is vital, more so than in traditional team situations.

However, in response to the ambiguity of team relationships, the traditional process of trust development is often omitted, with VTs employing 'swift-trust'. This type of trust is not based on "past experiences, but rather on the basis of their background, professional credentials and affiliations" (Kanawattanachai and Yoo, 2002, pp191). Kanawattanachi and Yoo (2002) discuss the work of Meyerson et al (1996) who found that often team members begin working, assuming others are trustworthy, and continue to seek confirmation and evidence throughout the duration of the project. This ongoing seeking of confirmation is a factor in VT's that may work on multiple projects. In the case of swift-trust development, the stage of calculus-based trust above would be omitted, with team members simply expecting others to deliver on what is required of them. The weakness of this trust development, however, is that it creates inherent fragility in the trust supporting team processes. Without the correct support from leadership and communication, this type of swift starting trust can easily fail.

It is clearly important that team members are aware of the stages of trust, in order to facilitate its development and the effectiveness of the project as a whole. Indeed, Kanawattanachai and Yoo (2002) demonstrate that teams starting and ending with high levels of trust show "outstanding performance", while teams with low initial trust experienced unproductive and distrustful behaviours at the beginning which were rarely overcome. By being aware of the importance of trust, the stages of development, and the team environment required for development, a team can collectively become more effective. This is because the development of trust is supported by the processes and practices of the team, including their communication

and management. The inherent challenges and difficulties associated with VTs imply that a concerted effort is required to create and foster trust.

VT Trust Development and Maintenance

As discussed previously, communication is of utmost importance in the development of trust. This puts added pressure on VTs to ensure that the communication taking place is not only involved in the completion of tasks, but is also effectively developing trust between team members—ultimately leading to the most important stage of 'identification-based trust'. Yoo and Alavi (2004) explain that "socio-emotional support is important to the relational development of teams (e.g. development of trust and group cohesiveness); and weak relational development may, in turn, impact team performance" (p 30).

Many of the inherent characteristics of VTW erode the development of trust. Indeed, technologically-mediated communication can impact on the development of social bonds. It is more difficult for individuals to form impressions of team-mates when communication is through an electronic medium, because it affects the ability to decode social cues, such as; warmth attentiveness and trust (Gibson and Manuel, 2003). In addition, in a traditional co-located team environment members would inherently have things in common to stimulate the development of social bonds and therefore trust (e.g. geographical proximity, similarity on backgrounds, and experience). Whereas in VT's there are few cues, meaning that initial impressions are formed quickly and persistently, making it difficult for members to develop a real understanding and trust of one another. Indeed, Zaccaro and Bader (2003) argue that due to the often transient nature of VTs, deeper forms of trust may never be achieved: "if the team is to exist for a short period, then its members may never attain the level of identification-based trust" (p 383). However, for a wide variety of more simplified tasks it may be sufficient to have knowledge-based trust, thereby avoiding the effort required to develop deeper forms of trust.

A recurring theme in discussing trust is the importance of effective leadership. As discussed, teams will not necessarily have a defined leader; however the roles and

expectations of leaders are always carried out in some form. Zaccaro and Bader (2003) explore the importance of the leadership role in the development and management of trust in a VT environment. In the simplest form, the leader's role is to "foster the progress of team trust from calculative trust to identification trust" while helping "members repair any breaches in team trust as quickly as possible" (p 383). An effective leader helps makes the purpose and actions of the team clear.

The stages of trust development and the specific actions leaders can take to develop and nurture trust effectively are presented by Zaccaro and Bader (2003) in the diagram below (Figure 2.1).
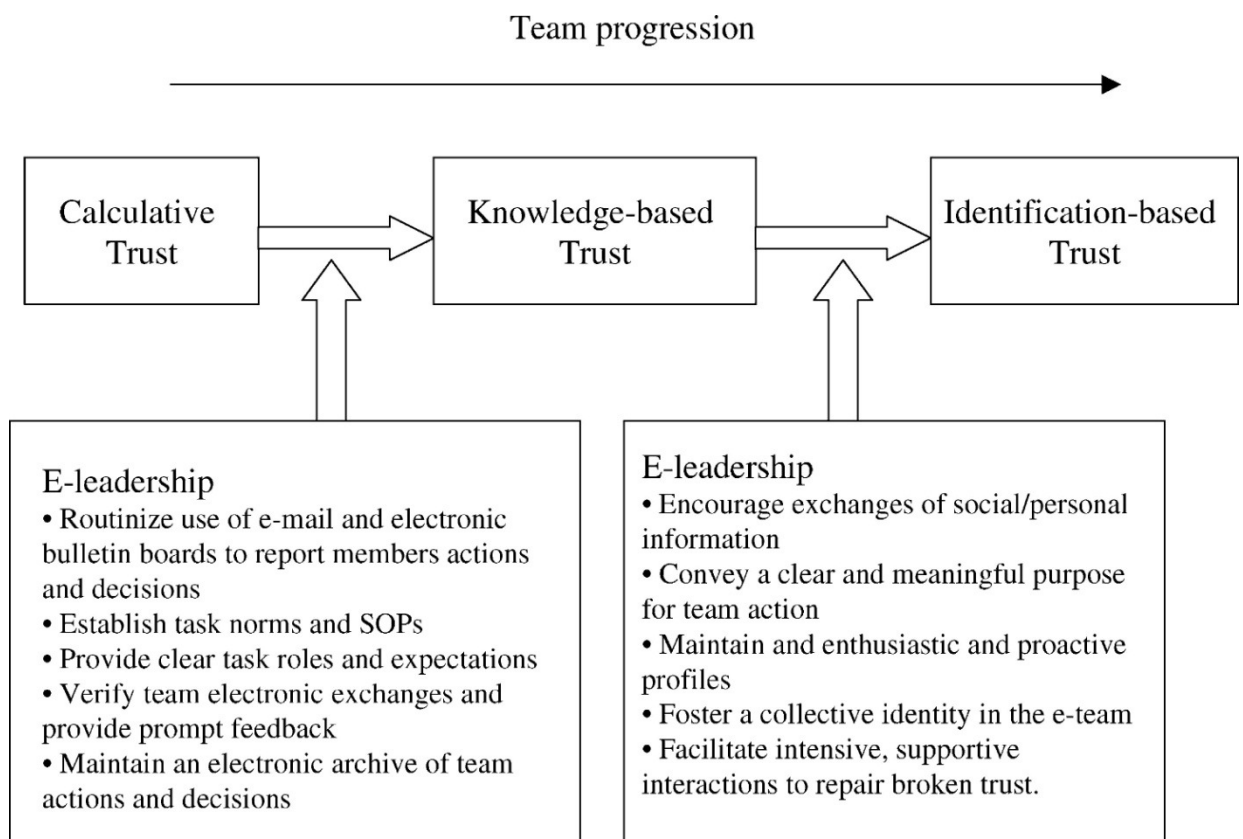
Figure 2-1 Trust Development

Source: Zaccaro and Bader(2003)

Trust is an interrelated element of effective VT operation and membership. The development and maintenance of trust in a VT is directly affected by the difficulties associated with communication and the richness of the technology used to facilitate that communication. Furthermore, effective leadership can have a very dramatic

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effect on the development and maintenance of trust in the VT setting. While the three stages and types of trust have been explored and explained, these may not be achieved by every VT. The development of trust in the VT setting is also affected by the duration the team will operate together and the tasks required of it. However, it is widely agreed that not only is trust affected by the elements of a VT, it also directly influences the effectiveness of VT performance. An understanding of the importance of trust, and the stages of its development, lead to a greater appreciation and awareness of the steps that can be taken to encourage the development of trust and maintain the cohesiveness of the team. In keeping with the established interrelated nature of the challenges involved in VTW, the development of trust in a VT is both vital to the establishment of an effective team culture, and impacted upon by the potential challenges of cultural differences between team members.

2.1.6 Culture

A member of a team of people will, inherently, have their values and practices influenced by a group, as well as the way they interact with other groups. The cultures of a team, then, must feature as a key element of VTW. For example, Hofstede and Hofstede (2005) attest that the often overlooked element of business success, is culture; "One of the reasons why so many solutions do not work or cannot be implemented is because differences in thinking among partners may have been ignored" (p 261).

While it is understood that culture can be used as a means for the differentiation of group, the development of a culture in that group may not be conscious. Duarte and Snyder (2001) explain that "culture is a set of learned mores, values, attitudes and meanings that are shared by the members of a group (and is) often one of the primary ways in which one group differentiates itself from another" (p 54). Indeed, culture can dictate intra-group interactions through "hidden 'scripts' that people use to guide their behaviours" (p 54). These 'scripts' are created by the interactions between members of a group. The members are often not aware of their development and they become innate, as 'mental programs' developed through one's social environments

and life experiences – through family, neighbourhood, school, youth groups, the workplace etc (Duarte and Snyder 2001, p 3).

The impact of a group's culture can be felt in the way the group operates, as well as how it interacts with other people or groups. In the context of VTW, this can mean that there are many cultural influences converging and affecting the VT. The issue of culture is especially prevalent in the case of global VT's, i.e. those with members from other countries. Zakaria et al. (2004) explain the complexity of this increasingly common work practice, "global virtual teams are not only separated by time and space, but differ in national, cultural and linguistic attributes" (p 17). This communication difficulty is further exacerbated, as discussed previously, by the difficulties associated with reliance on technology.

The issue of culture then is clearly related to effective communication between team members. Zakaria et al. (2004) discusses that often in the case of communication in a team setting, it is perceived that communication is a one-way process and the onus is on the sender to ensure clarity of the message. However, what should occur is that "the sender and receiver should be seen as both active participants engaged in knowledge transfer and culturally mediated discourse" (p 17). This reinforces the notion that effective VT members, especially those engaged in global VTW, need to be mindful of the difficulties associated with cultural differences.

Framework of Cultural Dimensions

In explaining the impact of culture, Duarte and Snyder (2001) state; "each team member brings his or her culture, and, as the team evolves, the unique blend of team members' national, functional and organisational cultures creates a unique team culture" (p 55). This means the interaction of these different cultural values and behaviours leads to the development of a culture for that specific VT, which will in turn affect the effectiveness of the team. The inherent difficulty in cross-cultural work is that the collective patterns of behaviour in one culture may seem incomprehensible to members of other cultures (Hofstede 1980). This is an important factor to understand because it means that members of a cultural group may not be

aware of their inherent values and attitudes, which can lead to difficulties in communication and inter-personal teamwork.

It is important then to understand the different types of culture impacting the operation and success of a VT. Duarte and Snyder (2001) outline three types of culture; national, organisational and functional.

National

The globalisation that has led to the development and proliferation of VTW has also brought to the fore the impact of national culture on the operation and success of VT's. The importance of recognising and understanding the impact of national culture is due to the fact that it is often the most deeply entrenched culture affecting team members, because the patterns of national culture are often established in childhood (Duarte and Snyder, 2001).

A major study of national culture carried out by Geert Hofstede between 1968 and 1972, involved IBM Corp. employees worldwide, to determine behavioural pattern differentiation between national cultural groups. This study led to the development of five national culture dimensions that differentiate workers of different cultural groups:

    a. Power Distance: add brief explanation here

    b. Individualism-Collectivism: add brief explanation here

    c. Uncertainty Avoidance: add brief explanation here

    d. Masculinity-Femininity: add brief explanation here

    e. Long Term-Short Term: add brief explanation here

Dimension	Definition	Characteristics
Power Distance	*"The extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally" (pp46)*	Small power distance countries are found to have clear characteristics. While large-power distance cultures, logically, are the opposite: • limited dependence of subordinates on bosses • a preference for consultation (that is interdependent between boss and subordinate. • Small emotional distance between subordinate and boss • subordinates will rather easily approach and contradict their bosses.
Individualism-Collectivism	*"Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetimes continue to protect them in exchange for unquestioning loyalty" (pp76)*	This dimension of culture, directs a person's feeling of belonging and loyalty to the group they find themselves in. According to Hofstede and Hofstede (2005), the vast majority of people live in "collectivist" societies, where the "interest of the group prevails over the interest of the individual." This means people "think of themselves as part of a 'we' group… this 'we' group is distinct from other people in society who belong to the 'they' groups" (p 75). The minority of the world, live in societies with opposite values. In "individualist" societies "the interests of the individual prevail over the interests of the group" (p 75). People think of themselves as 'I'. In the workplace, the individualism or collectivism of a person's culture impacts on their work goals.

Uncertainty Avoidance	*"Uncertainty avoidance can therefore be defined as the extent to which the members of a culture feel threatened by ambiguous or unknown situations"* *(pp167)*	Uncertainty avoiding cultures have: 1. more formal laws and informal rules controlling the rights and duties of employers and employees 2. more internal regulations controlling the work process The working styles of employees in societies with a strong uncertainty avoidance culture; "like to work hard or at least to be always busy. Life is hurried, and time is money" (p 183). While weak uncertainty avoidance societies are characterised by workers who "work hard if there is a need for it, but they are not driven by an inner urge toward constant activity. They like to relax. Time is a framework to orient oneself in, but not something one is constantly watching" (pp183).
Masculinity-Femininity	*"A society is called masculine when emotional gender roles are clearly distinct: men are supposed to be assertive, tough, and focused on material success, whereas women are supposed to be more modest, tender and concerned with the quality of life. A society is called feminine when emotional gender roles overlap: both*	"Masculinity-femininity is about a stress on ego versus a stress on relationships with others, regardless of group ties" (p 123). Based on their research the following goal items are most important to each pole on the continuum of masculinity-femininity. **For the masculine pole:** 1. **Earnings:** have an opportunity for high earnings 2. **Recognition:** get the recognition you deserve when you do a good job 3. **Advancement:** have an opportunity for advancement to a higher-level job 4. **Challenge:** have challenging work to do **For the opposite, feminine, pole:**

	men and women are supposed to be modest, tender and concerned with the quality of life" (pp120)	5. **Manager:** have a good working relationship with your direct supervisor 6. **Cooperation:** work with people who cooperate well with one another 7. **Living Area:** live in an area desirable to you and your family **Employment security:** have the security that you will be able to work for your company as long as you want to
Long Term-Short Term	*"Long-term orientation stands for the fostering of virtues oriented towards future rewards – in particular, perseverance and thrift. Its opposite pole, short-term orientation, stands for the fostering of virtues related to the past and the present – in particular, respect for tradition, preservation of 'face', and fulfilling social obligations" (pp210)*	Long-Term cultures are characterised by: • The fact that the family and work are not separated. • The encouragement of entrepreneurial activity. • The value placed on the qualities of "persistence", "tenacity in the pursuit of goals" and "thrift" leading to "savings and the availability of capital for reinvestment by oneself or one's relatives" (p 218). • The value placed on a sense of shame, because it demonstrates the importance placed on interrelatedness in society and the importance of keeping one's commitments. While in short-term oriented cultures, those values important in long-term oriented cultures, were seen to impede business success. Overstressing the importance of personal stability, saving face and respect for traditions were seen as a barrier to innovation, effectiveness and business success.

Table 2-5 National Culture Dimensions

Source: Hofstede and Hofstede (2005)

In relation to VTW practices and participation, these characteristics can form an important element in the design of VT processes and interactions. Where a country falls on the scale of power-distance it gives an indication of whether the staff expect and prefer to have an approachable leader who is open to discussion, or to be told what to do. This is an important element in designing the processes and practices of VT interaction. As discussed previously, leadership is not always defined in a VT. An awareness of the power-distance index for the national cultures influencing the team members will determine the extent to which the team needs to be led, or can be self-directing, as well as the nature of communication and conversation. This understanding will also ensure that leaders behave accordingly, and support the needs of the team members.

The dimension of collective/individualism directly impacts on VT's, because the basis of a team is to bring together a group that will successfully communicate and complete tasks. The culture of the team members will therefore determine how much importance they place on being a member of that team, and the loyalty they feel they are owed. In a collective society, importance should be placed on non-task, relationship-forming communication in order to develop and strengthen the feeling of cohesion in the team. In an individualist society, the team members will simply want to finish the required tasks quickly, so they can move on to other tasks or teams.

This inherent difference in work styles between cultures with different levels of uncertainty avoidance is a potential catalyst for misunderstandings between VT members. Team members from cultures with different levels of uncertainty avoidance may either feel annoyed at others for not appearing to be working hard, or may feel stifled by rules and constant work. An awareness of these cultural differences will lead to a better teamwork structure, design participation and leadership.

The importance of the dimension of masculinity/femininity for VT's is in the selection of team members, and understanding what drives different team members. By understanding what goals, both business and personal, are important to a team

member, the team leader or their fellow members can better work with them to achieve effective and successful ends. This will involve the design of communication norms, management processes, leadership styles and reward systems.

Finally, the dimension of long/short term cultures directly affects VTW through the attitudes that team members have for the future. Long-term oriented team members will believe strongly in the feeling of shame for breaking commitments, and place importance on having a clear hierarchy to work under. While short-term oriented team members will want to get the job done quickly, and take risks to be innovative, in an effort to increase performance, perhaps to the detriment of team relationships and interaction. This cultural dimension is directly related to the interpretation and attitudes towards risk and the development of trust. Short-term oriented team members will take risks, in the pursuit of success, with little regard for the potential impact it will have on the development of trust. Meanwhile, long-term oriented cultures will place importance on their responsibilities to the group, but in a fear of losing face they may not be proactive of innovative. It is necessary for team members, managers and leader to be aware of this cultural dimension in order to ensure that team practices, communication and trust are created and maintained in a way that is suitable and effective.

Organisational

Organisational culture is the cultural identity and norms evident and affecting employees of an organisation. This culture can be developed through employee interactions, or through the structure and management of the organisation. Schein (1992) defines organisational culture as "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems" (p 12).

The culture created in the organisation is directly affected by national culture, with the overriding culture of an organisation being dictated by the "home country, not the

subsidiary" (Hofstede and Hofstede 2005, pp257). Most importantly, the culture dimensions of power distance and uncertainty avoidance are found to determine the organisation's culture towards decision-making power and the rules and procedures enforced, thus determining to the configuration of the organisation, which in turn affects the culture impacting on its employees. The importance of these two factors is echoed by Mintzberg (1973) who attests that the two variables in organisational configuration are structure and coordination, which are related to the factors of power distance and uncertainty avoidance. Hofstede and Hofstede (2005) go on to explain that this relationship between national and organisational culture also explains why people from a "particular national background will prefer a particular configuration because it fits their implicit model", while "similar organisations in different countries will resemble different Mintzberg configuration types"(Hofstede and Hofstede, 2005, pp 258). This can be extended to the formation and design of VT's, in that the structure and practices of a virtual team need to be mindful of the preferences and cultural attitudes of its team members.

While the influence of organisational configuration on the operation of the organisation is understood, the specific dimensions and factors that make up an organisation's culture are more difficult to define. Duarte and Snyder (2001) provide a few key examples: "different perceptions of the importance and nature of time (regarding schedules and timetables), the organisation's relationship to its competitive environment (leading it or reacting to it) and the theories about human nature (good or evil)" (p 60).

This link between national and organisational culture affects the operation and success of VT's, because often team members are drawn from a variety of nations, organisations, and members of a supply chain. This means each team member brings their own inherent cultural identity to the team, and their innate idea of how things should be run. This increases complexity in the team, and potentially affects the time taken to complete tasks, as well as overall team effectiveness. (Duarte and Snyder, 2001)

The integration of different organisational cultures in a VT may seem problematic, however, it has been attested by many that it can provide an opportunity for diversity of approaches to the carrying out of teamwork tasks. Cameron and Quinn (1996) (as quoted by Duarte and Snyder (2001), explain that a recognition and effective management of cultural differences can actually lead to innovations in the team, but that a failure to properly understand and minimise the potential difficulties associated with cultural differences can be highly detrimental to team effectiveness.

Functional

Due to the varied and often complex nature of VTW, team members may be drawn from a variety of functional backgrounds. These functional backgrounds will have their own cultural complexities, which will need to be integrated and incorporated into the culture of the team.

It has been found that people who work in the same functional area begin to create a culture of their own, this stems from: a common background in terms of education; professional goals and skills; and, the development of their own practices. This is important because when VT members come together from different functional areas, they bring with them their assumptions and practices, potentially affecting the operation and success of the team. (Duarte and Snyder, 2001)

The importance and impact of differing functional cultures coming together will depend on the prevailing organisational culture. As discussed above, the organisational culture determines the practices and process of the organisation, meaning that if an organisation has a tradition of cross-functional teamwork, the members of a newly created VT will be better able to cope with their functional differences. Duarte and Snyder (2001) explain the advantages of team members that are capable of understanding and coping with functional culture differences; they will have experience in "subordinating their functional biases to achieve broader, integrated goals of their teams" (p 63). In addition, in understanding these differences they will also they will also have knowledge of how to leverage these differences and maintain balance in the team. This is particularly important in the

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construction industry, due to the inherent cross-functional nature of the supply chain is it all the more important that potential members of construction industry VTs have an understanding of the functional cultural differences and are aware of the impact it can have on VT performance.

Clearly, many cultural influences are unavoidable, national culture especially. However, cultural traits and behaviours do not necessarily need to, or can be avoided. Indeed, Duarte and Snyder (2001) attest that "cultural diversity in a virtual team can be a competitive advantage" (p 66). This is, in fact, one of the reasons for the ongoing success of VT's in the increasingly globalised business world, because people from different backgrounds, with different approaches to problems, will bring new ideas to the completion of tasks. VTs that can leverage the power of differences can outperform other teams that have members from similar backgrounds and cultures. Moreover, many innovations come when people from different cultures come together to work (Duarte and Snyder, 2001, pp66).

Whilst there have been some suggestions that increasing globalisation will homogenise culture, others argue that the perceived dominance of technology over culture is illusory—technology is fundamentally and diversely informed and shaped by the people who use the technology (Hofstede and Hofstede 2005). As Zakaria et al. argue "technologies are only as effective as those using them"(Zakaria et al., 2004, pp1).

Therefore it is vital that VT members are mindful of the impact of culture on the design of team processes and the expectations and behaviours of other team members. Moreover, awareness of the cultural influences at play in the development of team members will lead to more effective management. As explained by Hofstede (1980), the culture and 'mental programming' of people leads to different strengths, weaknesses and desires. These, in turn, determine how they operate in the business world, and therefore in as part of VTs. It is the role of the VT members, to ensure the creation of a culture within the team that utilises the strengths of each member, while minimising confusion and conflict. It is the recognition of the unique diversity of team member cultures which must drive the development of an effective team

design. This design includes team member selection, communication norms, technology selection and implementation, as well as leadership and management, that come together to determine the effectiveness of VTs.

Two important frameworks of cultural dimensions are presented by Hall (1977) and Hofstede (1980). These dimensional frameworks endeavour to simplify what is a complex issue. Shachaf (2008) suggests that this simplification could be argued as a weakness of the research, but admits that very little other research has been done to explore this issue effectively. For this reason these frameworks assist in the development of an understanding of the dimensions.

Hall (1977) presents a contextual theory of cultural diversity. In order to understand behaviours and communication priorities of a culture, it is necessary to understand the context in which they occur. According to Hall (1977) cultures can be placed on a continuum between 'high-context' and 'low-context', with each cultural group having a degree of each and a mix of the characteristics. The contextual theory is not designed for national cultures specifically, but is instead an explanation of the attitudes and practices of people within a cultural context.

The work of Hall (1977) is a simple exploration of cultural differences, and can easily be applied to different VT contexts. However, the work of Hofstede (1980), and his later editions (2001, 2005), presents a number of cultural dimensions, to help understand work patterns and attitudes. According to Hofstede and Hofstede (2005), "A dimension is an aspect of a culture that can be measured relative to other cultures" (p 23). Like the work of Hall (1977), the cultural dimensions of Hofstede (1980) were explored and presented as dimensions of national culture, but can be applied to the cultures of organisations and functions.

The importance of an understanding of the effect of cultural differences on the effectiveness of VT's is because that understanding should be a driving force in the design of team practices and procedures. For instance, depending on the cultural preferences of the VT members, the communication technology utilised, and the content of the communication may need to be augmented. This is related to the

management of the VT, involving; the selection of the team members, the design of the processes, and the monitoring of the effectiveness of the team in order to make changes where necessary.

2.1.7 *Management*

Like traditional projects and team environments, effective management of the processes involved in VTs is paramount. Management of VTs is fundamentally similar to the management of traditional co-located teams. As McDaniel (2008) explains, both involve groups of people working towards a goal, they must trust each other, and have commitment, and both forms of team must "look towards a manager or a leader to guide their processes" (p 18).

However, VT management is a progression from traditional management practices, in response to the growing prevalence of communication technologies. It is the execution of fundamentally standard management practices in a new environment, with unique challenges. Goncalves (2005) explains the role of a virtual manager;

> "The role of a virtual project manager is neither a professional profile nor a new profession. Instead it is a complementary and intrinsic role of higher technical and managerial jobs in the new technologies sector because of the new work methods that these tools provide and impose. In other words, it is not a profession strictly speaking but a specialisation of the conventional project manager role that has seen the discipline evolve in a more ubiquitous, synchronous and pervasive form where the role of project manager has to deal with activities that are being developed on a distributed and delocalised basis through the use of new technologies" (p 274).

The challenges presented by moving the management of teams to the virtual should not be an excuse for difficulty or ineffectiveness in management; rather they can be seen as part of a competitive advantage.

It is important, however, in discussing the significance of managing to establish the difference between management and leadership. Management can be defined as the efforts to "direct diverse activities with the objective of achieving a desired result."(Goncalves, 2005, pp 146). This process can include a variety of functions such as planning, staffing, directing and controlling. Meanwhile, leadership is the "ability to conduct interpersonal relations that influence people to take desired actions" (Goncalves, 2005, pp 146). Therefore, you *lead* the people of a team, and you *manage* the process. In fact, as discussed previously, teams can be successful without any defined leader, yet the tasks involved in the management of the VT are required regardless of the teams' hierarchical structure.

A concise, yet thorough, presentation of the tasks involved with the effective management of VT's is presented by Hertel et al. (2005), through the lifecycle of the project. This is because managers are required to perform different tasks at specific times in order to maximise the potential success of the team. These tasks and lifecycle explanations are based on extensive meta-analysis and quantitative studies.

Below is a diagram presented by Hertel et al. (2005) outlining the key tasks associated with the management of VT's during each phase of the teamwork lifecycle.

Phase A:	Phase B:	Phase C:	Phase D:	Phase E:
Preparations	Launch	Performance management	Team development	Disbanding
Mission statement	Kick-off workshop	Leadership	Assessment of	Recognition of
Personnel selection	Getting acquainted	Regulation of	needs/deficits	achievements
Task design	Goal clarification	communication	Individual and/or	Re-integration of
Rewards systems	Development of	Motivation/emotion	team training	team members
Technology	intra-team rules	Knowledge management	Evaluation of	
Organizat. integration			training effects	

Figure 2-2 Management Tasks

Source: Hertel et al (2005)

While these tasks are echoed by the review carried out for this study, some areas have been revealed as particularly important and are outlined in more detail below.

Staff Selection

As discussed previously, the advantage of VTW is the ability to bring together team members best suited to the team, based on skills and knowledge, without the need for physical presence. Virtual group management thus begins with identifying specific skills and then choosing the appropriate individuals for staffing VT's (McCord and Boone, 2008, pp356).

Yet, knowledge requirements are not the only criteria important in the selection of team members for VTW. The unique nature of virtual work dictates that team members should also possess certain personality traits and skills base required for effective teamwork in a virtual environment. Gonclaves (2005) identifies these key abilities for VT members:

- Perform the work requirements with limited supervision and feedback
- Handle reduced social interaction
- Have good organisational and time management skills
- Be self-motivated
- Demonstrate good performance

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- Be able to concentrate on the task at hand despite being away from a worksite and the rest of the team

Team Building and Management

The role of the leader in a teamwork situation has been discussed previously, and it is in the area of team building and management that the roles of leader and manager can become blurred. However, it is the role of the manager to handle the management and control of the processes involved in the building of the team, and the completion of the teams' tasks.

According to McDaniel (2008), "the basic principles of team building do not change when moving to a VT; however, the way team members work together and the methods which they use to communicate change completely" (p 18). This means that the building and management of a VT involves unique requirements. The building of a VT is not strictly the bringing together of the team members. The building of a successful VT involves selecting the correct team members and facilitating the development of the group into an effective team, through the creation of a supportive and successful teamwork environment. This successful work environment is based on four key factors:

- Cohesion
- Trust
- Conflict Management
- Cultural Awareness

(McDaniel, 2008, Goncalves, 2005, McCord and Boone, 2008, Switzer, 2008)

(a) Cohesion

In order to work effectively in a team environment, it is important to establish a feeling of cohesion between team members, to ensure everyone is invested in the success of the team and is working towards the achievement of the team's goals, as described below:

"Cohesive teams work as one unit with every member's contribution contributing towards the goal. Characteristics of a cohesive team include both social attraction and the ability of individual team members to complete their share of the work"(Wellen and Neale, 2006, pp178).

The first step in developing team cohesion is the development of a clear team definition and identity, including a statement of purpose, norms, goals, processes and connections with those outside the team who can provide resources and support (Gonclaves 2005). This will ensure that the team members will be aware of who is on the team, how it works, and where the team is positioned in the organisation, project or professional environment. This clarity of purpose also helps to build social cohesion in the team by providing a common purpose and mutual attachment (McCord and Boone 2008).

(b) Trust

The issue of trust has been discussed in Section 2.1.5, including types of trust and the importance of the development of trust in a team. However, McDaniel (2008) attests that the development of that trust is the primary responsibility of the VT manager. This is particularly important when building a new team, as Jones et al (2005) explains, "unless the manager and the team have worked together before, the manager of a VT needs to spend a dedicated amount of time early on to build trust and credibility" (p 118). This implies that the initial steps taken by the VT manager in the building and development of the team, will also lead to the development of trust, and conversely, the potential corrosion of trust when this management is facilitated in uninformed and ineffective ways.

(c) Conflict Management

Conflict in teams is defined by Griffith et al. (2003) as "awareness by some or all of the members of differences, discrepancies, incompatible wishes or irreconcilable differences (p 362)". As discussed previously, the inherent characteristics of VTW can lead to conflicts between members. This is commonly related to difficulties in communication, caused by the reliance on technology, cultural differences or lack of trust. However, it is important to remember that different forms of conflict exist, with

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not all being detrimental to team functioning. Indeed Zaccaro and Bader (2003) argue that "conflict can often serve the group quite well in terms of energizing new ideas and perspectives" (Zaccaro and Bader, 2003, pp385). It is for this reason that the traditional business approach of 'conflict resolution' has been replaced by the notion of 'conflict management', as Rahim (2001) explains:

> "What we need for contemporary organizations is conflict management, not conflict resolution. Conflict management does not necessarily imply avoidance, reduction, or termination of conflict. It involves designing effective strategies to minimize the dysfunctions of conflict and enhancing the constructive functions of conflict in order to enhance learning and effectiveness of an organization" (p 76).

This is the current interpretation of dealing with conflict—to encourage and maintain healthy conflict, while minimising and mitigating the effects of negative conflict.

Indeed, in distinguishing the different outcomes of conflict it is also possible to define various conflict types. Three conflict types are commonly discussed and are summarised in Table 2.6.

Table 2-6 Conflict Types

Conflict Type	Characteristics	Effect
Relationship (or affective) Conflict	* Interpersonal Differences * Hostility or Annoyance	* Negative effect on satisfaction and cohesion
Task (or cognitive) conflict	* Differences in viewpoints about what tasks are performed	* Moderate levels can be beneficial * Leads to effective synthesis
Process Conflict	* Conflict about how to do the task	*Negative effect if unresolved, because it can distract the team from other important issues.

While it shows that task-conflict can be beneficial, Zaccaro and Bader (2003) explain that "people often misperceive which of the forms of conflict they are experiencing"(p 385). Therefore, teams should be wary of encouraging task conflict, in case it manifests in detrimental forms of conflict. Ensuring healthy levels of trust in VTs will aid in moderating conflict, allowing reasonable levels of task conflict while avoiding misinterpretation.

These conflict types necessarily imply different conflict management behaviours— not only for the behaviours of team members, but also in the response by team managers and leaders. A commonly accepted categorisation is the work of Thomas and Kilmann (1974), who present five conflict handling modes of behaviour (see also Montoya-Weiss et al. (2001); Rahim (2001); Rahim and Blum (1994); and Thomas (1990).

1. Avoidance **–** evasiveness and failure to confront other parties
2. Accommodation **–** obliging concern for others
3. Competition **–** pursuing of own interests without regard for others
4. Collaboration **–** attempts to identify and achieve outcome integrating interests of all parties
5. Compromise **–** acknowledgement of differences and middle ground settlement

These have been explored in a VT setting by Montoya-Weiss et al. (2001) whose findings provide an interesting exploration into the transferability of traditional organisational psychology, in the context of VT's. They tested the effect of each behavioural style and whether these effects could be moderated by temporal coordination; "process structure imposed to intervene and direct the pattern, timing and content of communication in a group" (p 2000). The following findings were presented, however they point out that some findings could be due to the nature of the VTW in the experiment:

- A*voidance* behaviour had a negative effect on team performance, but could be easily mitigated through effective timing and control of communication.

- *Accommodation* behaviour had no significant effect on performance (potentially due to the anonymous and often asynchronous nature of VTW, allowing accommodation to go unnoticed.)

- *Competition* behaviour had a significant, positive effect on performance. (potentially due to the lean, asynchronous nature of the VTW in the experiment, mitigating the effect of the domineering and aggressive conflict behaviour)

- *Collaboration* behaviour had a positive effect on team performance (however, the temporal coordination had no effect on the positive attributes of collaboration, meaning that collaboration could potentially be inherently effective conflict resolution behaviour.

- *Compromise* behaviour was found to have a significant negative relationship to performance.

These findings are significant and useful in the exploration of VTW skills required of members, because by understanding the characteristics of possible responses to conflict, suitable processes and procedures can be implemented to minimise the negative effects and maximise the positive attributes of VTW.

(d) Culture

The issue of culture has been explored in Section 2.1.6, but it is the role of the manager to be mindful of these cultural differences in the establishment of team processes and norms. This includes differences in communication requirements and norms, guidance, feedback, conflict management etc. Goncalves (2005) attests that "The sociocultural challenges of enabling VT's may outnumber the technical challenge" (p 143).

In order to minimise the detrimental effects of inter-cultural differences in VT's, and maximise the opportunities presented by the mixture of cultures available through VTW, McCord and Boone (2008) believe "managing virtual team members from different cultures requires additional focus on cultural diversity. Team leaders should provide opportunities for team members to discuss cultures and values, and to address cultural communication differences" (p 351). This is again related to the

effective building and development of the team, reinforcing the fact that the manager role is to manage the formation of the team and establish of cohesion and understanding between members effectively, in order to create a well organised and functioning team.

Communication Facilitation through Technology

Instrumental in the development of an effective team is adequate communication between team members to ensure the building of trust and cohesion. The importance of communication has been explored thoroughly in section 2.1.3. However, it is important to note how technologies can be supported by VT management, as explained by McCord and Boone (2008) "effective management practices may be leveraged by the appropriate use of supporting technologies" (p 352). Regardless of the development of communication technology in the past, and into the future, the required team building and managing processes will remain constant. Indeed, a strong leader or manager can mitigate many of the identified challenges in VTW by "creating an environment that stresses clear and precise communication strategies" (Switzer 2008, p 43).

It is the role of the manager to provide the appropriate and best-suited technologies for the development of the team and the completion of the tasks expected. As with the socio-cultural factors discussed above, the key role of the manager in the selection and utilisation of appropriate technologies is executed early in the lifecycle of the team—"deciding which tools and best practices you will use up front will help avoid confusion and simplify the way your team operates" (Jones et al., 2005, pp 133).

While the factors affecting technology selection and the important elements of communication technology – such as richness and synchronicity – have been discussed in section 2.1.2, what is important to understand is that it is the manager's responsibility to ensure that the team discusses the options available, selects the

systems to be used and ensures their effective utilisation throughout the lifecycle of the team. The technology chosen to support the teamwork is based on the requirements of the tasks and the team. The effectiveness of VT communication is determined by more than the technology used, it is the community of people behind the technology. The team members must be involved in the design of the team processes and the selection of the technology that best supports their needs and the project objectives. (Goncalves, 2005, Harvey et al., 2004)

It is through an understanding of the role of a VT manager, as opposed to and in conjunction with, a team leader that will lead to a successful, cohesive and effective team. Many researchers provide lists of the steps and processes involved in effective management of a team, but the team building, management and facilitation requirements are dependent on a variety of variables. As McCord and Boone explain, "virtual team management is influenced by the nature of the work itself, the context within which the work is performed, and the virtual work tools used" (McCord and Boone, 2008, pp352). This means that no set list of steps and processes will suit every VTW context. Instead of trying to make one list fit with every situation, it is more important that VT professionals, be they managers or team members, are aware of the important managerial functions and decisions affecting team effectiveness and the general role of VT managers in the creation of a cohesive, trusting and effectively communicating VT.

Section - 2.2   Conclusion

Through the review of literature above, an understanding of the key challenges and associated skills affecting VT performance has been achieved. It is the education of these challenges and skills that will be explored through the methodology below. As determined by the review of current research, integral to a VTW participation is an understanding of not only the technological options available, but also the factors affecting technology selection (media richness and synchronicity) as well as the suitability of technologies to different teamwork process and requirements, such as the facilitation of communication and the development of trust. It has been discussed

previously that an intimate knowledge of every technological option is not expected in a VT member; instead an understanding of the key factors affecting technology choice and implementation is advantageous in a VT member (Kayworth and Leidner, 2000).

The challenge of communication mediated by technology, in the VTW context, has highlighted the specific difficulties and required skills of a VT member. The education of this understanding, of the inherent communication difficulties and required skills, will be explored in the research herein. This is related to the exploration of technology skills, because it is these technologies that facilitate effective team communication. In addition, however, the skills associated with meetings and the inherent difficulties of effective written communication will be explored.

The research reported here explores the educational importance of the skills associated with the leadership roles and functions in a VT. The education of leadership skills is closely related to the management skills required in the running of VT's. As explained above, the role of leader and manager are similar but have inherent differences, the leader's is a motivational role, while the manager's affects the running of the team. In some cases, there is no defined leader or manager of a team, but roles and functions required will still be performed. It is the education of future practitioners in these skills and processes, and their impact on team success, which is the core of the study reported herein. These skills include; staff selection, motivation, conflict management and trust.

The challenges associated with the factors of trust and culture have been found to impact on, and be impacted by, all the other challenges involved in VTW. Education of the importance of establishing and maintaining trust, and the skills involved is imperative. An awareness of the impact of cultural differences, and the steps that can be taken to harness the advantages of cultural difference, and mitigate the disadvantages, is vital in an effective VT member.

CHAPTER 3 - METHODOLOGY

Section - 3.1   Approaching the Research Problem

The research methodology outlined below has been designed to facilitate the completion of the research aims and objectives outlined in Section - 1.5. The review of the relevant VTW literature in the preceding section has established an understanding of the key challenges and skills required for effective VTW. Through the methodology outlined below, these skills will be explored in the context of Australian University Construction Programs. Central to this study is exploring whether these VTW skills are identified in Australian university construction programs, and therefore, if they are delivering graduates with these necessary capabilities.

While the review of current knowledge has established the core personal and technological skills required for VTW effectiveness (thereby addressing Research Objective 1, see Section - 1.7), the methodology outlined below has been designed to address the remaining objectives and questions. Fundamental to establishing the extent to which Australian University Construction Programs are delivering graduates with the skills required for VTW, is a determination of the attitudes of the relevant stakeholders in the education of construction students (i.e. education practitioners, students and industry representative bodies). It is these attitudes and perceptions that determine the response of the education sector to the growing prevalence of VT practices in the construction industry.

However, while the attitudes and perceptions of the education stakeholders have a direct impact on the education of graduates, the implicit education of the skills required for effective VTW education also need to be explored. This involves an analysis of the content of the courses that make up the Australian University Construction Programs, as well as the graduate competencies prescribed by industry representative bodies. The methodology adopted to explore these factors is outlined below. The methodology employed is based on an understanding of the nature of differing paradigms and ontology's, as well as an exploration of the variety of research strategies available.

Section - 3.2   Methodologies of the research

This research has been conducted using a multi-strand mixed method design, based on the pragmatic ontological stance. The basis of these methodological decisions is explored and explained below. An understanding of the reasoning of the methodological design is vital to the exploration of the key issues related to the education of VTW skills.

The idea of a research paradigm, introduced by Kuhn (1970), is based on the fact that science has become separated into communities of practice. These research communities share paradigms based on their ontology and epistemology, which in turn affect the methodologies utilised in the execution of research, as well as the interpretation of the results. By understanding the research paradigm adopted in this study, the methodologies employed will form part of a more cohesive and clear direction towards developing an understanding of the extent to which VTW skills are present in Australian University Construction Programs.

This study is based on the pragmatic ontological stance. The development of a pragmatic ontology has been attributed, according to Cherryholmes (1992), to the works of CS Peirce, William James, George Herbert Mead and John Dewey, among others. From a philosophic standpoint pragmatism is explained as follows: "the core idea of pragmatism is that the meaning of any concept is determined by its practical implications; and that the truth of any judgement is determined in and through practical activity" (Hammersley, 2004, pp847). Pragmatism, like many other philosophies, was developed in response to the realisation that the studies of social science and natural science are fundamentally different. According to Baert (2005, pp192), science philosophers have been in the "pursuit of ontological and methodological unity of science." The difficulty is that, even within the realm of natural science, the methodologies and epistemologies adopted are not unified as there are differences between the branches of science such as biology, physics or chemistry.

The fundamental difference between pragmatism and many other ontology's, is the realisation that theory and research outcomes, cannot be separated from the context in which they were created. In the classical sense, science endeavours to separate the researcher and methodology from the knowledge created, in an effort to create a single 'truth'. However, pragmatists believe that "scientific research always occurs in social, historical, political and other contexts" and have an understanding that, "knowledge produced by inquiry is always fallible; it cannot be known to be valid with absolute certainty" (Cherryholmes, 1992, pp13).

In terms of the research methods utilised, pragmatism is based on the notion that research begins with an idea or problem. As Creswell (2003), explains, "there is a concern with applications – 'what works' – and solutions to problems. Instead of methods being of primary importance, the problem is most important, and researchers use all approaches to understand the problem" (p 11). From this perspective, differences in ontological positions are only meaningful if they make a difference in how the research is conducted. (Burke-Johnson and Onwuegbuzie, 2004) This is in direct opposition with the classical view of epistemology and ontology being strictly divided and determining the method utilised. It is for this reason, that pragmatism has become the key foundation for mixed method approaches.

The ontological stance of pragmatism has been found to be most suitable to this research project because this project endeavours to provide an exploration of the extent to which VT skills are being taught in Australian University Construction Programs. The findings of the different layers of the strands were used to build and design the next level. For example, the results of the quantitative study of the course outlines in the public domain, were used to support and shape the qualitative semi-structured interviews. The ontology of pragmatism recognises the multifaceted nature of a research problem, and allows the researcher to utilise a variety of methodologies to explore the depths of the problem. However, a characteristic of the Pragmatic ontology is that the findings of the research are contextually based. This includes contextual characteristics such as; the point in time, the researchers, and the

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methodologies adopted etc. The findings will not, necessarily, be a fundamental truth or profess to be infallible, but rather an interpretation of the results of methods adopted, and a view of the situation at hand. Further investigation by other researchers, utilising other methods, could produce different unique results, as is the nature of social research.

Section - 3.3   Research Strategy

The research utilised a mixed method approach. In the past, there has been a methodological divide between qualitative and quantitative purists, with both viewing their research paradigms and associated methods as the ideal (Burke-Johnson and Onwuegbuzie, 2004). In more recent research, there has been increasing opposition to the stark paradigmatic separation of these approaches, with a growing tendency to combine these approaches as part of what's now known as a mixed method approach.

The most important element of the movement to a mixed-method research strategy is the belief that by recognising the limitation of the different methodological practices, and mixing methods the researcher can "draw from the strengths and minimise the weaknesses of both in single research studies and across studies" (Burke-Johnson and Onwuegbuzie, 2004, pp14). This is echoed by Brewer and Hunter (1989) who explain that the strength of mixed methodology is that "A diversity of imperfection allows us to combine methods… to compensate for their particular faults and imperfections"(p 16).

The mixed methods approach is closely associated with the ontology of pragmatism, as demonstrated by Table 3.1 (Burke-Johnson and Onwuegbuzie, 2004, Creswell, 2003). The idea of mixing methods in order to answer specific factors of a research question is directly related to the idea of pragmatic enquiry, where the basis is a freedom to design a method that is best suited to the specific nuances of the research.

PRAGMATISM CHARACTERISTIC	MIXED METHOD SUITABILITY
Not committed to any one system of philosophy and reality	Inquirers draw from both quantitative and qualitative assumptions when they engage in their research
Individual researchers have the freedom of choice, to choose methods, techniques and procedures	Mixed method ontology is based on this freedom
Pragmatists do not see the world as an absolute unity	Mixed methods is based on the utilisation of many approached to solve or explore a problem
Truth is what works at the time; it is not based on a strict dualisation between the mind and reality completely independent of the mind.	Mixed method use of qualitative and quantitative provide a clear and more complete understanding of the research problem.
Pragmatists look to the "what" and "how" to research based on its intended consequences.	Mixed method requires the establishment of the purpose and rationale for mixing methods.

Table 3-1 Pragmatism and Mixed Method Suitability

The mixed method approach to research is the most suitable for this research project because, in a practical sense, taking a "mixed position allows the researcher to mix and match design components that offer the best chance of answering their specific questions" (Burke-Johnson and Onwuegbuzie, 2004, pp18). This research project involved a number of separate research questions that are best explored using a variety of methods, in order to create a more complete picture of the current state of the education of VTW skills in Australian University Construction Programs. In order to establish the explicit inclusion of VTW skills a content analysis is necessary. However, to establish the attitudes of those involved in the education of these skills, and therefore establish if there is an implicit inclusion of VTW skills in the programs, the semi-structured interviews were the most suitable. This is an example of the rationalisation for the use of a mixed method design in order to explore the multi-faceted nature of the research question. The specific detail of the mixture of

methods is explored below, to establish how the information gleaned from the variety of methods will be used together, to answer the over-arching research question.

3.3.1 *Mixed Method Design*

The establishment of a clear research design is fundamentally important in driving the data collection and analysis methodology. Obviously, mixed method approaches present particular challenges in defining the selection, adoption and execution of methods due to the flexibility of this approach. As Teddlie and Tashakori (2009) explain, it is difficult to "create a complete taxonomy of mixed method designs due to the designs' capacity to mutate into other forms" (p 139). This mutation is in keeping with ontology of pragmatism—the flexible design of methods to suit the research being undertaken.

To address this issue, Teddlie and Tashakori (2009) actually avoid presenting a series of design typologies to guide mixed method approaches, as many other researchers have undertaken (e.g. Hammersley (2004); Morgan (1998); Creswell (2003); Greene et al (1989)). Instead, they present a list of the criteria that lead to different designs, to determine which design is best suited to the research. The criteria used in the development of their typologies are:

- Number of methodological approaches used
- Number of strands or phases
- Type of implementation process
- Stage of integration of approaches

Teddlie and Tashakori (2009) also recognise the criteria often presented by other typologies, such as those presented by Creswell and Plano Clark (2007), which involve the determination of the "Priority of methodological approaches", emphasising the recognition of one method's importance over the other. Teddlie and Tashakori (2009) argue that the "relative importance of the QUAL or QUAN components of a research study cannot be completely determined before the study occurs… because the actual priority is often determined after the study is complete"

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(p 140). The research herein chose to recognise and utilise these criteria in the mixed method research design, along with the typology presented by Teddlie and Tashakori (2009).

Teddlie and Tashakori (2009) go on explain that an important distinction needs to be established between the term "simultaneous", used by Morse (2003), "concurrent" used by Cresswell & Plano Clark (2007) and their "parallel". They explain that the terms "simultaneous" and "concurrent" are used when the strands of research are carried out at the same time. However, Teddlie and Tashakori (2009), explain that "there are also numerous case in which the two types of data are collected at different times due to practical considerations" (p 172). This is the case in this research project, and as a result the more "inclusive term" of "parallel" will be used. This means that while the data was collected at different times chronologically, in terms of analysis and integration, it was collected at the same stage of the project.
The design typology of the research herein, is based on the typological differentiations of Teddlie and Tashakori (2009). At its most basic, the criteria for determining the typological "family" are the type of approach and the number of strands (or phases) of the study. This research involves both qualitative and quantitative data collection, which will be carried out in a number of phases. This means that the research falls under the category of "Mixed Method Multi-strand." Within that broad design typology, the research will be carried out through a Parallel mixed design, with one strand involving a sequential design, as shown in the Project Diagram (Section - 1.8).

According to Teddlie and Tashakori (2009), in Parallel Mixed Designs "mixing occurs in a parallel manner, either simultaneously or with some time lapse; planned and implemented QUAL and QUAN phases answer related aspects of the same questions." The research is carried out using two strands of inquiry, with inferences made from each strand of the study, "inferences based on the results of each strand are integrated to form meta-inferences at the end of the study" (pp172).

As discussed previously, while Teddlie and Tashakori (2009) do not incorporate the criteria of method priority in their typologies, this study will recognise the

importance of the Qualitative stage of the study, in exploring and expanding on the findings of the quantitative stages (as explained in detail below.)

Teddlie and Tashakori (2009) explain that this form of mixed method research design is effective in its ability to allow the researcher to "simultaneously ask confirmatory and exploratory questions, thus verifying and generating theory in the same study" (pp152).

The suitability of this mixed method research design is related to the multi-faceted nature of the area of research in this study. While explored in detail below, this research will involve the sequential design element of quantitative data leading to the development of the qualitative data collection instrument. Meanwhile, quantitative data will be used to explore related facets of the research question, with the inferences from all strands being brought together to create a more complete understanding of the education of VTW skills in Australian University Construction Programs.

3.3.2 *Research Design Evaluation Framework*

In order to ensure the effectiveness of the enquiry phase of research, and resultant findings, this research has been designed with commonly accepted research evaluation criteria in mind. While these criteria have been designed as tools for evaluation of research upon completion, by ensuring these issues are addressed the research can be assured of effective design and direction. Predominantly, the design of this research methodology has been mindful of the central evaluation principles of Spencer et al. (2003); the research needs to be "Contributory", "Defensible", "Rigourous" and "Credible".

In addition, the criteria presented by Garman (1996) has shaped the design of this research, especially due to the specific relevance to research in the field of education. Garman (1996) presents eight criteria. While similar to Spencer et al. (2003), the criteria presented by Garman (1996) found to be unique and applicable to the research herein were the questions of "utility" and "vitality". Respectively, this

means ensuring that the research is useful and professionally relevant to the field of education and that the findings will be important and not trivial. These evaluation criteria have been involved in the design and execution of the methodology explained below, in order to ensure the effectiveness of the research and results.

Section - 3.4   Sampling and Ethics

3.4.1 *Sampling and Exclusions*

The first stage in the data sampling for the project was to determine the relevant university institutions to include in the study. These were universities that offer degrees in any of the relevant construction program disciplines; construction management, quantity surveying or building surveying, either in an on-campus or distance capacity. From information available in the public domain, a list of the relevant education professionals from these institutions was compiled. This list was then sent to the heads of school at each institution to confirm the staff lists developed. The final list then provided the contacts for the two key research methods: the quantitative online survey and qualitative interviews.

Due to the extensive nature of the research, all relevant university staff members had the opportunity to participate in the study. This removed the need for sampling conventions or randomisation. However, to facilitate the research process and ensure the ethical suitability of the project, two research population exclusions were made, namely:

- Sessional staff: the study concentrates on full-time staff because of the inherent difficulties associated with contacting sessional staff.
- First year students: due to the significant number of first year students under the age of 18, and the ethics of determining their correct age, these students have been excluded from the study.

3.4.2 *Ethical Considerations*

This research recognises the inherent ethical considerations regarding human research, and has been carried out in accordance with international standards for ethical human research. As explained, this research formed part of a larger study and was included in the ethical approval for the larger study; University of Newcastle Human Research Ethics approval number for the larger study is H-2008-0042. This research, specifically, paid particular attention to the anonymity of the interview and survey respondents. The online survey was hosted by a third party, and as such the specifics of the respondents were not available. In addition, as discussed in Section - 3.4, the interview participants' anonymity was protected by a coding system for the responses used in this research. This coding system is known only to the researcher. Furthermore, the respondents were given the opportunity to withdraw from the study at any time, and given the opportunity to review the transcripts of the interviews.

Section - 3.5 Data Collection Strands and Analysis

After establishing the methodological strategy to be used in this research, multi-strand parallel mixed method, the specifics of these strands of enquiry must be established, in order to facilitate an understanding of their relationship to the project objectives and aims. The project structure has been provided again, here, to aid in the understanding of the design of this research. Each strand has been designed to address and explore the different project objectives.
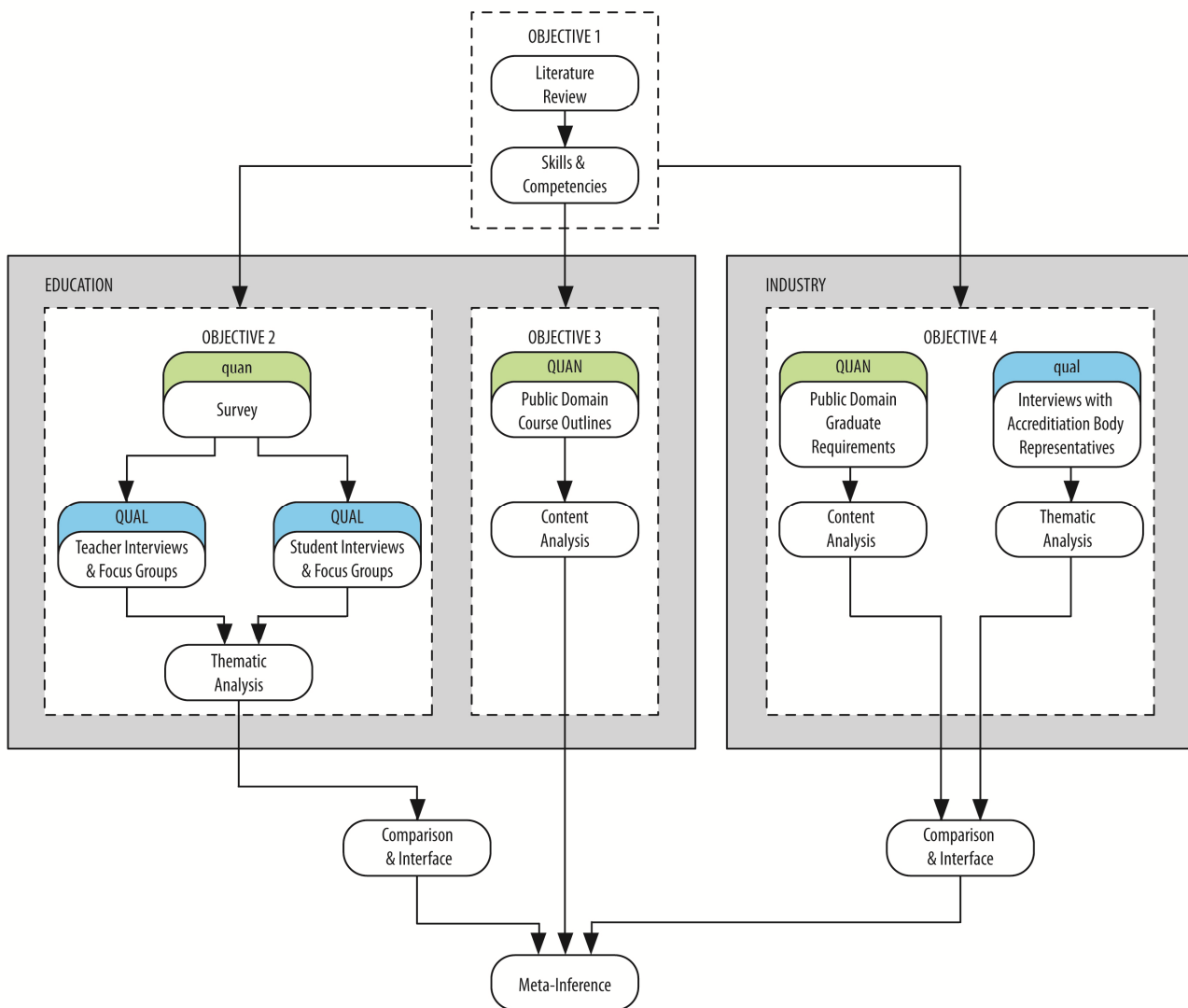
Figure 3-1 Project Diagram

3.5.1 *Strand 1 – Objective 2*

Strand 1 uses a mixture of quantitative and qualitative methods to address objective 2, and examine the perceptions of the teaching and learning of VTW skills in Australian University Construction Programs. The quantitative results of the survey will feed into the design of the semi-structured interviews. The results will then be analysed to determine common themes in the attitudes of the education stakeholders.

Quantitative Collection

A quantitative online survey is used to investigate the extent of education of VTW in each university (see appendix 1 for full details of the survey). The survey explores issues such as online course delivery, perceived education of VTW, teamwork in the courses and the assessment of student teamwork participation. The online survey was only to be carried out by staff in each university, as the questions related directly to the course content. All participation in the study was voluntary. Furthermore, the survey was administered online by the Corporate Information division of the University of Newcastle which ensures anonymity and expedites analysis.

Due to specific nature of the respondent suitability criteria, 100% of the possible respondents were given the opportunity to respond to the online survey. This means that it was not necessary for the results of the online survey to undergo statistical analysis or extrapolation. The information gleaned from the online survey was used to support and develop the qualitative data collection methods that follow—i.e. interviews and focus groups.

Qualitative Collection

An analysis of the survey results were used to develop the questions and direction of the semi-structured interviews, and focus groups, to follow. As explained by Bryman (2008) the key differentiation of a semi-structured interview is that the "interviewer has a series of questions that are in the general form of an interview schedule but is able to vary the sequences of the questions" (p 438). Meanwhile, a focus group is simply a semi-structured interview involving 4 or more people.

The variability and fluidity of the semi-structured approach allows the interviewer the freedom to let the participants affect the movement of the interview from one issue to another, rather than confining them to a strict list of ordered questions—allowing the room for participants to pursue topics of interest. Thus, the use of a semi-structured interview helps to ensure that all relevant issues are covered using similar wording, albeit in a fluid manner.

In this study, semi-structured interviews are employed, individually and as part of focus groups, to investigate educational issues with both construction staff and students (see appendix 2 for interview schedule). This is in an effort to explore the teaching and learning of the VTW skills list derived from the literature, and the attitudes of the education professionals towards the education of these skills. Three qualitative data collection sessions were carried out at each institution:

- Head of School Interview
- Staff Focus Group
- Student Focus Group

The interview and focus group participants were provided with an information statement outlining the purpose of the study, and received verbal explanation of what was expected in the interviews or focus groups. Participants were made aware that the interviews were recorded, and the process of maintaining their anonymity was explained. Finally, a consent form was signed by all participants.

In order to facilitate the analysis of these interviews, the recordings were transcribed. This transcription was carried out by a third party, and was accessed and analysed in an anonymous fashion, with all identifying comments and names removed and a Code and Number were used to distinguish participants in the different interviews and institutions; Head of School (HoS), Staff Focus Groups (Sta) and Student Focus Groups (Stu). Participants were also given the opportunity to review their transcripts to delete and/or edit any information.

Thematic Analysis

The data created through the interviews and focus groups will be analysed looking for recurring patterns or themes in the discussion, regarding the skills taught and the importance placed on VT education. Thematic analysis involves identifying and exploring themes in qualitative data. Boyatzis (1998) explains that at its most basic level thematic analysis involves the recognition of an "important moment", then encoding it, and providing comment and interpretation. The themes to be codified are "a pattern found in the information that at minimum describes and organises the observations and at maximum interprets aspects of the phenomenon" (Boyatzis, 1998, pp7). Rather than trying to make the data fit a pre-determined coding system, the data reveals the codes and themes, which then leads to interpretation and understanding. Thus, thematic analysis creates a systematic way to analyse, organise and interpret qualitative data.

In this project, thematic analysis of the transcriptions involved the digital codification of the text. The text from the transcriptions was categorised using QSR Nvivo. The preliminary codes used in the thematic analysis were developed through an interpretation of the literature review and on-line survey, but evolved through the course of the analysis, as themes were revealed and discussed. The use of thematic analysis in this strand of the research is in an effort to interpret the attitudes and practices of university staff and students towards the education of VTW skills.

3.5.2 *Strand 2 – Objective 3*

Strand 2 is related to the completion of Objective 3. Strand two utilises a quantitative analysis of the publically accessible course outline descriptions for the relevant Construction related programs. This was used to determine the extent to which VTW skills are explicitly included in the programs.

Quantitative Data Collection and Content Analysis

This data collection phase involved an exploration and collection of data available in the public domain—specifically the Australian construction program course outlines. The outlines were collected, to facilitate the statistical analysis of the course content descriptions.

Content analysis techniques were adopted to examine the course outlines to develop quantitative data. Using the content analysis code framework presented in Table 3.2 the course outlines are explored to identify recurring themes/terminology that matches the identified core skills of VTW derived from the literature. These are not, necessarily, literal word searches but rather an interpretive analysis of relevant synonyms and phraseology.

Table 3-2 Course Outline Analysis Framework

Skill Area	Traditional Teamwork	VTW
Technology		
	ICT	
Communication		
	Meetings	
		Text Chat
		Voice Chat
		Video Chat
	Written	
		Email
	Management	
Leadership		
	Leadership	
		E-leadership
Trust		
	Development	
Culture		
	Cultural Awareness	
		National Culture
	Cultural Dimensions	
Management		
	Conflict Management	
		Computer Mediated
	Cohesion	
		Virtual Team Cohesion

In order to establish a more complete understanding of the education of VT skills in these courses, the content coding framework sets out to determine a variety of scenarios, to help establish a richer understanding of the inclusion of VT skills in the relevant construction programs. One element determined in the content analysis is the use of teamwork in class delivery; this analysis was used to establish if the

courses involved students undertaking teamwork of any kind, traditional or virtual. Secondly, the analysis of the course outlines set out to determine the extent of the inclusion of any teamwork skills, even those that could be construed as traditional. This was in an effort to establish if teamwork is evident in the presentation of these courses. Finally, the analysis set out to establish if the extent that skills specifically related to teamwork in the virtual context were being taught. This distinction between specifically virtual skills, and those skills that could be used virtually or in a traditional context, was important because it adds to the complexity of VT skill education. Some skills that are useful in the traditional context can be transferred to the virtual context.

3.5.3 *Strand 3 – Objective 4*

Strand 3 is related to objective 4, and explores the presence and attitudes towards VT skills education in the requirements of the industry representative bodies, and their course accreditation process. Similarly to the education sphere, this strand involves both quantitative and qualitative methods. The quantitative method aims to determine, the extent of explicit inclusion of VT skills in the graduate competencies, while the qualitative explore the attitudes of the industry bodies towards the inclusion of VT skills.

Quantitative Collection

The quantitative analysis phase of this methodological strand involved the collection of further data available in the public domain. The graduate competency requirements for industry representative body accreditation were collected and analysed, to determine the extent that VTW skills are required and represented in the accreditation process requirements. The industry bodies included in the analysis are:

1) The Australian Institute of Builders (AIB)
2) The Australian Institute of Quantity Surveyors (AIQS)
3) The Australian Institute of Building Surveyors (AIBS)

Only those industry bodies that represent the Australian construction industry were included in this analysis. While many universities hold accreditation from

international representative bodies, these are not deemed relevant in the exploration of the alignment between Australian University Construction Programs and the Australian Construction Industry.

Qualitative Collection

The qualitative phase of data collection in this strand involves semi-structured interviews with construction industry representative bodies. These interviews were similar to the other semi-structured interviews conducted as part of the research. These interviews were designed to explore the attitudes of the construction industry representatives to the education of VTW skills.

Content Analysis

The content analysis of the graduate competency guidelines utilises the same content framework as in strand 2, in order to ensure validity and comparability of results. This content analysis endeavours to determine the presence of VTW skills in the required graduate competencies in Australian University Construction Programs.

Thematic Analysis

The thematic analysis of these interviews is based on the same preliminary codes as discussed above. This ensures similarity in the starting point of organisation, interpretation and understanding of the data. However, in keeping with the principles of thematic analysis, the themes revealed in the data lead to a unique codification and understanding of the perspectives of the industry representative bodies, regarding the education of VTW skills.

Section - 3.6   Response Rates

3.6.1 *Online Survey*

Owing to the nature of online surveys, and the inherent ease of completion, the response rates of staff were found to be adequate. Overall a response rate of 56% was achieved. The details of specific institutional response rates are provided below in Table 3.3.

STATE	INSTITUTION	RESPONSE RATE
New South Wales	The University of New South Wales	36%
	University of Technology, Sydney	32%
	University of Western Sydney	26%
	University of Newcastle	88%
Queensland	Bond University	33%
	Central Queensland University	75%
	Queensland University of Technology	42%
West Australia	Curtin University of Technology	63%
Victoria	RMIT University	47%
	Deakin University	25%
	The University of Melbourne	18%
South Australia	University of South Australia	73%

3.6.2 *Semi-Structured Interviews*

The response results of the interviews are presented in Table 3.4. The interviews were carried out in phases. This was done according to university hierarchy, in an effort to minimise the effect of perceived pressure from managers on employees. As a result, separate interviews were done for heads of school, staff and students. It is important to note, however, that heads of school participated in three of the staff focus groups. This was not found to detrimentally affect the process. As explained

previously, the students were from second year onward, and an even distribution between construction management, building surveying and quantity surveying students was maintained.

Table 3-4 Interview Participants

GROUP	MALE	FEMALE	TOTAL
Interviews with Heads of School and Program Coordinators	19	1	20
Staff Focus Groups Participants	28	2	30
Student Focus Group Participants	79	7	86
Total	126	10	136

Section - 3.7   Limitations

As outlined in Section - 1.9, this research formed part of a larger study which resulted in both advantages and unique limitations. The larger study also involved semi-structured interviews with the staff and students of Construction related programs. Due to the limitations of time and cost, it was not possible for this researcher to facilitate every semi-structured interview. However, for the scope of this research, a representative proportion of available respondents were interviewed. In addition, every effort was made by the assisting researchers to facilitate meaningful discussions regarding this area of knowledge. The transcriptions resulting from these interviews were analysed by this researcher and no significant difference was found in the quality of responses.

Another limitation found in the course of this research was the ability of the online survey to capture the attitudes and perceptions of the staff and students towards the education of VTW skills. Due to the complex nature of VTW skills, and the possible need for explanation, these results offer limited use. This is predominantly due to the variety of terminology and levels of understanding of what was meant by VTW. This limitation was addressed, however, in the methodological strategy chosen for this research. The quantitative results from the survey were to be used in the shaping of the semi-structured interview, and supported the exploration of the complex issues through the qualitative methods.

Section - 3.8   Conclusion

The methodology adopted for this research has been designed to explore the variety of facets of the research problem. As outlined in the research aims and objective, this research question involves the exploration and analysis of VTW in the spheres of both education and industry. The methodology developed and explained above seeks to address the objectives of this research by utilising a mixed method in the pragmatic ontological stance, using both qualitative and quantitative methods of research in order to establish both the explicit representation of VTW skills in the education and industry expectations, as well as the attitudes of both the educators and industry representatives. In addition, the attitudes of the students will be explored to establish if their recognition of the importance of VTW and whether or not they feel the required skills are being taught. This mixed method allows the researcher to establish a richer understanding of the implicit and explicit education of VTW skills in the construction programs.

CHAPTER 4 - RESULTS

Section - 4.1   Quantitative Results

In accordance with the methodology outlined in Chapter 3 - an online survey was created and made available to all relevant staff in the Australian Universities delivering Construction Programs. While forming only a part of the entire mixed methodology, the quantitative phase of enquiry was designed to determine the initial attitudes of the staff towards the emergence and utilisation of communication technologies in education and the education of the field of VTW. The quantitative enquiry and analysis establish the initial attitudes of the staff, and capture the attitudes of staff that may have been unable to attend the ensuing focus groups. The results below demonstrate that those involved in the education of Construction Programs acknowledge the growing importance of ICT in education, but do not understand or acknowledge the field of VTW. This is the issue that is further explored in the qualitative phase of enquiry.

4.1.1 Online Survey

The quantitative results of the online survey are presented below. As discussed in Section - 3.7, the quality of these results was limited by the complexity of the issue of VTW skill education. As shown, the respondents often chose not to answer the questions related to VTW. However, this further supported the need for a qualitative exploration of their attitudes to the issue, and the potential reasons for their electing not to answer the relevant questions.

Question 1: Does the education of Virtual Teamwork skills form part of your program?

7, 11%

3, 5%

1, 2%

Yes
No
Don't know
No answer

52, 82%
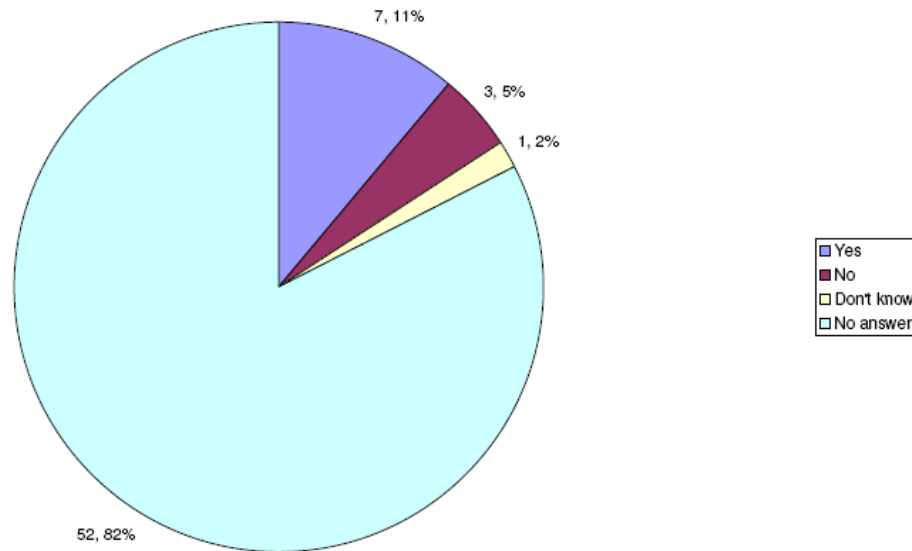
Figure 4-1 VTW Skills in Programs

The results of this question establish if the staff members feel that the required skills for VTW are present in the programs they deliver. While this result is related to the results of the content analysis of the course outlines, this survey question established if the staff believe explicitly that VTW skills are being taught. As shown in figure 4-1, the majority of respondents chose not to answer this question. This is perhaps attributable to the fact that they were unaware of practice of virtual teamwork, and the skills involved. However, interestingly, of the 18% of respondents that answered this question, the majority felt that the education of VTW skills formed a part of the programs they delivered. The details of the skills being taught is explored in the qualitative and content analysis phases of enquiry.

Question 2: Is Student Participation in Virtual Teamwork an assessment component?

6, 10%

1, 2%

0, 0%

☐ Yes
■ No
☐ Intending to implement
☐ No Answer

56, 88%
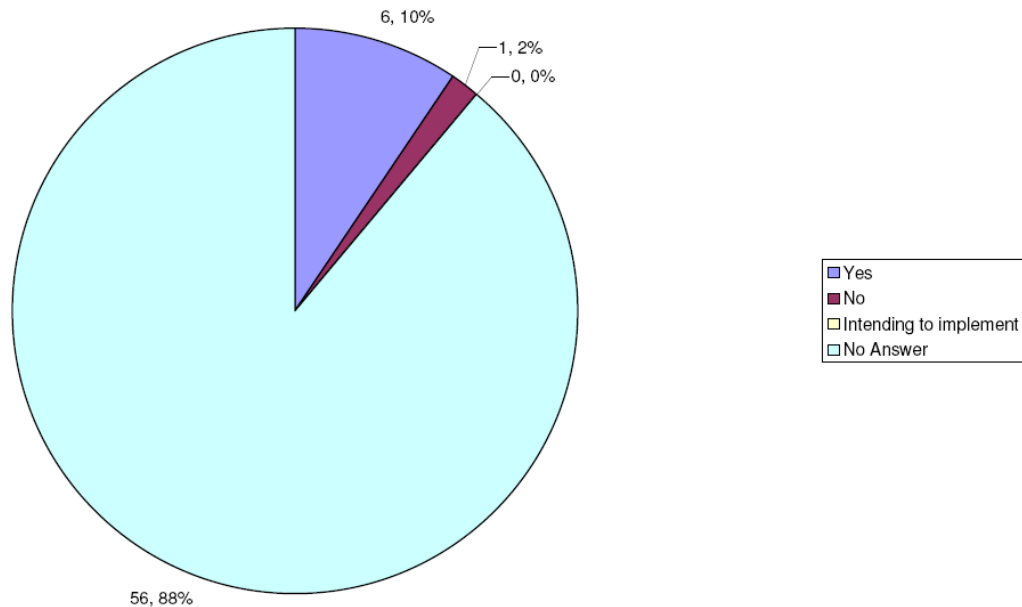
Figure 4-2 VTW Participation Assessment

This question was in an effort to determine if the participation in virtual teamwork, by a student, was an assessable component of the course or simply experiential unstructured learning. Again, the large majority of respondents chose not to answer this question; however of the 12% that did the majority said that it was an assessable component. This is an important element to establish because it demonstrates the importance placed on VTW, by the staff. If the student's experiences in the VT are being measured and assessed, it means a greater importance is being placed on how they interact and complete the required assignment in the context of a virtual team. This issue of assessment of the implementation of the skills required for VTW is further explored in the enquiry phases that follow, where the specific skills taught and qualitative attitudes of the staff are explored.

Importance Ratings

As discussed previously, this research was part of a larger study exploring the education of Australian University Construction Programs generally. The results below came from a question asking staff to determine the importance of some key curriculum issues being explored. An interesting result from those survey questions related to that study has been included here. Figure 4-3 shows the importance placed on a variety of curriculum issues and compares them. Meanwhile, Figure 4-4 presents the relative importance placed on the education of computer skills specifically.
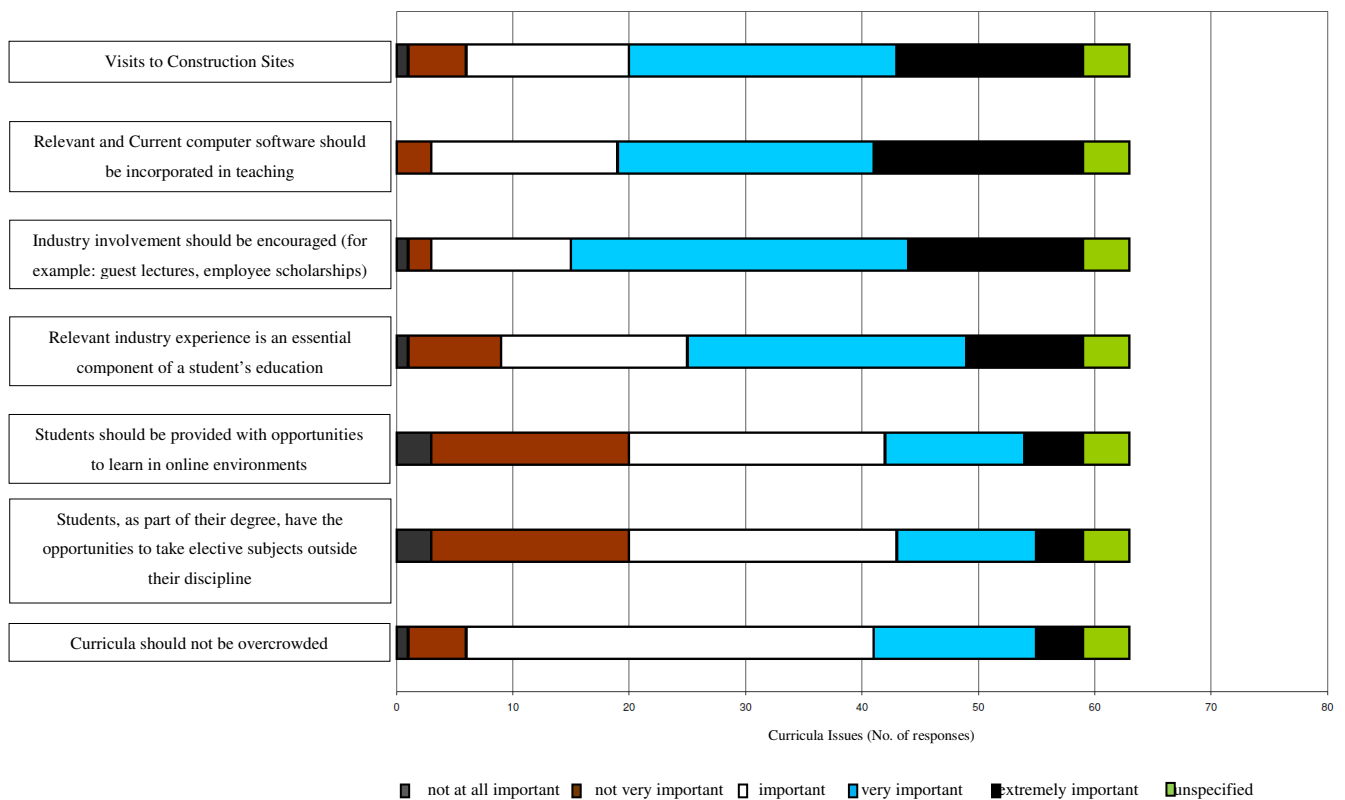
Figure 4-3 Curriculum Issue Importance
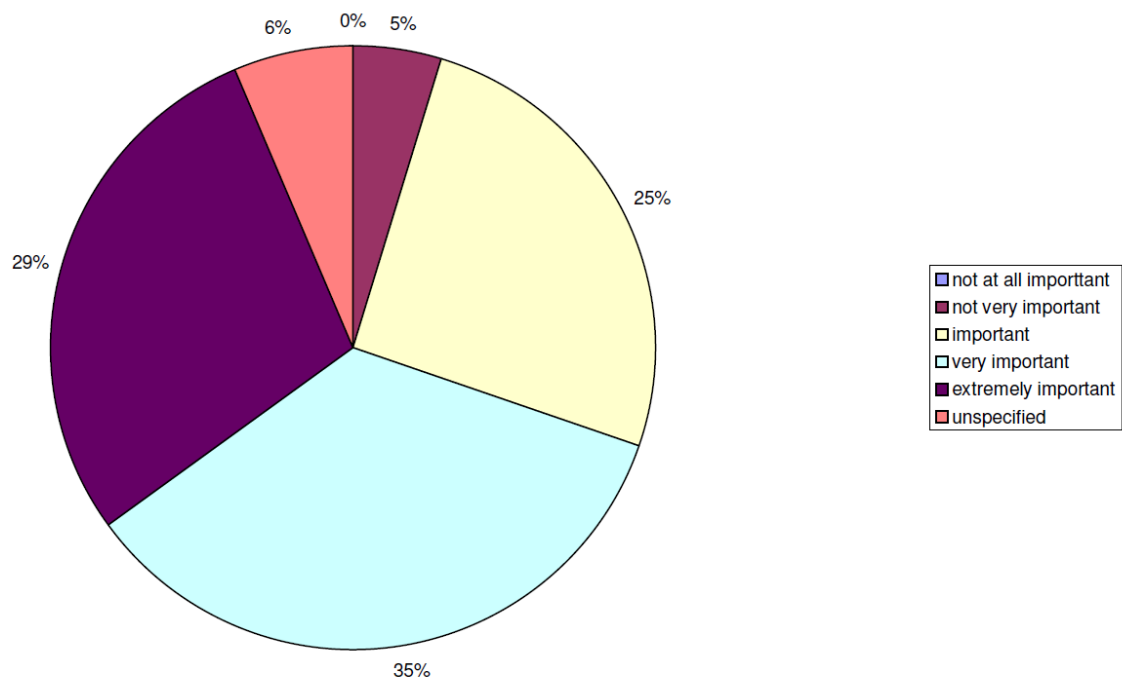
Figure 4-4 Importance of Computer Education

Figure 4-4 shows that the respondents all found the incorporation and education of computer skills to be very important, with the largest proportion electing "extremely important". Also, only 11% either found computer education to be not important, or chose not to answer. This is echoed by Figure 4-3, which demonstrates that a vast majority placed at least some importance on the incorporation of computer software in teaching. This result is interesting because it seems to be contradictory to the results of the VTW questions previously. The importance placed on computer education is demonstrated in Figure 4-4 and Figure 4-3, but no importance was placed on the use of teamwork in a computer mediated environment, and the education of the skills inherent.

While the results of the online survey appear, at first, to be of limited use, they did form part of the exploration of the attitudes of education professionals towards VTW skill education. It was found that great importance was placed on the education of computer skills. These programs are designed to educate students in preparation for the Construction Industry, which inherently involves the interaction of a variety of

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stakeholders in the completion of a project, but the staff do not make the connection to place very much importance on the inclusion of VTW skills in their curricula. In keeping with the methodology, this result is explored further in the qualitative semi-structured interview. The interviews establish if this contradiction of attitudes towards computer education is due to a lack of understanding, or apathy towards the growing VT trend in the Construction Industry.

4.1.2 *Course Outline Analysis*

Content analysis was used in an effort to establish if the education of VTW skills was evident in Australian University Construction Program, course outlines available in the public domain. As explained in section 1.3.2, for this research each University Program is made up of individual courses. There are 12 relevant construction programs in operation across eleven Australian universities, with three offered through distance learning. However, course outlines were only available for nine of the programs. These programs were made up of a variety of courses, with some straddling programs and departments. Across the universities it was found that there were a total of two hundred and sixty-four (264) relevant construction-related courses.

The content analysis involved analysing the available course descriptions for key terms that were developed through a review of the literature and a determination of the key skills involved in VTW, to establish a key term framework (Table 3-2). While this terminology framework formed the basis of the analysis, the analysis also allowed for the interpretation of synonyms and phraseology in establishing the representation of VTW skills in the course outlines.

With regard to teamwork and the education of VT skills, 19 (7.2%) of the courses offered mentioned the use of groups or teams explicitly, but not necessarily the education of team skills, simply the fact that students would be working in teams or groups. In addition, teamwork skills that could not necessarily be attributed specifically to VTW were present in 41 (15.5%) of the courses, such as

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communication or conflict management. Finally, it was found that VT specific skills were present in 32 (12.1%) of the courses. These skills found in the content analysis were predominantly the inclusion of a computer or IT component to the course. It is important to note that every program explored had at least one course involving the education of a VT specific skill.

The analysis of the public domain has also provided an interesting picture regarding the education of VTW skills in a teamwork environment. It was found that 5 (1.9%) courses that listed the use of teamwork, did not mention the education of any skills that could be construed as teamwork specific. Conversely, 27 (10.2%) courses included the education of skills that could be related to traditional teamwork, but made no mention of the application of these skills through the use of teamwork in the class. Similarly, 7 (2.7%) referred to VT skills, but no use of teams in the class. Finally, only 13 (4.9%) courses offered mentioned the education of team skills in a class environment involving the use of teams.

These results are important because from them it is deduced that the skills useful in the practice of teamwork, traditional or virtual, are included in the course outlines, either implicitly or explicitly. However, overwhelmingly, the students do not appear to be putting these skills into practice through organised teamwork in the classroom. These results will then be used, as shown in the project structure (Figure 3-1), in conjunction with the results of the strand 1, to explore the implicit and explicit education of VTW skills in the relevant programs. From this research strand, it seems that the skills are being taught inadvertently, and the students are not being given an opportunity to put these skills into practice, or engage in experiential learning of the skills related to teamwork; virtual or traditional. The qualitative research strands will then explore if this supposition is founded and the attitudes of the education stakeholders towards this situation.

4.1.3 *Accreditation Requirements Analysis*

The relevant documentation required for professional body accreditation of university courses is available in the public domain, and has been analysed below. The guidelines and criteria presented in this documentation are designed to be representative of the needs of the industry. As explained in the methodology, an analysis of this data will aid in the exploration of the alignment between industry representative professional bodies and the education of VT skills in Australian University Construction Programs. The results below are simply a presentation of those criteria deemed to be relevant to teamwork. As can be seen, some are related to traditional teamwork and are not VT specific, while others could be construed as relevant to VTW. This data will be explored simultaneously with the results of the qualitative analysis of the professional body interviews, to determine the extent of the recognition of the importance of VTW skills in the education of Construction Industry professionals, and the attitudes of the Industry Representative bodies towards the field of VTW.

Australian Institute of Builders (AIB)

In an analysis of the accreditation requirement documentation for the AIB, some evidence of skills associated with effective teamwork has been found. In the skills requirements section of "Annex D: Competencies for a construction management graduate" (AIB, 2006) the following skills could be interpreted as relevant to the practice of teamwork – some related to VTW specifically, while some could be interpreted as for either traditional or virtual, including:

> **"11.** Apply the principles for managing human relations and resources for a building project
> **17.** Apply business management principles."

Meanwhile, the attributes list includes some attributes that could be construed as relevant to teamwork;

"1. Communicate effectively both orally and in writing, using all forms of communication.

5. Participate effectively in a team, including the role of leadership

10. Have an international awareness and appreciation of cultural diversity."

These results are indicative of the attitudes of this representative body towards the education of teamwork, and VTW specifically. It is evident that teamwork is a recognised skill requirement in the industry. However, the application of these skills in a virtual context is not a requirement. In fact, the only allusion to any skill that could be potentially useful in a virtual environment is the ability to communicate effectively in writing, and be aware of cultural differences.

Australian Institute of Building Surveyors (AIBS)

The accreditation requirements for the AIBS are presented in the form of benchmarks, covering various areas of professional practice requirements (AIBS, 2008). Skills related to teamwork have been found, as below;

"Professional Ethics
- Demonstrate good understanding of meeting protocols, including ability to conduct and chair meetings and reporting to a board/council

Management Practice
- Establishment of recording procedures and management
- Possess effective and relevant interpersonal skills, including the ability to communicate effectively within workplace and general public
- Demonstrate good understanding of meeting protocols, including ability to conduct and chair meetings and reporting to a board/council

Communication Practice
- Use IT in communication and information management and demonstrate overall computer literacy

Problem Solving Skills
- Demonstrate basic understanding of forms of conflict and their resolution"

The graduate skill requirements of this industry representative body involve a number of skills that could be used in a virtual context. Importantly, these requirements specify the need for skills in communication in a virtual context. This is the only direct reference to virtual communication found in the accreditation requirements analysed.

Australian Institute of Quantity Surveyors (AIQS)

The accreditation documentation for the AIQS is presented as a series of key graduate competencies (AIQS, 1998). These are broken up into elements, with specific performance criteria for the achievement of each element, which should be present in the education courses. Skills related to both traditional and VTW are present in both the initial basic abilities, and in the detailed performance criteria. The relevant sections only, are listed below.

Basic Abilities
- **Communication:** The ability to impart knowledge, ideas and concepts through oral, written and visual means.
- **Interpersonal Skills:** The ability to work with others effectively and to be part of a team.
- **Leadership:** The ability to lead and motivate.
- **Computer Literacy:** The ability to understand and apply basic computer skills.

Competency Standard Unit 23 – Computer Services
- Computers used to access, enter and process information
- Data exchange between participants in construction activities promoted

Competency Standard Unit 29 – Business Management
1. Appropriate means of communication for a variety of situation, instruction given and received accurately.
2. Take part in formal and informal meetings

3. Sources of data identified and accessed to ensure that relevant information is available to work groups

4. Networking and other work relationships maintained and used to provide identifiable benefits for the team, organisation and client.

These graduate requirements involve a number of references to skills that would be applicable to VTW. While IT skills and communication skills are requirements separately, communication in the virtual context is not specifically mentioned. However, the application of "appropriate means of communication" could be construed as a reference to the need for an understanding of the correct mediums of communication for a given task situation. Importantly, these criteria also make specific mention of the need for the ability to work as a team, and the requirements for a variety of skills that could be used in a VTW situation.

The salient results from these analyses are the fact that there is only one mention of the need for a specifically virtual skill. Most often it was found that generic skills that could be used in a team situation are presented in the course outlines, such as proficiency in different forms of communication. These were presented along with some mention of the need for computer literacy. However, very few made specific reference to the need for proficiency in computer mediated communication.

Similarly, the use of teams or groups in the education was referenced very occasionally, but this was rarely mentioned in conjunction with skills involved in teamwork. While at no point was there a course outline that involved the use of teamwork, the education of skills that could be used in teamwork, and the education of computer skills. Instead, elements of a variety of course could be construed as being related and if brought together, could be deemed useful in the practice of virtual teamwork.

The attitudes of the staff towards VTW determined by the online survey, and the results of the course analysis will be explored further in the qualitative phase of enquiry. These early phases of enquiry have determined that while computer skills are deemed important, and appear occasionally in course outlines, and skills that

could be useful in VTW appear in course outlines. The links between teamwork and technologically mediated communication are not evident, and the specific skills required for effective VT participation do not seem to form an explicit part of the education sector's attitudes or deliverables. This result is supported by the analysis of the industry body expectations, which do not seem to be calling for VTW skill education. These results will be further explored in the qualitative phases of enquiry, to establish if the results are indicative of their attitudes, and if the education professionals and industry representative attitudes are in keeping with the expectations of the students.

Section - 4.2   Qualitative Results

The thematic results from the semi-structured interviews will be presented and explored in this section. These results are based on the analysis of the interview transcripts, using the basic thematic code presented in Section 4.1.2. However, in keeping with the method of thematic analysis, the interviews were not analysed using a rigid structure, instead the common themes revealed themselves. Each resulting theme is discussed individually. As outlines by the project diagram, the resulting themes will be explored in conjunction with the quantitative analyses of the different strands of enquiry, to address and explore the objectives of this research.

4.2.1 *Interviews – Staff*

In keeping with the methodological design outlined in Section - 3.3, the qualitative data collection was carried out after the completion of the online survey, which had established general attitudes towards VTW. These semi-structured interviews were designed to explore themes evident in the online survey further, and those issues related to the education of VT skills, that could not be explored in an online survey situation. These interviews provide a richer understanding of the opinions and issues facing education professionals in the education of VTW skills. The results of the thematic analysis are presented below. The themes are presented in two main sub-themes: the issue of virtuality in the learning practices, and the use of teamwork in teaching.

Virtuality in Teaching

The issue of technological implementation and integration into the teaching and learning practices of the universities was a major theme in the interviews. As explained in Section 1.2.3, the nature of VTW is the undertaking of teamwork in a non-traditional virtual environment, reliant upon communication technologies. The discussion of these technologies in the university environment resulted in the key

themes presented below, which are indicative of the dichotomy of opinion and educational approach present in Australian university construction related programs.

a) Online Communication Platform

The interviews were used to determine the availability of technologies to support the education of VTW skills. Almost every university provided an online platform allowing for information storage, sharing and communication. However, it was found that the perceived usefulness of the systems and the integration of their capabilities with the learning environment was a point of contention.

The opinions of the participants were divided on the issue of the usefulness of incorporating the online platforms in the education. These discussions did not deal with teamwork through these platforms necessarily, but were rather related to the educator's perceptions of the integration of online learning capabilities. Some institutions incorporated the online component heavily: *"blackboard would at this point be the hub"* (JHOS1). While others had the system in place, but referred to a lack of incorporation in education, *"it's just our staff don't necessarily use it as much as they might, and our students don't either"* (KSta1).

It was found that those participants who embraced the platforms, also referred to their useful capabilities, especially in the area of communication and information sharing, as outlined by the following respondent:

> **FHos2:** *"They can work through Blackboard and – you know,*
> *there's all sorts of different packages that are there electronically*
> *for them to use– discussion groups and all that sort of thing that*
> *they can go on there and discuss things."*

Participants also referred to the capabilities of the online platform in the area of teamwork, and specifically the assessment and monitoring of student communication and collaboration. The issue of assessment of teamwork participation was a recurring theme of discussion for both staff and students, as one respondent describes here:

> **KSta3:** *"The lecturer can go and have a look and see how each group is. It seems to have a lot of advantages over going it face to face. They can see who is pulling their weight and who isn't."*

It became clear that regardless of whether a university provided a distance learning capability for their construction related degrees, the vast majority supported their teaching practices with an online platform capable of enabling communication and information sharing. The perception of usefulness was divided, with the majority applauding the capabilities, and some lamenting their lack of use by students and staff. This attitude towards the virtualisation of the education sphere is consistent with the quantitative findings, where the education of computer skills was deemed to be very important by the majority of respondents. This attitude is also reflective of one of the key challenges of virtual teamwork evident in the literature, the difficulties associated with technology choice and the effective matching of needs with capabilities (section 2.1.2). However, interestingly, as found in the review of course outlines, while the virtualisation of education experience is seen as useful, the skills required for effective participation in the virtual environment are not being explicitly taught.

b) Teaching Expectations

A common theme of discussion was the tension between what is expected of the educators in their delivery of knowledge to the students, and their teaching techniques. It was found that there was a change in learning style of students, attributed to 'Generation Y'. It was the response to these changes, however, that was found to be very different in all the institutions.

Almost all participants referred to the fact that students in today's university system are different, and have different expectations of the way knowledge is delivered and what is expected of them as students. Some saw those changes from a negative perspective: *"Australian students are disengaged from university"* (FHos1) and *"this experience of talking to the lecturers and so on is devalued"* (GSta1). This negative perspective of student expectations was found to be in correlation with the opinion of

the integration of technology in teaching practices, and their utilisation of the online capabilities.

However, the majority of participants had a different perspective of the changing expectations of students and learning. They had an acceptance of the changes, and a realisation that the teaching practices will need to adapt to accommodate the changing expectations of the students and industry.

> **ASta1:** *"I just think there are lots of opportunities to try different ways. It's all very well to say students don't take an interest and they don't learn, but I think staff need to learn new ways to engage."*

> **CSta2:** *"I think we are still teaching, we are still assessing and we are still time-tabling on the assumption that the student cohort has not changed, and they have. They are not going to change to suit our system so our system needs to change to suit them. We are stuck, I think, like many universities, with an academic cohort that is sluggish to move to a new challenge. I think part of that is they simply do not understand the challenge. So they are an issue, but I do not think it is the students' problem, I think it is our problem."*

> **IHos2:** *"So people coming out of school they actually had the internet probably available through nearly all their school life. So why would we expect, when they're used to all these digital devices, that they are going to sit in a lecture and take notes in longhand with a pen? It's not what they do. So if it's not the way that they do things, we have to try to – for better or for worse, and everybody's parents for generations have said 'I said don't know what the young people of today are coming to. What we used to do worked okay'. It's like okay we seemed to have prospered okay. As a university we've done all right in spite of every generation thinking the next generation is going to screw it all up. I think we*

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have to change and just accept that. But of course some find it easier to do that than others. We have one bloke here who says 'I'll teach it the way my father was taught and I don't see any reason to change'."

While the major change in education ethos referred to is the need for increased flexibility, attainable through online information delivery, this issue of technological incorporation in education is directly related to the area of VTW skill education. Traditional teamwork is a common practice in Australian construction related university education and the virtualisation of education practices will inevitably lead to the use of VTW, either implicitly or explicitly. As IHos2 explained, increasingly the students completing the programs have been raised with the internet in the home, and are comfortable with the virtuality of their lives, which will inevitably be reflected in their education practices, and should be reflected in the delivery of the course. However, it is evident that some education professional are unaware of the practice of VTW, and are resistant to the integration of online capabilities to support and shape their teaching and learning.

c) Impact of Technology in Teaching

In addition to determining the platform used in each university, the staff discussed their opinion of the issue of technology in teaching. This theme was related to the themes discussed above, in that the staff member's opinion of online platform capabilities and changing expectations of students, directly affected their opinion of increased implementation of computer technology in teaching practices.

The major impact of the increased utilisation of online learning platforms, and the changing practices of 'Gen-Y' students, is an issue of student attendance and work ethic. As discussed previously, staff had different views on their response to the changing practices of students, but the majority agreed that the increased virtualisation of the learning environment has led to a change in the learning paradigm.

ASta2: *"As we make more and more use of Blackboard, and we give recordings of lectures and things, students feel that they can catch up and they don't come to class."*

ISta2: *"Increasingly we're substituting class time for online engagement with the students, partly because the little buggers won't turn up for class, partly because even when they do turn up for class, after an hour or an hour and a half they just get all bored witless and just start switching off and walking out."*

While this issue is common, the response to this issue of a changing learning environment dynamic is the point of contention. It was found that many respondents were disappointed with the perceived lack of engagement of the students, and the way the education process has been detrimentally affected by the introduction and proliferation of communication technology. Some respondents were simply resigned to the fact that this was how education was being done now, and they had to move with the times. However, it was found that some respondents appreciated the opportunities that the introduction and proliferation of technology in teaching presented, such as increased flexibility for students, and ability to reach students remotely. However, the need for training in the inherent challenges of technologically mediated communication and teamwork was not mentioned or alluded to.

Teamwork in Teaching

a) Use of Teamwork

In order to verify and triangulate the analysis of the course outlines, the interviews were used to determine the extent to which teamwork was used in the education environment. The majority of participants said that they use teamwork, or know it is a part of the course.

The reasons for implementing teamwork in teaching were found to be twofold: alignment with industry practice and reduction of teaching burden. As explained in the following statements:

> **CSta1:** *"I guess the stock standard answer is we have lots of group work assignments which students largely hate. Despite all the arguments that you know well 'You only give us group work assignments because it helps your marking load' and that is true. We, like most universities, do it deliberately. It is a collaborative industry and whether they like their fellow students or not they are going to have to work with them sooner or later. We encourage, deliberately as much as possible, reasonable levels of group work activity."*

> **JSta2:** *"I know but the problem you've got is as much of these courses in construction management are bringing people together and figuring out if they're doing group work, 'you know group work we hate doing group work because this person let's me down.' That's as much of an experience as to what's going to be experienced in the real world."*

A recurring theme, however, was that while educators realised that teamwork is inherent in the construction industry, many acknowledged that students did not seem to enjoy the process.

> **ASta1:** *"But I don't know how many students really value that. The amount of comments you ask, I have worked in a number of teams, I don't need this. But then many look at their reflection of teamwork, it's the most horrendous experience, it's individualistic, very aggressive, arrogant nature of approach to the team. You may not learn a lot, but we do actually request them to go through that experience."*

This is an important point, because it demonstrates that some education professionals realise that even though the inclusion of teamwork in the education practices is often unpopular with students, it is still a necessary facet of the learning process. This feeling is, interestingly, echoed in the views of the students. While they may not enjoy the teamwork, they realise it is a reflection of the industry, and it was necessary to learn to overcome the unique challenges of a team situation. Most interestingly, while the use of teamwork is recognised as being important in the alignment between education and the industry, and the increased proliferation of communication technologies is recognised, the connection leading to the need for VTW education is not made.

b) Challenges of Teamwork

While the majority of participants confirmed the use of teamwork in education, it was explained that the use of teamwork in education presented its own challenges that resulted in some participants ceasing to utilise this teaching strategy. The recurring issues highlighted were: assessment and member selection, as stated here:

> **ASta3***: "The concept of teamwork is good, but when you try to implement it, the students have problems with it and the staff have problems with assessing it. Previously I had teamwork but I dropped it out. It's much easier to manage individual assignments. And students are more happy to do individual work."*

A common theme was the recognition of the importance of individual assessment of contribution to a team outcome. *"Unless they're being marked, often they act individualistic"* (ASta4). It was recognised that this individual assessment was not only an assessment of the knowledge contribution to the team, but would also foster effective utilisation of teamwork skills. In response to a question on whether such teamwork skills are actively taught, one respondent explained:

ASta1: *"They are taught to a certain extent and arguably more importantly they're assessed, which is usually the trigger to learning."*

The vast majority of institutions explained that it was a policy to ensure that team assignments had an individual mark component, to ensure 'fairness' for the students. Commonly, this assessment took on two forms: either the assignment had individual components, or the students were subject to a peer assessment which moderated their group assignment mark. It could be argued that this issue is directly related to the inherent challenge of motivation and cohesion of VT members. Interestingly, the use of online communication platforms was highlighted as an effective facilitator of teamwork assessment:

KSta1: *"The lecturer can go and have a look and see how each group is. It seems to have a lot of advantages over going it face to face. They can see who is pulling their weight and who isn't."*

A second recurring theme from the discussion of teamwork in education was the question of how to form the teams. The staff members were divided on the issue of allowing students to form their own teams, or to assign team members randomly. While it was acknowledged that random selection would reflect industry practice, in order to ensure a smoother running of the class it was common that students were allowed to choose themselves, as explained by the respondent here:

JSta2: *"just randomly putting them into groups, I don't think we'd get as much co-operation between the group, I think they'd be more combative and I'd have to deal more with breakdowns of groups than I do at the moment, so that's the main reason why I let them form their own groups."*

The third theme in discussing teamwork was a widespread acknowledgement that the practice of VTW is growing in prevalence and importance in the Construction Industry. The reasons evident from the interviews are in keeping with the literature

reviewed in 1.3.1. Several respondents noted this growth, as illustrated in the following statements:

> **ASta1:** *"My research suggests that that's the way of the future that in fact remote teams, remotely assembled teams are going to become increasingly likely. It's a cost reduction, efficiency saving technique."*

> **HSta2:** *"I think my own view is we're going through a revolution at the moment, which is as big as the industrial revolution but it's the electronic IT revolution."*

Importantly, it was found that some staff acknowledged that it is the responsibility of universities to reflect this growing industry practice, in the education environment.

> **IHos2:** *"Given the globalisation of the industry I think it's incredibly important. We're looking at the new digital aspects of our course, that area is going to receive a lot of attention."*

The final theme among the discussion of VTW was the unique challenges presented by this business practice, as illustrated here:

> **EHos1:** *"I think that if you're in the workplace and you're working on a remote job, or even slightly bush job, you soon experience that remoteness by trying to communicate back to head office or whoever is in the controlling office."*

The issue of the education of the skills required for effective teamwork, virtual or traditional, was contentious. Many participants referred to the education of traditional teamwork skills, which could be used in a virtual context. The skill most commonly referred to was communication: *"humanities is the communication, verbal and written communication subjects"* (GHos1). One participant referred to the

use of self-assessment to ensure awareness of *"how they resolved conflicts and the whole experience of teamwork and where they went wrong or what are their personal strengths of being in a team, or their weaknesses, are they leaders or followers?"* (AHos2)

However, it was found that the majority of participants did not actively teach the skills necessary for teamwork, virtual or otherwise. The majority based their teaching practices on experiential learning:

> **JSta2:** *"It's not like a formal approach as such, in terms of teaching the team work skill. But if you throw someone within a group of course they have to talk with each other. Quite often the group fails because they can't communicate properly, I guess by counsel and exercise they will learn how to work within a team"*

Meanwhile some participants attested that VTW skills cannot be taught, or were not aware of the unique skills required, as illustrated in this following excerpt:

> **Facilitator:** *"Do you think the practice of distance team work is growing in terms of leading the industry? Do you feel like it's something that you guys – in universities in general need to teach or foster?"*
>
> **ISta1:** *"You don't teach it."*
>
> **Facilitator:** *"Do you find that you're teaching the skills required to effectively work online at all?"*
>
> **ISta2:** *"If we knew what those skills were we'd teach them."*

The attitudes and themes evident from the semi-structured interviews with education professionals were found to be largely consistent with the findings of the quantitative strand of enquiry. It was found that while some were resistant to the situation, the majority of staff acknowledged the growing prevalence of communication technologies and virtuality in both

the Industry and Education spheres. Also, the relevance of teamwork in learning, in the alignment between industry and education was acknowledged. In addition, some challenges associated with teamwork in education were a common theme; these challenges were related to the selection of team members and the motivation and cohesion of teams.

However, the link between the growing virtuality of business practice, and the importance of teams was not commonly made. The majority of respondents were resistant to the need for the explicit teaching of teamwork skills, to help students overcome the inherent challenges of teamwork.

4.2.2 *Focus Groups – Students*

In the exploration of the attitudes of the stakeholders in the education of Construction Industry professionals, it was vital to determine the views and attitudes of the students. The strand of enquiry was in an effort to establish if the views and attitudes of the students are different from the education professionals and the industry representatives, and determine the extent to which the students recognise the growth of the practice of VTW, and the need for the education of the relevant skills. Similar to the staff interviews, the analysis of the semi-structured interviews with the student's revealed two key theme areas. In the discussion of technology in the learning experience the key themes were; the reflection of industry and the desire of flexibility in their education. Meanwhile, the discussion of the practice of teamwork in learning resulted in a discussion of the importance of teamwork, and the challenges of motivation and assessment. While the themes of the discussion were found to be similar the staff discussions, the attitudes presented were often quite different.

Technology in Learning

    a) Reflection of Industry

Due to their limited experience with the business practices and technologies of the industry, the majority of students interviewed were not necessarily familiar with the technological platforms available. However, it was commonly agreed that technology plays an important part in business practices today, especially in communication. This understanding led to the finding that a majority felt that university education should reflect current business practices in the adoption and integration of technology in teaching and learning, as demonstrated in the following:

> **Facilitator:** *"What things could help improve the program?"*
>
> **DStu1:** *"Just more realistic… the IT side of it."*
>
> **DStu2:** *"Yeah. I think there's probably a big onus on yourself to know internet kind of stuff I think. There's not many subjects if any to do with internet kind of stuff."*
>
> **Facilitator:** *"Yeah so it's not like ... communication."*
>
> **DStu2:** *"Yeah, that's right, yeah."*

Importantly, not only did the majority discuss and agree on the importance of the alignment between industry and education in the use and familiarity with technologies, but many students directly referred to a lack of technological integration in their learning.

b) Desire for Flexibility

The majority of participants highlighted the capabilities of technological implementation in education and the flexibility that online platforms provide in their education practices. The majority agreed that there is a need for flexibility in delivery in order to cope with learning requirements.

The issues of transport and work commitments were highlighted as catalysts for the need for education flexibility. However, it was found generally that students simply

had a desire to determine their own work practices, in keeping with 'Gen Y' characteristics, as illustrated in the discussion below:

> **FStu2:** *"And people are busy; like if you want to do your work at one o'clock in the morning, like I want to, it's good to know that you're all working off the same base so that when people wake up in the morning they can see what you've done and they can work off that. It's always open 24 hours a day."*

> **IStu6:** *"I think you need options. Over the six months the semester is not the same. I mean you start a subject and when you finish it a lot of the time you can't be here. A lot of it is work and we'll do fifty hours a week even though we're at uni and we travel. So I think you need to have the option…"*

> **JStu3:** *"I'd rather do it online because I live in the eastern suburbs so if it's a two hour lecture I've got to travel for four and it kind of feels like a waste of time at times and you just don't end up coming."*

However, while students expressed a desire for the greater flexibility of learning provided by technological integration, many expressed reservations towards too much technological dependence in learning, citing the inherent issue of motivation, as below:

> **JStu2:** *"It's not laziness it's just if it's online I'm like yeah I'll look at it later [laughter]. Don't worry about it I'll look at it later online."*
>
> **Facilitator:** *"Do you think you would look at it later?"*
>
> **JStu2:** *"No I wouldn't."*

This discussion of the desire to incorporate the advantages of the virtualisation of education, and the recognition of the inherent challenges is directly related to this study and the need for training and education in the effective maximisation of the advantages of computer mediated interaction, while minimising the potential difficulties.

Teamwork in Learning

a) Importance of Teamwork in Education

It was found that the majority of student participants agreed that it is a necessity to incorporate teamwork into university programs, in order to emulate the building industry effectively. However, many inherent issues were raised which were found to affect the students experience of teamwork in these educational settings. Interestingly, these issues are similar to the challenges in the use of teamwork found in literature, as illustrated below:

Facilitator: *"Do you think teamwork skills are important for work in industry?"*

BStu1: *"Absolutely."*

BStu2: *"Yeah, definitely. Well within our industry, it's everyday life pretty much."*

BStu1: *"It's very important."*

BStu2: *"If you're going to get out of bed and go to work it's a working group pretty much so you need to be able to communicate effectively otherwise you just get left behind."*

Facilitator: *"So do you feel like the course is balancing that?"*

BStu1: *"I think it's trying to introduce the whole working as a team thing. But, like I said, it's pretty hard when you're in a group but you're working individually."*

It was interesting to note that many participants appreciated that the difficulties associated with working as a team in the university environment were useful in

preparing them for the challenges of teamwork in the business environment, and saw it as an important part of their education.

> **FStu2:** *"And you've got to get good at working in groups, especially with work, because I think that's why they try and prepare us for getting along with people who don't do their job properly. So all the group experience I've had at uni has helped me prepare for dealing with people who don't contribute in adequate ways, and just kind of getting around that and how you motivate people. Even though it's so crap working in groups at Uni, so annoying working, it's probably good."*

This is an important theme that was revealed in the analysis of the student interviews, while the students recognised the difficulties associated with teamwork; they also recognised the importance of the need to learn to work effectively in teams. In addition, they called for their education to reflect industry practice, in preparing them to work in teams.

b) Motivation

A common grievance with the use of teamwork in the education environment is the mismatching of team member motivation. Many participants highlighted this as an inherent annoyance in the practice of teamwork in building programs, with a division between participants regarding whether this challenge is reflective of the building industry.

> **IStu12:** *"It's important to be able to work in a group and work with other people, I just find it frustrating and sometimes think that there are always people who are getting carried through group work."*

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IStu4: *"I know you have it in the work scene but I find that the mentality in the work is different because people are there to actually do a job where in the universities you get students that just don't really care about it and then can be really slack and it's a bit annoying."*

JStu3: **"It depends who your team is too like if you've got someone who's highly motivated, highly wants to get it done everyone else is going to learn off him but if you're in a group where everyone's passive and sits back no one's going to learn the skills they need."**

This theme was found to be consistent with the views of the staff. Students referred to the inherent teamwork challenges of motivation and the need for leadership and management. Furthermore, the challenge of the development of trust is alluded to in these discussions. Where students discussed that due to the swift nature of teas in the education sphere, they could not necessarily trust their team members to contribute to the team sufficiently. While student, and staff, cited these challenges as reasons to shy away from the practice of teamwork in education, it could also be argued that the inherent nature of these challenges in teamwork mean that the education sector is the opportunity to provide the students with the skills necessary to overcome these challenges in the future.

c) Assessment

While the challenge of motivation was a common theme in responses, the resulting issue of assessment was found to be of greater importance. The majority of students expressed that the fair assessment of individual effort was of the greatest importance to their teamwork experience. Assessment is the principle method of feedback for the student; therefore their motivation is directly related to their perception of the fairness of the assessment. Students wanted to be rewarded for their efforts, and not be unduly penalised for the lack of effort by some team members, and as a result would often have to increase their own workload, as described here:

> **BStu1:** *"I don't think it's fair for a group to be graded when certain people do more work than others."*

> **BStu2:** *"If it's a group of four people it would be maybe 50% or two people out of the four who are just passengers and I am doing the bulk of the work. So I prefer to do my own work and get the full credit or benefit of my own work."*

Interestingly, some participants highlighted that the integration of VTW, and the use of online platforms helps address the issue of fair assessment of workload. This is through the ability to record team communication and effort, allowing for accurate measurement and effort assessment, as one respondent describes:

> **JStu2:** *"I think it's a good idea because it helps. First of all, if you've got people that are slacking off you can tell they're not contributing and you've got a record."*

From the discussions with the students, and the analysis of the themes evident, it has been found that the students are definite in the need for their education to reflect industry practice, and responsive to the increased integration of technology in their learning experience. However, similar to the staff, it was found that the connection between the practice of teamwork and the increased prevalence of communication technologies was not made. While student did not directly discuss VTW, the attitudes acknowledging the importance of technology and teamwork in their education, and the need for industry alignment demonstrate that the students identify a need in their education.

4.2.3 *Interviews – Industry Representative Bodies*

From the semi-structured interview with the industry representative bodies, some common themes were evident. However, the issue of VT importance in the industry

was not discussed in great depth, due to the representative's lack of awareness or understanding of the area of VTW. The participants were adamant of the ongoing need for accreditation of construction related courses in order to align education with industry needs, but did not acknowledge or comment on the growing prevalence of the practice of VTW in the construction industry.

> **Ind1:** *"I don't think that the universities or academics are in any position, given what we're seeing in terms of a crisis, in terms of quality of graduates that we're getting from feedback from industry in terms of the profession and what its saying. In terms of graduates to say to us, leave it to us, trust us, we'll deliver you people who will meet your standards and you guys should butt out. Because the bottom line is they aren't."*

While they chose not to discuss the issue of VTW directly, it was a common and recurring theme that the integration of technology is growing in prevalence in the education of industry professionals and is related to the need for flexibility in education design, but the connection between the growing prevalence of IT and the practice of VTW was not acknowledged.

> **Ind2:** *"We're dealing with different people altogether these days, the current generation is wanting, as we all know, instant gratification. They want to know it now, they don't want to wait. They're not interested in the 'campus life', they are busy working. They are busy socialising. They want to learn how they learn which is via technology. So we can't dismiss distance learning as a viable option. You know certainly I can't see the face-to-face ever fading out completely, but certainly the distance education is a good option."*

Section - 4.3   Conclusions and Findings

In accordance with the methodology outlined in Section - 3.5 the results of the multi-strand mixed method data collection will be explored, with inferences being found and discussed. These inferences are separated into the realms of education practice and industry representation. This separation has been made in order to examine the education of VTW skills and assess the alignment with the construction industry accreditation bodies, in keeping with the aims and objectives.

It must be noted that, as demonstrated in the results above, it was found that the majority of respondents were unaware of the practice of VTW, and therefore were not able to discuss the specific challenges of VTW and their education. However, in keeping with the research methodology and strategy, and the semi-structured nature of the interviews, some themes from the results above are related to the inherent challenges of VTW found in the literature (see Chapter 2). For example, the issues of team member selection, communication technology selection and team cohesion.

4.3.1 *Education*

In the examination of the education of VTW in Australian University Construction Programs, a number of themes became evident. These themes are related to the attitudes of staff and students to the elements of VTW, as well as the demonstration of these attitudes in education practices.

ICT Recognition and Education

As demonstrated in the results above, it was found that the staff and students were in agreement regarding the recognition of the importance of ICT in the modern business environment, especially the construction industry. It was recognised that increasingly, communication and management of construction is carried out in a

technologically-mediated manner, and an understanding of these technologies and education is important.

This is evident in both the quantitative and qualitative data, which recognises the growing importance of ICT in the construction industry, and the education of Australian University Construction Programs. While it was found that some staff were reluctant to incorporate ICT in their education practices, the majority did acknowledge that it is the duty of educators to recognise the changes in both the industry and the students, and reflect them in their teaching practices. This was echoed by the majority of students who acknowledged this importance in the industry, and appreciated the advantages of increased technological incorporation in education. Those that found their institution lacking in technological integration cited it as a major downfall of their program.

The recognition of the importance of ICT education is also reflected in the analysis of course outlines. The vast majority of programs explicitly mentioned the inclusion of training in ICT in some form, albeit communication technology, or advanced estimating and management programs. The importance of an understanding of the range of technologies available is agreed upon by all relevant parties: staff, students and industry representatives.

Traditional Teamwork Recognition and Education

By the same token, there was an agreed recognition of the importance of teamwork in the construction industry. Both staff and students appreciated that the construction industry fundamentally involves teamwork to produce the deliverables. However, the education of the skills required was a point of contention.

While the majority of staff acknowledged teamwork as important, it was found that some staff members chose not to incorporate the use of teamwork in the delivery of their programs; citing reasons such as time constraints, and student dissatisfaction. Meanwhile, the majority of students acknowledged that while they may not enjoy

teamwork in the education environment, they realise it is an important reflection of the construction industry.

In the analysis of the course outlines, the use of teamwork was heavily evident, but through the interviews it was deduced that the skills related to effective teamwork – traditional or virtual – were predominantly not taught explicitly. Instead, staff chose to teach experientially, believing that by putting students in groups they would learn how to manage or participate effectively in a team environment. While it was found that some elements of course outlines could be construed as teaching relevant teamwork skills, such as communication, meetings and conflict resolution, they did not mention the education of these skills, particularly in a teamwork environment.

These results suggest that while staff and students realise teamwork is a fundamental part of the construction industry, they do not actively or explicitly incorporate the education of the relevant skills required to be an effective team member in their education practices, instead experiential learning is heavily relied upon.

VTW Recognition and Education

As evident in the quantitative results, the majority of staff were not aware of the unique skills required to work effectively in a VTW environment. This is supported by the qualitative results. Those that were found to be aware of the practice of VTW did agree that it is growing in importance and prevalence. But only a handful of those participants that were aware of the practice acknowledged its need for unique skills and capabilities. In keeping with this theme, the vast majority did not acknowledge the importance of teaching these unique skills in Australian University Construction Programs. This result was echoed by the students, with the majority being unaware of the practice of VTW.

While the majority of staff and students were unaware of the practice of VTW in the construction industry, it was found that elements of the unique skills required were evident in the course outlines analysed. As discussed previously, these were mostly

related to the use of ICT, with its recognised importance. However, it must be noted that a few courses did, in fact, discuss the education of culture and conflict management, however these were not necessarily directly taught in the context of VTW.

4.3.2 *Industry*

The themes found in the examination of the education sphere are echoed by the industry representative bodies. While the examination of the graduate requirements highlighted the presence of some skills that could be construed as related to VTW, it was found that the industry body representatives were largely unaware of the practice of VTW, and did not view it as a priority in education. Their views were very similar to the education sphere, with just an acknowledgement of the growing prevalence and importance of ICT, and the acknowledgement of the established and continuing importance of teamwork in the construction industry. However, the connection of the two was not made. The growing importance of teamwork in a virtual moderated environment was not acknowledged or reflected directly in the graduate requirement analysis or qualitative findings.

It was found that the ability to work in a team featured heavily in the graduate attributes, as well as effective communication and management, and proficiency in ICT. This is not surprising, as the graduate requirements are used to shape the programs delivered by the institutions. However, it must be noted that it is not a requirement of the industry bodies to teach the skills required for effective teamwork in the context of a team explicitly. Instead the relevant skills were inferred in the results, and interpreted by the researcher, with the possibility of being able to apply them to a teamwork environment—virtual or traditional. This is in keeping with the findings of the attitudes and practices in the education sphere, where the majority of education in teamwork skills was done through experiential learning, with the

students being expected to grow an understanding of the skills required from their experiences in teams and groups.

The important feature of this result is the fact that the graduate competencies required in the accreditation guidelines are reflected in the course contents. In addition, the attitudes of the industry body representatives are in keeping with the themes found in the analysis of the graduate requirements. However, both the attitudes and accreditation requirements do not reflect the movement in the Construction Industry towards virtualisation and teamwork. The industry bodies are not leading the education sector to be proactive and train professionals of the future, but rather seem to be behaving in a reactive way, producing graduates lacking in some skills that are becoming increasingly important in the increasingly globalised and virtual business context.

CHAPTER 5 - CONCLUSIONS AND RECOMMENDATIONS

This research was designed to examine the education of VTW skills in Australian University Construction related projects. The design of this research was outlined in the Project diagram (Figure 3-1, page 101), and involved a multi-strand parallel mixed method. Initially, a review of the literature established the key skills involved in VTW. The establishment and understanding of these skills involved not only determining the skills associated with VTW, but also how they are similar or differ from those skills associated with traditional teamwork. While many skills are common to the two teamwork contexts, it was found that the skills associated with VTW were those that involved the application of traditional skills in a virtual context. The virtuality of a team creates an additional difficulty and complexity in the teamwork environment. It was found that in order to ensure the effectiveness of team members, it is necessary to ensure they possess the relevant skills to cope with the difficulties of VTW and utilise the strengths of the growing business practice. This understanding of the skills involved in VTW informed and shaped the ensuing enquiry phases.

The quantitative phase of enquiry established the overall attitudes of staff members in the institutions offering Construction related programs. It was understood that the investigation of VTW education was a complex issue, that would involve qualitative enquiry and discussion, however the quantitative phase of enquiry was included because it allowed for responses by staff members who may not be able to attend the focus groups, and allowed the researcher to establish the general level of understanding and attitudes of the staff towards computers in education, and the education of VTW. It was found that staff placed great importance on the education of computer skills, and the incorporation of computers in the classroom. However, it was found that very few explicitly and knowingly included the education of VTW skills in their programs. The results of this phase of enquiry established the contradiction in the attitudes of the staff that was found to continue through the ensuing enquiry phases. This contradiction is that staff place great importance on the education of computer technology, but not education in the skills required for effective application of that technology in an industry that inherently involves teamwork.

In addition to the online survey, and analysis of the course outlines available in the public domain was carried out, to establish the extent to which VTW skills were explicitly present in the courses that formed the Construction related programs. This content analysis was done using the framework created from the review of literature as a guide. It was found that some skills that could be used in teamwork, virtual or traditional, were mentioned in the course outlines. Also, the education of VTW specific skills was present in some courses, with a percentage quite similar to the percentage of staff respondents that said VTW skills were represented. In addition, while many of the courses involved the use of teamwork, only a small proportion of the courses (4.9%) involved the use of teams, and the education of any skills associated with teamwork. It findings of this phase of enquiry were that while teamwork was present in some courses, and the education of skills that could be used in a VT context were present, a very small proportion of courses made reference to the explicit education of VTW skills and the application of those skills in a team in class. This was a finding that would be further investigated in the qualitative phase of enquiry.

The content analysis framework was also used to determine the presence of the education of VTW skills in the education expectations of the Industry Representative Bodies. This content analysis established that there was a need for education in teamwork, and a requirement for computer education, but no specific mention of VTW. The requirements included the education of some skills that could be applied to the field of VTW, but were not necessarily specifically virtual. Also, the need for experience in teams, but not necessarily the explicit education of the skills required for effective teamwork, traditional or virtual. This is in keeping with the findings of the analysis of the course outlines, which is to be expected as these industry body guidelines are the basis of course accreditation.

Finally, the qualitative phase of enquiry involved the investigation of the attitudes of the education stakeholders towards the education of VTW skills. This phase of enquiry was used to establish if the results of the online and survey and the content analysis were truly indicative of the attitudes of the staff and industry bodies. Importantly, the qualitative phase of enquiry also included a discussion with the

students to establish their attitude toward VTW and the need for education of the VT specific skills. It was found that the themes of the results of the quantitative phase and content analysis were corroborated by the responses of the staff. It was found that the growing importance of computer technology in the construction industry was broadly recognised and that, however difficult, there was a need for computer education. Also, the importance of teamwork in the construction industry was agreed upon, and while there were difficulties associated, it was largely agree that students should have at least experiential education of the challenges of teamwork. However, the link between the growing importance of computer technology, and the established nature of the industry involving extensive teamwork was not commonly made. The majority of staff respondents were resistant to the idea of explicit education of teamwork skills, traditional of virtual.

This attitude was also found in the interviews with Industry Body representatives. However, they were even less aware of the field of VTW and chose to not speak of it at any great length. From the discussion, it could be said that they too appreciated the importance of computer technology in the industry, but also didn't make the connection with the practice of teamwork in the industry. They were adamant of the importance of accreditation, however, and the need for the industry bodies to shape the curriculums of the Universities.

The interviews with the students resulted in similar findings to the staff. However, it was found that the students were quite definite in the need for their education to reflect construction industry practice, and the importance of their education in preparing them for their chosen profession. They recognised the importance of computer education, and felt the need for greater incorporation of computers in their education. Also, while they discussed the difficulties associated with teamwork in education, the respondents largely agreed that the incorporation of teamwork in their education was an important reflection of the industry. This finding is interesting because while they find teamwork challenging, they recognise the need for experience and education in the skills required. Staff are largely against the use of teamwork in education because of these very challenges.

Importantly, there are some common themes regarding the education of VTW skills in Australian University Construction Programs. It has been found that all relevant stakeholders are in agreement regarding the growing importance and prevalence of ICT in the construction industry, as well as the established importance of teamwork in the construction industry. This is reflected in the graduate attributes of the industry representative bodies and the programs. However, very few parties have made the connection that the growth of ICT, and therefore virtuality, coupled with the inherent importance of teamwork, has led to the growing prevalence of VTW in the industry.

Owing to the fact that this growing business practice is largely unrecognised, the unique skills required to work effectively in a VTW environment are not explicitly expected or reflected in the Australian University Construction Programs. Some elements of the university programs, however, could be construed as incorporating the education of some teamwork skills, namely communication, culture and management. Also, most programs incorporate ICT in some capacity, either explicitly taught or inferred in education practices. But the explicit education of the teamwork skills unique to the virtual context was not evident in the construction programs.

It could be said that the reliance on experiential learning of teamwork skills is not in keeping with the suggestions found in the body of knowledge on teamwork challenges and required skills. Most interestingly, the movement by staff to minimise even traditional teamwork in education, in response to perceived student dislike of the practice, has been found to be misinformed. From the majority of student responses, the feeling was that while there were difficulties associated with teamwork in education, they realised the benefits of this approach in the way it reflected construction industry practice. Unfortunately, due to the unstructured and unsupported nature of the experiential learning technique adopted by many programs, the experience of students in teams was often negative.

From the interviews it was commonly found that the difficulties of working in a team did not necessarily lead to the students learning to overcome the challenges, but instead led to a lack of cohesion in the team. With no explicit or directed education in

identifying and overcoming the common challenges of teamwork, the students generally became resentful of the use of teams in their education, and took very little from the experience. It could be argued that instead of abandoning the use of teamwork, the issue of fairer assessment should be addressed, and the skills required to overcome the other inherent challenges of teamwork should be actively taught. In doing so, this will address the agreed recognition of the importance of teamwork, and the common grievances of students. In addition, it would prepare students for an industry that inherently involves teamwork.

Thus it can be said that while some Australian University Construction Programs were seen to include elements of both traditional teamwork and virtuality, it has been found that the vast majority either do not provide their students with the opportunity to actively learn the skills required for the growing business practice of VTW, or give support to put the skills taught into guided and assessed practice in order to ensure comprehension, retention and understanding.

The conclusions from this research have found that there is a notable lack of investment in the human capital of the construction industry, especially in the area of VTW. The education of future professionals should be proactive, and should prepare the students for the industry they will be entering and shaping. Instead, the education of VTW seems to be reactive and delayed. Furthermore, the industry representative bodies do not seem to reflect the growing prevalence and importance of virtual practices, such as BIM, and the inherent need for teamwork in the virtual context. The education of professionals is guided by, and responds to, the graduate requirements set by the industry bodies, but the need for graduates competent in the practices and challenges of VTW is not stipulated.

The movement to BIM practices in the construction industry was an inevitable response to a variety of factors; including the growing prevalence, speed and efficiency of ICT and the increasingly globalised and complex supply chain. However, the human capital required to effectively incorporate, participate and maintain these virtual practices in the construction industry has not been supported in a holistic way. As found in this research, there is an acknowledged shortage of

construction industry professionals with the knowledge, skills and competencies required for effectiveness in the increasingly virtual business environment. But this shortage is not reflected in the graduate requirements or education practices of Australian University Construction Programs. While facets of teamwork skills, usually in a traditional context, and some technologies are incorporated in the programs, the education of the unique skills required for effectiveness in VTs is not incorporated sufficiently to provide graduates with the skills required for their future in the construction industry.

From this research some direct recommendations can be made, in order to better prepare the graduates for participation in an industry that inherently involves extensive use of teams, and has a growing reliance on computer technologies. It is evident that Industry Representative Bodies need to ensure that the students undertaking the courses they help shape in the present, will be ready for the industry in the future. Industry bodies need to ensure that they take a proactive approach in informing the universities of the changing practices of the industry. Also, the education of upcoming professionals in the Construction Industry needs a greater focus on not only the knowledge required in the industry, but the skills involved in participation in an industry that is inherently reliant on teams. The staff and students agreed that teamwork in education was difficult, but this is also true of teamwork in the business environment. These difficulties are further exacerbated by the use of teamwork in a virtual environment. The skills required for effective virtual team participation need to be taught explicitly, applied in a virtual team environment in the classroom, and assessed. It is the responsibility of the Universities to prepare the upcoming professionals for the challenges of the increasingly virtual Construction Industry.

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APPENDIX 1

Online Survey - Construction Academics

Thank you for taking time to respond to this survey. You've been selected because you are a full-time or near to full-time academic teaching construction related subjects at a University. Our research is funded by the Carrick Institute and will identify the current state of education and the major issues facing Construction Management, Quantity Surveying and Building Surveying (*Construction*) in Australia.

Taking part in this survey is your opportunity to voice your opinions about your teaching experiences.

The findings of our study will be used to identify the opportunities and challenges facing *Construction* education.

We greatly appreciate your involvement in this survey.

Further details can be obtained from the Information Statement

Please Note:

The survey should take approximately 25 minutes to complete

Please take your time and answer the questions as thoroughly as possible

If you cannot complete the survey in one sitting you may save your answers and return at a later time

Some questions are compulsory. You won't be able to move to the next section until all questions in the current section have been answered

If you have no knowledge or experience of a topic, select N/A (not applicable)

Some responses will automatically 'jump' you to the next section without the need to 'Save Answers'

If you have any questions about the content of the survey, please email Dr Catharine Simmons, or phone Catharine on (02) 4921 5779

If you have any technical problems, please email the Survey Administrator

About You

AY1... What is your gender?

(1) Male

(2) Female

AY2... What is your age?

(1) Under 30 years

(2) 30 - 35 years

(3) 36 - 45 years

(4) 46 - 55 years

(5) Over 55 years

AY3... What is your current academic position?

(1) Assistant/Associate Lecturer

(2) Lecturer

(3) Senior Lecturer

(4) Associate Professor

(5) Professor

(6) Other *(please specify below)*

....

AY4... What is the highest degree you have obtained?

(1) Diploma

(2) Bachelor (Pass or Honours)

(3) Postgraduate Diploma/Certificate

(4) Masters (by coursework)

(5) Masters (by research)

(6) Doctorate

(7) Higher Doctorate

(8) Other *(please specify below)*

....

AY5a... Please identify the undergraduate study content areas in which you CURRENTLY TEACH.

(select as many as apply)

Building Materials

Building Science

Building Services

Business Management

Communication and Documentation

Computer Skills

Construction Technology

Cost Control

Drawing and Surveying

Economics

Environment

Estimating and Tendering

Facilities Management

Health and Safety

Law

Measurement or Quantity Surveying

Procurement

Project Management

Quality Management

Research

Risk Management

Structures

Sustainable Development

AY5b... Please identify the undergraduate study content areas in which you HAVE PREVIOUSLY TAUGHT (select as many as apply)

Building Materials

Building Science

Building Services

Business Management

Communication and Documentation

Computer Skills

Construction Technology

Cost Control

Drawing and Surveying

Economics

Environment

Estimating and Tendering

Facilities Management

Health and Safety

Law

Measurement or Quantity Surveying

Procurement

Project Management

Quality Management

Research

Risk Management

Structures

Sustainable Development

AY6... From the following list, please choose the primary discipline which most closely aligns with the content you teach.

(1) Construction Management

(2) Quantity Surveying

(3) Building Surveying

AY7... How many years have you been teaching in this primary discipline?

(1) 0-4 years

 (2) 5-10 years

(3) 11-20 years

(4) 21-30 years

(5) Over 30 years

AY8a... Have you had a promotion during this time?

(1) No, never

(2) Yes, once

(3) Yes, twice

(4) Yes, three times

(5) Yes, four or more times

AY8b... For each of your promotions, please indicate

the academic level you held prior to promotion

the level to which you were promoted

the year of your promotion

Promotion 1

(1) Associate/Assistant Lecturer

(2) Lecturer

(3) Senior Lecturer

(4) Associate Professor

(5) Professor

Level prior to promotion

Year of Promotion

Promotion 2

(1) Associate/Assistant Lecturer

(2) Lecturer

(3) Senior Lecturer

(4) Associate Professor

(5) Professor

Level of promotion

Year of Promotion

Promotion 3

(1) Associate/Assistant Lecturer

(2) Lecturer

(3) Senior Lecturer

(4) Associate Professor

(5) Professor

Level prior to promotion

Year of Promotion

Promotion 4

(1) Associate/Assistant Lecturer

(2) Lecturer

(3) Senior Lecturer

(4) Associate Professor

(5) Professor

Level prior to promotion

Year of Promotion

AY8c... During your employment have you had any of the following additional roles or responsibilities?

(select as many as apply)

Dean

Assistant Dean

Supervisor for Postgraduate/s

Research Director

Head of School

Head of Department or Discipline

Course Coordinator

Other *(please specify below)*

No additional roles or responsibilities

....

AY9... How many years industry experience do you have in the area in which you teach?

(1) 0

(2) less than 2 years

(3) 2 - 5 years

(4) 6 - 10 years

(5) 11 - 20 years

(6) 21 - 30 years

(7) more than 30 years

AY10... Are you currently working in a part-time capacity in an industry related to the discipline in which you

primarily teach?

(1) Yes

(2) No

AY10a... How many years has it been since you worked in the industry?

(1) less than 1 year

(2) 1 - 2 years

(3) 2 - 3 years

(4) 3 - 4 years

(5) 4 - 5 years

(6) more than 5 years

AY11... How long have you been employed at your current university?

(1) 1 - 3 years

(2) 4 - 6 years

(3) 7 - 10 years

(4) 11 - 20 years

(5) more than 20 years

AY12... Have you worked at more than one university during your academic career?

(1) Yes

(2) No

AY12a... Were any of the Universities you changed to in a different State?

(1) Yes

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(2) No

AY12b... Why did you change Universities?
(select as many as apply)
For promotion/ pay increase
End of contract
Personal reasons
Research opportunities
To teach in your speciality area
Other *(please specify below)*
....

Curriculum Issues

CI1... Please consider each of the following factors and rate their importance to your primary discipline.
Not at all
important
Not very
important
Important
Very important
Extremely important

a... Curricula should not be overcrowded
b... Students, as part of their degree, have the opportunities to take elective subjects outside of their discipline
c... Students should be provided with opportunities to learn in online environments
d... Relevant industry experience is an essential component of a student's education
e... Industry involvement should be encouraged (for example: guest lectures, employee scholarships)
f... Relevant and current computer software should be incorporated in teaching
g... Visits to construction sites

CI2... In your opinion, what are the 3 most significant issues facing your discipline?

a... Issue 1 ....

b... Issue 2 ....

c... Issue 3 ....

CI3... Please list 3 changes you would like to see in your discipline?

a... Change 1 ....

b... Change 2 ....

c... Change 3 ....

CI4... Can you identify 3 key obstacles to implementing these changes?

a... Obstacle 1 ....

b... Obstacle 2 ....

c... Obstacle 3 ....

Learning, Teaching and Generating Academic Knowledge

LT1... In your opinion, how many contact hours per week are necessary for full-time students to reach their full potential in your primary discipline?

(1) less than 12 hours

(2) 12 - 15 hours

(3) 16 - 19 hours

(4) 20 - 24 hours

(5) more than 24 hours

LT2... In your opinion, how important are the following student skills?

Not at all

important

Not very important

Important

Very important

Extremely important

N/A

a... Critical thinking

b... Teamwork

c... Written communication

d... Oral presentation

e... Visual presentation

f... Time management

g... Problem solving

h... Assignment writing

i... IT skills

LT3... Please indicate your level of agreement with each of the following statements about student attitudes.

Strongly disagree

Disagree

Neutral

Agree

Strongly

agree

N/A

a... Students regularly attend my classes.

b... Student absenteeism does not impact on students' learning.

c... Students rarely complain about their workload.

d... Students often take on part-time employment whilst completing their studies.

e... Students are increasingly expecting entertainment-oriented lectures.

f... Students readily accept constructive feedback.

g... Students are able to give critique of their own and others' work.

h... Students are motivated to achieve high grades.

LT4... Do you think students' expectations of teaching have changed over the past 5 years?

(1) Yes

(2) No

(3) I haven't been teaching for the past 5 years

**LT4a... Please list the three most significant ways that student expectations of teaching have changed over the past
5 years.**

Change 1 ....

Change 2 ....

Change 3 ....

LT5... How many assessment tasks do you generally set in a course in one semester?

Note: The term 'course' could refer to 'module', 'study area' or 'unit' at some schools

(1) 0

(2) 1

(3) 2

(4) 3

(5) 4

(6) more than 4

LT6... Has your discipline increased its use of online environments for administering assessment tasks over the past 5 years?

(1) Yes

(2) No

(3) Don't know

LT7... Have staff in your discipline increased giving electronic feedback on assessment items over the past 5 years?

(1) Yes

(2) No

(3) Don't know

LT8... In your typical assessment practice, how important is it to provide the following?

Not at all important

Not very important

Important

Very important

Extremely important

N/A

a... Detailed description of levels of attainment (rubric), at the beginning of an assignment

b... Written feedback for students' assessment items (formative)

c... Verbal feedback for students' assessment items (formative)

d... A grade (summative) for assessment items

e... Online assessment as opposed to hardcopy assessments

f... Several assessment items

LT9... Please identify the most effective methods you use to update your knowledge of teaching practices (up to 5 methods can be selected).
(Place a 1 in the box next to the method that is most useful for you to update your knowledge of teaching practices; if you wish to select more than one method, use the numbers 2, 3, 4 and 5 to indicate the next most useful methods in order of effectiveness.)

a... Academic conferences

b... Education conferences

c... Academic journals

d... Web sites and e-newsletters

e... Attendance at workshops/seminars/short courses

f... Networking

g... Belonging to professional or academic associations

h... Postgraduate study

i... Being a member of the School and Practice Advisory Board

j... Being up to date with Industry

k... Other *(please specify below)*

....

LT10... Please identify the methods that you use to keep abreast of current industry developments in the area/s in which you teach (up to 5 methods can be selected).

(Place a 1 in the box next to the method that is most useful for you to keep abreast of current industry developments in the area/s in which you teach; if you wish to select more than one method, use the numbers 2, 3, 4 and 5 to indicate any other methods that you use.)

a... Academic conferences

b... Academic journals

c... Industry journals and magazines

d... Websites and e-newsletters

e... Attendance at workshops/ seminars/ short courses

f... Networking

g... Belonging to professional or academic associations

h... Postgraduate study

i... Being a member of the School and Practice Advisory Board

j... Professional body (AIB, AIQS, AIBS etc.)

k... Other *(please specify below)*

....

LT11... Please indicate if you use any of the following approaches in your Discipline.

Do not use/ Do not intend to use

Currently use

Intend to use

Not applicable to my teaching practices

a... Learning contracts

b... Simulation projects

c... Peer assessment

d... Self assessment

e... Group work

f... Other *(please specify below)*

....

LT12... Does your institution offer an online degree program for your Discipline?

(1) Yes

(2) No

 (3) Intending to implement

LT12a... Does your online program run concurrently with your on-campus program?

(1) Yes

(2) No

(3) Intending to implement

LT12b... Does the delivery of virtual team work skills form part of your online program?

(1) Yes

(2) No

(3) Don't know

LT12c... Is students' participation in virtual team work an assessment component in your online program?

(1) Yes

(2) No

(3) Intending to implement

LT13... In the future, does your University intend to change the length of the degree program in your discipline?

(1) Yes

(2) No

(3) Don't know

LT13a... Please indicate the length change.

(1) Decrease from 4 to 3 years

(2) Increase from 4 to 5 years

(3) Other *(please specify below)*

....

LT14... In the table below, please indicate the teaching and learning development in which you have participated in 2006 and 2007, and have planned for 2008.

2006 2007 2008

a... Induction programs

b... Symposium/ Conference

c... Workshop

d... One-on-one advice from a teaching and learning adviser

e... Peer review of teaching

f... Teaching development grants

g... Higher degree study in university teaching and learning

h... Other *(please specify below)*

....

Academic Staff Conditions

AS1... In an average week, how many hours do you work to complete your academic responsibilities?

(1) less than 38 hours

(2) 38 - 43 hours

(3) 43 - 49 hours

(4) 49 - 55 hours

(5) 55 - 65 hours

(6) over 65 hours

AS2... Across a year, how is your academic work broken down into the following activities?

Your responses should be percentages and total 100.

% .... Teaching

% .... Research

% .... Administration

% .... Other *(please specify below)*

AS3... From your current teaching experiences, what are the 3 most significant strengths of your teaching?

Strength 1 ....

Strength 2 ....

Strength 3 ....

AS4... From your current teaching experiences, what are the 3 most significant issues affecting the strengths of your teaching?

Issue 1 ....

Issue 2 ....

Issue 3 ....

AS5... In the next five years, what are the 3 most significant challenges that you expect to encounter in your teaching?

Challenge 1 ....

Challenge 2 ....

Challenge 3 ....

AS6... Are there any other issues that have significantly affected your teaching career?

....

AS7... From the following list, please select the greatest areas of need confronting your discipline's teaching practices (Up to 5 needs can be selected). (Place a 1 in the box next the greatest area of need; if you wish to select more than one area, use the numbers 2, 3, 4 and 5 to indicate the next greatest areas of need.)

a... Tutorial spaces

b... Lecture rooms/ theatres

c... Computer laboratories

d... Up-to-date visual equipment

e... Up-to-date academic books/journals

f... Staff offices

g... Student meeting rooms

h... Increase in staff numbers

i... Professional development

j... Curriculum reforms

k... Staff and student internet access

l... Online teaching and learning resources

m... Other *(please specify below)*

……………………………………………………………………………

AS8... What are the current impacts of your school's budget and OHS on the following areas?

N/A

impact

Some impact

Large impact

a... Site visits

b... Workshop activities

c... Other *(please specify below)*

....

AS9... In your opinion, how important is the accreditation process to:

Not at all important

Not very important

Important

Very important

Extremely important

N/A

a... Maintain standards

b... Set an agenda for future directions

AS10... Please indicate your level of agreement with each of the following statements.

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

N/A

a... Preparation for accreditation increases my workload.

b... Feedback from the accreditation process has improved the school's curriculum.

c... The accreditation process encourages diversity in my discipline.

d... The accreditation process is valued by the academic community.

AS11... Any further overall comments?

....

APPENDIX 2

Pro-Formas for Facilitated Discussions

Focus Group Schedule - Academic Staff

- Welcome

- Ethics

- Overview of Topic

- Provide overview of plan for discussion

- (Check that everything has been understood, information statements have been read and consent forms signed).

- (Introductions)

BEGIN RECORDING

Teaching and Learning

1. What do you feel are the biggest issues in regards to teaching and learning facing *Construction* education today? Prompts: Values, attitudes, resources, economics, culture, bias, cost, role of others, workload, information technology, class sizes, course structure, academia versus industry, teaching versus research, the curriculum and course structure.

2. Do you think there would be a consensus in the School on these biggest issues?

Students

1. A significant number of respondents identified that students' working whilst study was an issue. Does students' working whilst studying present itself as a problem at

your School? If so in what ways? How do you see ways that this problem could be managed?

2. Attributes of Generation Y was identified as an issue in the survey. Do you think this is a problem in regards to teaching and learning? Are you doing anything to address this? Or what do you think could address this?

Assessment

1. What is your predominant mode of assessment and feedback? Are there any primary issues confronting assessment and giving feedback?

2. Are there changes you would like to see in the curriculum/discipline in regards to assessment?

3. Do you or would you like to experiment with other ways of assessment and or feedback?

Distance Team Work

1. Do you believe in the practice of distance learning?

2. Do you think the practice of distance teamwork is growing in prevalence in the *Construction* industry?

3. Do you think there is a need for more education of skills for effective distance teamwork in the disciplines? If so, in what ways?

Curriculum

1. Do you find that there is an issue with the disciplines in regards to it being like a network of interrelated subjects, with some subjects being run within other departments? What processes were used in the development of your curriculum? Like was it a collaborative process, or based on accreditation rules?

2. The survey showed that *Construction* Education is not recognised compared to other disciplines, such as Engineering. For what reasons do you think *Construction* Education is undervalued or not seen as 'academic'? Do you think this is an issue?

3. Does student's industry experience present itself as an issue in your School? What could help it? How could it be better managed/supported?

Role of Accreditation

1. The survey identified Accreditation as having issues. What is your Schools experience of Accreditation. If a problem, in what ways do you think this process could be improved? Prompts: Does it stimulate your practice? In what ways does it value add?

Industry

1. The survey identified a perceived conflict between industry expectations and University education. Do you think this is a problem? If so, in what ways do you think this conflict could be resolved?
2. Does industry expectations cause problems with your teaching? What like?

Staff Issues

1. Do you think staff working in industry is important and or an issue for teaching if have not?

Staff Workload

1. A significant number of staff identified workload as an issue in the survey. Do you see this as an issue at your School? What do you think contributes to your workload?
2. Does the problem of too much administration requirements influence your workload?
3. More than half of the survey respondents either stated that they had 'no' or one promotion over their teaching career. Do you feel that this is a trend at your School? Are there reasons you think why this is happening? Prompts: Promotion under-valued, values or expectations of staff, politics in the workplace, academic expectations.

4. Are there any other workload issues that are limiting or inhibiting you in achieving your teaching outcomes?

5. Are there tensions between work balances of research and teaching? If so how does it present itself? How do you see that this tension could be improved?

Research

1. Connected to your workload, is their pressure within this organisational unit to do research? How is it measured?

2. Do you see there is a need for more research like this study on the disciplines?

3. How important is other research in Construction in this School? Prompts: Past, present, future, publications, teaching and research.

4. What sort of research is being undertaken? Prompt: Is it creative, social, scientific (traditional) based research?

Future Change

1. What are the main resources that you need for delivering these disciplines at your School/What would be the most beneficial to you?

2. What do you see are the major changes needed in the disciplines/curriculum to improve Teaching and Learning? What systems/initiatives do you think are needed to support these changes?

Questions

1. Is there anything else you would like to add?

2. Do you have any questions for the researcher?

Semi-Structured Interview Guide for Heads of School and Course Convenors

Introduction

Ethics

Background to Project

BEGIN RECORDING

Teaching and Learning

1. What do you feel are the biggest issues in regards to teaching and learning facing *Construction* education today? Prompts: Values, attitudes, resources, economics, culture, bias, cost, role of others, workload, information technology, class sizes, course structure, academia versus industry, teaching versus research, the curriculum and course structure.

2. Do you think there would be a consensus in the School on these biggest issues?

3. How has your academic role in regards to teaching and learning changed over time?

Curriculum

1. The survey showed that Construction Education is not as highly valued or recognized compared to other disciplines, such as Engineering. For what reasons do you think *Construction* Education is undervalued or not seen as 'academic' or proper disciplines?

2. The survey identified fragmentation of the curriculum as an issue. What processes were used in the development of your curriculum? Like was it a collaborative process, based on accreditation rules?

3. Some courses/subjects in the disciplines were identified as having the potential to be TAFE courses/subjects. What differentiates your degree program from TAFE studies?

4. Industry experience was identified as an issue in the survey. Does this present itself as an issue in your School? What could help it? How could it be better managed/supported?

Research

1. How active is your School in *Construction* disciplinary education research? Do you see there is a need for more research like this study on the disciplines?
2. How important is generic research in *Construction* education in this School? Prompts: Past, present, future, publications, teaching and research.
3. What is the pressure within this organisational unit to do research? How is it measured?
4. What sort of research is being undertaken? Prompt: Is it creative, social, scientific (traditional) based research?
5. How is the research supported/funded in your School?
6. Are there tensions between work balances of research and teaching? If so how does it present itself? How can this tension be improved?

Industry

1. The survey identified a perceived conflict between industry and University education. Do you think this conflict is present here? If so, in what ways do you think this conflict can be resolved?

Role of Accreditation

1. The survey identified Accreditation as having issues. What is your Schools experience of Accreditation. If a problem, in what ways could the process be improved? Prompts: Does it stimulate your practice? In what ways does it value add?

Staff Issues

1. Finding qualified, industry experienced staff was identified in the survey as an issue confronting the disciplines. Does this present itself as a problem in your School? Why do you think this problem exists?

2. How responsive are staff in revising their curriculum/creating a dynamic curriculum?

3. More than half the respondents said that it has been more than 5 years since they have worked in industry. What are your views on this, is this an issue for teaching?

4. Staff have expressed in the survey that the following aspects of industry – inflexible, staff lacking industry experience, commercialised, gender imbalances, lack of industry

perspective in the curriculum, traditional mindsets – cause barriers for making changes in the curriculum. Do you experience this as an issue at your School?

Staff Workload

1. A significant number of staff identified workload as an issue in the survey. Do you see this as an issue at your School? What do you think contributes to the perceived work overload of staff?

2. Does the problem of too much administration requirements inducing staff's workload present itself as an issue here?

3. More than half of the survey respondents either stated that they had 'no' or one promotion over their teaching career. Do you feel that this is a trend at your School? Are there reasons you think why this is happening? Prompts: Promotion under-valued, values or expectations of staff, politics in the workplace.

4. Are there any other issues that are limiting or inhibiting you in achieving your outcomes for the disciplines' outcomes?

Students

1. A significant number of respondents identified that students' working whilst study was an issue. Does this present itself as a problem at your School? How do you see ways that this problem could be managed? ('dumbing down', intensive blocks of study).

2. A lack of understanding as the QS and BS disciplines as being noticed as a career path was identified as an issue in the survey. Do you see this an issue? If so do you have any plans for addressing this?

3. Attributes of Generation Y was identified as an issue in the survey. Are you doing anything to address this? Or what do you think would address this?

Leadership

1. Do you have any issues with your role as Head of School/ Convenor of subjects in relation to the administration of these disciplines at your School? (prompts: power imbalances, communication issues, subject issues)

2. How important is the academic leader/subject convenor to the success of the School/unit?

3. It was noted from the survey that upper management need more awareness of these disciplines. What are your views upon this issue?

Future Change

1. What do you see are the major changes needed in the disciplines/curriculum to improve Teaching and Learning?

2. What systems/initiatives are out there that you think should be utilised to support these changes?

Questions

1. Is there anything else you would like to add?

2. Do you have any questions for the researcher?

Focus group guide for students

Introduction

Ethics

Overview of Research

Student Profile – About you

1. What are you studying and what attracted you to the disciplines *Construction*?
Prompt: For professional recognition, qualification, lifestyle, education,
advertisement, relatives?

Teaching and Learning

Student Motivation

1. What are the most affective ways in which you learn? Prompts: Lectures, projects,
group work, solitary study.

2. What motivates you to do well in each course you do? Prompts: Is it the way the
subject is organised, assessment items?

3. Do you prefer face to face or other ways of learning?

4. Are there factors outside of your study that motivate you to become more active in
University life?

Study Workload and Working

1. What factors do you feel contribute to a heavy studying workload?

2. Do you find that you have conflict between the requirements of your work (if
working part time) and the requirements of University? If so, how does this issue
present itself to you?

3. How many hours do you spend on outside work?

4. Do you see that your outside work is impacting on your study? If so, in what
ways?

5. Is there anything else that is stopping you from getting ahead with your studies and learning? Prompt: resources?

6. Do you find that missing classes impact on your learning?

Industry experience

1. Do you see the relevance of industry experience for your program?

2. How is your industry experience managed in your program? Is it assessed, not assessed, do you organise it, does the School, or something different?

The Curriculum

1. Do you think the length of your course is a good amount of time for what you are learning? Too long/short (relates to staff opinions on quick fixes and outcome-driven)

2. Do you see the relationship of your courses to your degree program, how they fit together for you? Do you think there is an appropriate balance of subjects in the curriculum?

3. Do you feel that you have been taught the necessary skills to communicate effectively in the online environment?

4. To what extent do you feel your course is teaching online teamwork skills?

5. What technologies are provided by your University to support online teamwork?

6. Do you believe the education of online teamwork skills is important, in preparation for work in the industry?

Assessment

1. What are your views on assessment? Are there issues in the way you are assessed?

2. Which form of feedback do you value the most? Prompt: grades, written, verbal, rubric (telling you how grades are created, self learning portfolio)? What makes this so effective for you?

3. What are your experiences of group work in regards to assessment?

Staff profile

1. What do you perceive are the primary pressures on academics? Prompts:
Pressures, workload, qualifications, administration work?
2. Is there enough opportunity for student/staff interaction?

Resources

1. Do you feel your discipline utilises and balances extra curricula resources well?
For example, lectures, site visits, guest speakers.

Future Change

1. What do you feel are the biggest issues for you as Construction Students? In
regards to the course and/or discipline?
2. In what ways do you think the program could change in the future to help with
these issues?
Thank-you for your time