Interactions and collaboration in interdisciplinary teams undertaking project work in higher education

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ABSTRACT

This study investigates the interactions and collaboration that occur in interdisciplinary teams brought together to undertake project work in a higher educational setting. The aim of the study is to understand whether teams interact to collaborate across project stages to develop project solutions together. The study was conducted at a subject or unit level within a school of design in an Australian university using a qualitative case study approach. The focus was on the processes and interactions of four teams, all of which were undertaking the same project with the same tutor.

Data were collected from a number of sources within each team, including pre-project interviews with students and tutor, team Facebook transcripts, self-reflection journals and assessment results. These data sets were triangulated for the analysis. The iterative analysis identified themes common across teams as well as variations unique to each team.

The study found that three key factors—team leadership, emotional intelligence and curriculum development—consistently influence interpersonal interactions and collaboration in interdisciplinary teams. The findings indicate that the leadership role is critical and that the knowledge and personality of the individual who performs this role have the potential to influence the level of team interaction and to guide opportunities for collaborative engagement in the design thinking process.

The research presented in this thesis suggests that leaders who are supportive and have the emotional intelligence to recognise and respect the individual value of team members are more likely to lead teams that interact collaboratively in design education. Conversely, a lack of discipline knowledge and/or low levels of emotional intelligence at the leader level limit the team’s potential to interact collaboratively across all stages of the design process. These findings provide significant guidance for educators using interdisciplinary teams in problem-based learning.
DECLARATION

I, Lucia Miceli, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy from the Melbourne Graduate School of Education (Centre for the Study of Higher Education), The University of Melbourne, is completely my own work except where otherwise referenced or acknowledged.

This work has not been submitted for qualifications at any other academic institution.

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CHAPTER 1

Introduction

The complex nature of problems in contemporary society has created a need for problem solving project teams to bring together a range of knowledge and skills to develop ideas and solutions. This issue in society has created a flow on effect to higher education and one of the ways the sector is responding to prepare students for changing industry needs is through the use of semester long interdisciplinary project work. This style of project work can pose unique challenges for students and educators as sometimes the project briefs selected may require team members to interact and collaborate on project work in discipline areas that are unfamiliar to them. However, how well student teams negotiate interaction and collaboration when undertaking interdisciplinary semester long projects is not yet well understood.

This study reviewed student interaction and collaboration in a semester long interdisciplinary project to provide knowledge about how students, from different disciplines (2), engage with problem solving in higher education. In the context of this study, interdisciplinary project work can occur in many units as students from different faculties can enroll in units without pre-requisite knowledge. Interdisciplinary teams referred to in this thesis are the teams randomly formed to include students from two or more different academic disciplines. More often than not, students are expected to contribute the discipline knowledge and skills they have acquired to date to problem solving process applied in these units.

While there is a substantial body of research on team processes, there is little that focuses on interdisciplinary teams in tertiary education. In particular, little is known about the factors that contribute to, inhibit or facilitate collaborative practices in student teams. This study contributes to filling this gap by investigating collaborative participation in interdisciplinary student teams in an Australian university.

1.1 Collaborative Projects

There has been increased demand for interdisciplinary teams in contemporary workplaces in recent years. This is because collaborative teams are considered to provide organisations with the increased flexibility, efficiency and competitiveness required to address complex problems in a changing environment (Marosi & Bencsik, 2009). Individuals with diverse knowledge, skills and experience are brought together to increase the team’s potential by bringing together the breadth of knowledge required to achieve novel solutions (Cumming et al., 2014; Donnelly & Fitzmaurice, 2005; Kozlowski & Ilgen, 2006). One way collaboration has been found to occur in creative teams is that team members build on the ideas of team peers to formulate solutions.
It might be said, then, that to achieve complex problem-solving the team requires participants to understand the problem and potential solutions from the multitude of views in the team.

For this to occur team members needs to have the interpersonal skills to collaborate across many industries (Volkov & Vokov, 2015). Workplace skills such as communication, negotiation and conflict resolution are often embedded in team projects and collaborative participation in these projects can provide students with the opportunity to develop and adapt these skills across a range of situations that might be expected to occur in the workplace (Scott-Ladd & Chan, 2008). With this in mind, teamwork pedagogies might be considered to be essential to building generic skills that are integral to the future careers of graduates (Volkov & Vokov, 2015).

Problem-based learning, where student teams are asked to find solutions to complex problems, is used in tertiary education to simulate real-world experiences for students. Approaches such as collaborative, co-operative and team-based learning pedagogies are applied to provide students with the opportunities to develop the communication and interpersonal skills required to solve complex problems. In interdisciplinary teams, the diverse discipline knowledge within the team provides student teams with knowledge depth and breadth creating the opportunity for all to participate in the development of solutions that demonstrate thinking that is beyond the obvious (Visser, Chandler & Grainger, 2017).

Furthermore, collaborative project work in educational settings can increase analytical skills in students and provide them with the opportunity to work together to critically evaluate both the project problem and proposed solutions thus developing problem solving skills that are highly relevant to future work environments (Scott-Ladd & Chan, 2008). At the same time, student participation in team problem-based projects can facilitate feelings of increased learning ownership and in turn contribute to create a more meaningful experience for students (Artz, Jacobs & Boessen, 2016).

Scholars (Levi, 2014; Volkov & Vokov, 2015) have noted that the success of the team is dependent on the situational factors that emerge within the team. To be successful, teams require collaborative practices that recognise the knowledge each individual brings to the team enabling them to work effectively to broaden solutions and practice (Sawyer, 2008). Where effective peer-to-peer communication and engagement occurs in team projects the potential to create a supportive learning community increases (Lave & Wenger, 1991). Collaborative teams that feel safe and supported create effective learning communities. These teams, through team discussion, encourage the development of the individual as well as the team and are more likely to facilitate peer-to-peer learning (Scott-Ladd & Chan, 2008).
In design education, the emphasis on collaborative learning is increasing and interdisciplinary design team projects are becoming commonplace (Barnes & Wragg, 2016). Tertiary design education is moving away from its vocational traditions and embracing contemporary approaches such as design thinking to produce graduates who are industry-ready (Frascara, 2017). While practical applications of collaborative projects that rely on design thinking approaches can vary in nature, generally, problem-based learning is used and student teams are required to work together to address both large and small scale societal problems.

Achieving an effective team environment is not an easy task and studies on the student experience in higher education suggest that collaborative learning often falls short of many of the desired learning aims (Ohl & Cates, 2006). Conflicting student views, differing expectations and logistic problems such as timetables and external commitments impact on the team and can contribute to break down the learning community and minimise the effectiveness of the team (Anderson, 2005; Ohl and Cates, 2006).

Student perceptions of teamwork and the team environment also contribute to the team dynamic. Team members with positive perceptions of collaborative learning have been shown to develop teams that have increased levels of social engagement within them which contributes to satisfaction with this style of learning (So & Brush, 2008). Furthermore, teams which enjoy working with their peers have been found to develop increased levels of trust while teams that foster low levels of communication and minimise individual accountability created negative experiences for students (Tseng & Yeh, 2013). The limiting impact of these social and interpersonal issues can have significant impact on learning. More specifically in a creative context, they have the potential to limit the development of trust relationships that are required for teams to work collaboratively to maximise the knowledge and skills required to adequately define the project problem and seek an appropriate solution (Levi, 2014; Volkov & Vokov, 2015).

There is a range of published research regarding the way in which interdisciplinary teams collaborate in industry. This research suggests that professional differences in interdisciplinary teams influence the team’s ability to collaborate and bridge knowledge across disciplines (Edmondson, 2016a; Ettington & Camp, 2001). In particular, in creative teams, for novel ideas to develop team members need to feel safe to contribute and develop trust that their team is able to tolerate divergent views (Abfalter, 2013; Anderson & West, 1998; Bain, Mann, & Pirola-Merlo, 2001; Lee, Gillespie, Mann & Wearing, 2010). Yet in interdisciplinary student teams in higher education, little consideration is given to the development of interpersonal skills that might help students to bridge disciplinary differences and collaborate effectively.
In part this is due to a paucity of theoretical literature that investigates the way students interact in these short-term teams. It is also due to the relative recency of the adoption of the interdisciplinary team in design education. As a result, in practical terms, the factors that influence participation and engagement within these teams are not well understood. This study addresses part of this knowledge gap by investigating the participation, learning and collaboration that occurs within interdisciplinary design teams.

1.2 Design Education

Design education has traditionally relied on a master/apprentice approach in which the skills and knowledge required to practice professionally are acquired through observation and guided application (Lawson, 2014). Lave and Wenger (1991) identify this style of skill and knowledge acquisition as “situated learning”, where students master skills through “peripheral participation” based on the knowledge and approaches demonstrated by the “master” instructor. To a great extent, the design discipline continues to rely on “situation learning”; however, broader changes to education are forcing a reassessment of design pedagogies. Processes are shifting decision-making away from intuitive responses and towards research and development that encompasses knowledge from a range of professional disciplines (Choi & Pak, 2006; Frascara, 2017). This shift has created an upsurge in approaches, such as “design thinking”, that have helped to facilitate recognition and validation of design in the university sector (Becher, 1989; Cennamo & Brandt, 2012). The research shows that design education is transitioning from its vocational origins towards a research-driven problem-solving discipline that relies heavily on teamwork. This approach aligns with trends across higher education, where problem-based team project work is being integrated across the curriculum to engage students in independent real-world learning (Donnelly & Fitzmaurice, 2005).

Design education is also changing in response to industry needs, with new working paradigms emerging in professional design practice. Research-led idea development is becoming commonplace in early project stages, and theoretical knowledge, rather than intuition, is being used to guide conceptual thinking and decision-making (Frascara, 2017; Nini, 2005; Schön, 1984). This leaves the iterative design process, where the problem and solution are continually addressed in a circular fashion – and once naturally the domain of the individual – dependent on knowledge that is often outside the expertise of the designer. This practice change has altered the manner in which ideas are developed, and reflective evaluation and validation of ideas are increasingly becoming a team process.

Furthermore, the benefits of the fluid nature of the design process are contributing to an increase in popularity of this problem-solving methodology outside the design discipline. Design, and more specifically design thinking processes, are being heralded as integral to innovation (Brown, 2008;
“Design thinking” refers to the non-linear problem-solving processes employed by designers. These processes combine knowledge and intuition to generate innovation. Design thinking differs from more scientific approaches as it produces possible solutions that best meet project requirements rather than specific answers (Dorst, 2011; Owen, 2007). In this approach, ideas are only discarded after they are reviewed and assessed against project criteria to determine appropriateness (Brown, 2008).

In many design education courses assessment tasks are formulated to meet semester structures. This creates a project milestone structure that aligns with the linear time requirements of the unit. Assessment points are used in design education to guide student learning. For the most part a linear structure that connects assessment requirement to project milestones is developed to help students to identify the learning expectation at each progress stage. Within this process formative feedback provides a link between theory and application to practice. Critical feedback is an integral part of the design education process as it stimulates reflective thinking, encouraging students to evaluate ideas and reconsider them in the context of the problem posed (Miceli and Zeeng, 2017). Frascara (2017) suggests however that students are disinclined to research and evaluate and tend to build on what they have developed in early project stages rather than review the appropriateness of ideas and solutions in relation to the problem posed.

Furthermore, researchers argue that the success of design thinking in teams relies on the ability the team has to bring together the collective knowledge of the members (Edmondson, 2016b; Martin, 2009). Several authors have noted that to achieve this, creative teams need time to develop a safe environment where all team members can trust that contributions made will be considered respectfully (Edmondson, 2016a, Sawyer, 2008). Teams who have the time and knowledge to develop holistic team approaches are better able to generate ideas together by using design processes such as brainstorming which enables them to fully consider all responses and suggested ideas as equally viable.

The semester structure of most universities limits the time students have to develop the trust relationship required to work effectively in a creative team. Furthermore, in undergraduate courses with students who are novices in their discipline, it can be challenging for educators to create a learning environment that is conducive to sharing creative ideas. In the context of interdisciplinary project work in design education, the teams’ lack of shared knowledge and face-to-face time has the potential to further limit the opportunity for collaborative interaction. This may lead to team processes that do not support the iterative design thinking process and where this occurs, may limited the ability the team has to work together to develop and evaluate solutions in direct relation to the problem posed.
1.3  The Study

The aim of this study is to investigate how individual students brought together for one unit in one semester collaborate in interdisciplinary design teams. This study focuses on the nature of the interactions and the manner in which teams embrace or do not apply collaborative practices. It examines team interactions, social learning and engagement with the project to understand how interaction facilitates or inhibits collaboration in the design process.

The research question central to this study is: “What factors influence collaborative practices and working relationships in interdisciplinary design teams in higher education?”

The research investigates the factors that enhance collaboration and identifies ways in which these factors influence positive teamwork relationships. Conversely, the study also investigates the factors that inhibit effective collaboration and limit the team’s potential to work collaboratively. To achieve this, the research investigates the:

- students’ (pre-task) expectations and perceptions about teamwork;
- interaction between team members;
- engagement of individual students in each team with the project;
- students’ personal reflections about how they and others contribute in teams; and
- learning that occurs between individual collaborators.

The research uses a qualitative case study method involving four interdisciplinary teams undertaking a unit of study in a school of design in a metropolitan university in Australia. The study focuses on the student experience in interdisciplinary design teams. The aim of the interdisciplinary group project was to bring together students from different disciplines to develop a design solution to a complex problem. To achieve this, the students worked together in teams to clarify concepts, solve problems and develop innovative solutions. The teacher in this collaborative pedagogy was primarily a facilitator who guided the student teams.

1.3.1  Significance of Study

This research on interdisciplinary team projects sheds light on how interaction among diverse students takes place in team projects and how this interaction influences the ability teams have to learn from each other and maximise the knowledge and skills the individuals bring to the team. In particular, the specific area of student attitudes, perceptions and engagement within collaborative processes in tertiary learning environments is not well understood or documented, and this research will provide valuable insights for educators in planning interdisciplinary team learning tasks. This knowledge will complement the body of research that currently exists in the area of team pedagogies.
The study draws on Lave and Wenger’s (1991) Community of Practice (CoP) theory and the findings will add to an understanding of how interdisciplinary student teams develop a unique CoP that contributes to influencing team interaction and collaboration in a classroom environment. The findings will also contribute to our understanding of individual student engagement with the team and the project. This can inform the development of collaborative pedagogies and provides academics with knowledge that will help them improve student collaboration, participation and engagement in project work.

1.3.2 Scope and Limitations

This research investigates interdisciplinary student teams in one subject at one university in Australia. It concentrates specifically on student interaction and peer learning to understand factors that influence collaboration at both a team and individual level. The investigation focuses on interpersonal interaction to unravel how students function and contribute in teams. At the same time, the study provides insight into how these interactions influence the solution-finding process.

The study investigates four interdisciplinary design teams in one class group over a full 12-week semester. This unit was selected by the researcher, an educator with broad experience leading student team-based project work in design education, as the random nature of team formation and collaborative pedagogical approach used in the unit was considered to be representative of interdisciplinary project work undertaken within the context of the study.

Four data sources were collected across the semester. At project onset, one on one interviews were conducted to identify preconceived views about teamwork. Throughout the 12 weeks two data sources were collected, the first was a transcript of the Facebook interactions that occurred in each team project group. The second was a personal journal that provided insight into the experience at an individual level. The final data source, assessment results provided a measure by which successes, as defined by the teacher, could be gauged.

The qualitative nature of this study may further limit the application of findings on a broader scale. The university at which this study was conducted has a long history of design education. The School of Design is working to consolidate its research reputation within academia while at the same time maintaining its strong links to industry. Academics within the school vary in age and experience, and therefore contribute different ideas about design priorities and pedagogy. A portion of academics align themselves with more traditional outcome-based approaches, while others focus on research and development. In addition, the School of Business, which provides the business students in this study, resides in a different faculty to the School of Design and therefore has little influence on the content or processes applied in the unit of study. Therefore,
processes and content may present as contradictory to students and could mar student perceptions of the collaborative process.

1.3.3 Terminology

Many terms, while not unique to design education, are used in this study as they are understood within the discipline. Contested terms, discussed in detail in Chapters 2 and 3, are defined briefly here.

- **Interdisciplinary teams** refers to teams that include students from two or more different academic disciplines.
- **Design thinking** refers to a process that uses an iterative approach to develop a project solution. The process is fluid and relies on the collective knowledge of the project team (Brown, 2008; Edmondson, 2016a; Owen, 2007).
- **Artefact** refers to the final product of the team, which in the context of this study is a design proposal.
- **Collaboration** refers to team processes in which problems, ideas and solutions are actively worked on together.
- **Collaborative Learning** refers to a pedagogical approach that requires students to make sense of knowledge by explaining and clarifying concepts with peers (Bruffee, 1981).

1.4 Thesis Overview

This thesis has seven chapters. This first chapter provides a background to contextualise the study. Chapter 2 examines the concept of the team. The literature reviewed provides a discussion of team pedagogies and learning in a community of practice. Factors known to benefit teams are discussed in detail to understand the characteristics that are integral to effective teams. Chapter 3 presents a review of the literature on the development of design education and outlines the design thinking process. This provides an understanding of the changing environment and the important role of the team in emerging pedagogies. Chapter 4 outlines the study methodology and provides a detailed description of methods applied in this study. The next two chapters analyse the project findings which are presented to allow the voice of the participants to come through. Chapter 5 analyses the perceptions of participants and influences of previous experience at the start of the project. Chapter 6 examines the experience of each team in detail to shed light on processes and practices that influence collaboration. Chapter 7 gives clarity and meaning to the main themes that emerged from the study. The contributions to the literature and implications of the findings for educators are discussed. A summary of the achievements of the research aims, significance of the thesis and recommendations for educators and further research is presented.
CHAPTER 2

Collaboration in Teams

This chapter provides a discussion of the factors known to impact on the collaborative problem-solving capacity of teams. Analysis of teams has shown that effective teamwork is dependent on a number of factors, which include team roles, leadership, problem-solving and analysis capacity (Akila & Thangavel, 2013; Belbin, 2010; Levi, 2014; Schoo, 2008, Shek & Ma, 2016), while team cohesion has been found to be interdependent on the pre-existing personality and behavioural factors of individual team members (Barnett, 2007; Belbin, 2010; Contu & Willmott, 2003; Roberts, 2006). This suggests that teams face two problem sets. The first set of problems are related to and unique to the particular project while the second set of problems are related to and dependent on the manner in which the team interacts and functions (Levi, 2014).

The focus of this study is to understand how team interaction influences collaborative processes; therefore, the problem of the team is considered first in this chapter. The literature provides an overview of collaborative learning in higher education. This is followed by a discussion of some of the factors known to influence how teams work collaboratively. The next section considers the social learning practices common to design education and explains the relevance of Lave and Wenger’s Community of Practice theory in the study context. The final section discusses the influence emotional intelligence has on teams, with particular reference to creative teams.

2.1 Team-Based Learning

The complexity of many problems that face society has created a need for the interdisciplinary team, where individuals with diverse discipline knowledge work to combine varied expertise to develop novel ideas and solutions. To prepare students for this industry need, universities are increasing the number of team-based projects students participate in. These projects aim to afford students the opportunity to work together to develop the interpersonal skills considered integral to effective teamwork (Donnelly & Fitzmaurice, 2005). However, how students interact and collaborate in interdisciplinary teams is not well understood and is therefore central to the research questions addressed in this thesis.

2.1.1 Collaborative Pedagogies

Collaborative pedagogies in higher education aim to bring students together to innovate through problem-based learning (PBL). In design education, team work generally has an industry focus and teaching focuses on the development of creative practices that improve the ability of students
to interact with other professionals, clients and end-users, as this is considered integral to achieving innovative design products (Brown, 2008; Dorst & Cross, 2001; Kimbell, 2011).

Many terms in the literature are used to describe the learning structures applied to team project work. Savin-Baden (2007) identified that learning teams can be engaged in PBL using five different epistemological underpinnings: (1) tutor-guided – tutor guides the problem, students undertake independent learning; (2) collaborative – element of tutor control but requires student engagement with team and processes for completion and learning; (3) reflexive team – focuses on the team experience, review is used to ascertain knowledge acquisition, both personal and topic-related; (4) cooperative – utilises complex problems to achieve both mastery and knowledge retention; and (5) action learning – reflection and action used for problem-solving, shared learning occurs through regular meetings. As design education most commonly uses collaborative learning, this pedagogy is discussed in detail here.

The literature suggests that collaborative learning is based on social-constructivist theory, with the members of the team expected to construct new knowledge. The main aim of the team in collaborative pedagogies is that its members serve as a catalyst for sense-making. By explaining and clarifying concepts to each other, peers develop their own method for understanding the content and/or the problem (Bruffee, 1999). In this way, the collaborative learning processes are considered to directly engage students in the process of learning (Barkley, Cross, & Major, 2005).

This learning approach, when applied to PBL, relies on the team’s ability to work together to bridge multiple stages and requirements of the project (Yew & Goh, 2016). Collaborative learning requires student teams to develop a method for structuring information, a process for engaging the team to share information and a method to apply the information to the project outcome (Bruffee, 1999). These stages align well with the iterative design thinking process, so it is not surprising that this pedagogical approach is preferred for interdisciplinary design teams.

It is considered that the pedagogy is most effective when the roles of the individuals within the team remain flexible (Barkley et al., 2005). In collaborative learning the tutor, as well as the students, become part of the learning. The role of the tutor has been likened to that of a facilitator whose role is to guide, rather than direct, knowledge acquisition within the team. Within this pedagogical approach, team roles are not allocated by the tutor. Instead, role allocation is left to the discretion of the team. The flexibility this process offers suits the creative disciplines. Open engagement across a range of roles is considered vital to creating increased opportunities for participants to contribute to the process in a “fluid” and collaborative way (Yew & Goh, 2016).

However, when applied to interdisciplinary design teams this pedagogy relies on a balance of variables between student, tutor and project. It might be considered that the potential lack of reliability of variables such as knowledge, time and a will to learn, creates multiple opportunities
for the processes to fall short of expectations. As noted above, the tutor in this approach is “hands-off”, which leaves student teams – often inexperienced – to negotiate all parts of the project with little or no direction or guidance as to how the team can work effectively together. This creates a learning environment that is team-directed. The result of this process is that significant parts of problem-solving, and indeed learning, lie squarely in the hands of the project team. Yet little is understood about the effectiveness of this pedagogical approach when applied to interdisciplinary design teams. This lack of research raises important questions about whether the approach does create opportunities for students to interact in a manner that facilitates collaboration or learning. To understand this issue from a teaching perspective, the following section outlines some of the skills students are expected to gain through collaborative learning.

2.1.2 Skills for Effective Teams

As noted in the introduction, universities are embedding teamwork across a diverse range of learning areas. The acquisition of interpersonal team skills is commonly viewed as necessary for graduates to be “work-ready”, however, Shek and Ma (2016) found that skills such as leadership were not effectively acquired in university settings. Ettington and Camp (2001) showed that developing effective teams is complex and requires a combination of interdependent skills, which they group into four categories: organisational, interpersonal, problem-solving and managerial. Engagement with each of these categories requires teams to develop distinct knowledge and skills to enable the team to manage complex interpersonal interactions. In practice, achieving this has been shown to be reliant on structures and processes that are often missing in collaborative pedagogies (Haas & Mortensen, 2016; Hackman, 1990).

A closer look at Ettington and Camp’s (2001) categories helps to understand the skills required for teams to function effectively at both a practice and interpersonal level. The first category, organisational skills, identifies that teams have a need for planning. It perhaps goes without saying that a team will not achieve its objectives unless it develops a method for prioritising and dividing work, setting deadlines and monitoring progress. Where effectively applied, these skills provide teams with processes that help them achieve timely completion in an equitable manner.

The second set of skills, interpersonal skills, focuses on relationship-building. These skills are important as they help teams manage differences and build trust, which is known to be vital to team function (Barczak, Lassk & Mulki, 2010; Roberts, 2006; Wheelan, 2010). Third, problem-solving skills (Ettington & Camp, 2001) are integral to teams as these skills help teams understand the core problem and develop appropriate responses. This category of skills has been shown to rely on active listening and negotiation skills to achieve consensus (Paulus, 2003; Sawyer, 2008). The final set, managerial skills, is identified by Ettington and Camp (2001) as important to the development of approaches that help others within the team. These skills, often undertaken by
team leaders, provide guidance and feedback for others and are vital for teams to manage difficulties and work cohesively.

Differences in views and ideas that arise, as they may in the interdisciplinary team, have the potential to limit the development of these skill categories. In particular, many of the skills required for the complex problem-solving that interdisciplinary teams undertake are closely aligned to interpersonal skills. However, the influence of the absence of any of these skills at a team level in an educational setting is not well investigated. This thesis aims to address this gap by looking deeply into the student psyche to understand the relationships between preconceived perceptions, team interactions and collaboration.

Ettington and Camp’s research provides an overview of the typical skill sets teams need in order to function. However, within each of these categories team participants need to engage with project requirements and each other in a number of different ways. To understand some of the ways in which individual team members interact and engage with the project requirements and peers, the following section presents an overview of Belbin’s Team Roles.

2.2 Understanding Teams

Meredith Belbin (2010, 2015) has undertaken extensive investigation of teamwork in industry and has found that the success or failure of a team is highly dependent on participation across nine distinct roles. This research led Belbin to develop a diagnostic measure to identify the requirements within each of these roles, which are widely known as Belbin’s Team Roles. This model is a useful tool for identifying and understanding the contribution of each team member as it outlines the strengths, weaknesses and functions of each role. These role descriptors are well-tested, reliable and have been extensively used to measure and understand team behaviour. Consequently, Belbin’s model has been selected to guide the categorisation and coding of individual contributions to team process as observed in the Facebook groups in this study. The categories defined by Belbin are broad and therefore suit the flexible ‘soft’ nature of problem-solving undertaken by interdisciplinary design teams.

2.2.1 Belbin’s Team Roles

To provide clarity, Belbin categorises the nine team roles into three groups: Action Oriented, People Oriented, and Thought Oriented. These categories group the roles to understand the three broad areas of contribution to the team, while the nine roles focus on more specific tasks.

Belbin defines some roles as more ‘visible’ than others. However, he also shows that, irrespective of visibility, each role has its unique place. Belbin’s roles and an overview of key characteristics associated with each role are provided in Table 2.1.
Table 2.1 – Belbin team roles overview (based on Belbin, 2010)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ROLE</th>
<th>CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Oriented Roles</td>
<td>Shaper (SH)</td>
<td>Challenges the team to improve</td>
</tr>
<tr>
<td></td>
<td>Implementer (IM)</td>
<td>Puts ideas into action</td>
</tr>
<tr>
<td></td>
<td>Completer-Finisher (CF)</td>
<td>Ensures thorough, timely completion</td>
</tr>
<tr>
<td>People Oriented Roles</td>
<td>Coordinator (CO)</td>
<td>Acts as a chairperson</td>
</tr>
<tr>
<td></td>
<td>Team Worker (TW)</td>
<td>Encourages cooperation</td>
</tr>
<tr>
<td></td>
<td>Resource Investigator (RI)</td>
<td>Explores outside opportunities</td>
</tr>
<tr>
<td>Thought Oriented Roles</td>
<td>Plant (PL)</td>
<td>Presents new ideas and approaches</td>
</tr>
<tr>
<td></td>
<td>Monitor-Evaluator (ME)</td>
<td>Analyses the options</td>
</tr>
<tr>
<td></td>
<td>Specialist Finisher (SF)</td>
<td>Provides specialised skills</td>
</tr>
</tbody>
</table>

Belbin states that the process and outcomes of teams that either lack participation or are overrepresented in any role are likely be negatively affected. For example, a team with no Plant is less likely to develop innovative ideas, while one with too many Plants may overlook or under-consider large quantities of high-quality ideas. Similarly, teams with no Shapers may lack drive and direction, while a team with too many Shapers can lead to infighting that reduces the overall morale of the team. This study uses Belbin’s model to guide participation analysis of each student in each team in this study. The following section details the functions and personality traits typical to each role to understand the potential contribution each makes to the team.

Belbin (2010) argues that Shapers in teams are individuals who are goal-oriented and drive team improvement. His findings show that Shapers can be determined and assertive and are likely to generate action and push the team. Belbin states that Shapers tend to be dynamic, extroverted individuals who can be perceived as being directional in their approach. Individuals who take on the Shapers role are inclined to be highly motivated. They are also likely to seek out the best problem-solving approaches; consider all possibilities; question others; and reject accepted norms (Belbin, 2015). Shapers can be viewed as aggressive by others as they show a tendency to be outspoken and argumentative. Despite this, Belbin found that Shapers function well as managers as they have a strong ability to make decisions and generate action, which helps the team to maintain steady progress when difficulties arise. This role has the potential to influence the team to seek out innovation and, therefore, might be considered a critical role for the interdisciplinary design team which is required to create innovative solutions.

The second role, the Implementer, is undertaken by individuals who are practical and get things done (Belbin, 2010). Belbin’s research shows that these individuals are generally organised planners who tend to work systematically to action work requirements. Implementers tend to be reliable and able to apply themselves to tasks whether they like the task or not. They also tend to be perceived as loyal and reliable. However, Belbin (2015) finds that the personality of the individuals who take
on this role tends to be conservative and, as a result, Implementers can be perceived as inflexible and resistant to new ideas or change. The Implementer is action-focused and the role has the potential to contribute to the team’s capacity to progress ideas; however, in the interdisciplinary design team, where innovation is the core of solution-finding, the conservative nature of these individuals has the potential to limit idea exploration and hinder collaborative interaction.

Role three, the Completer-Finisher, is considered by Belbin (2010) to be critical to project completion. Belbin argues that individuals who take on this role strive for perfection, pay attention to detail and are likely to expect that the people around them will contribute the same to the team. The research suggests that the Completer-Finisher is more likely to be introverted and has the propensity to conscientiously meet deadlines and focus on detail. As a result, Completer-Finishers may be reluctant to trust others, which can increase their anxiety levels (Belbin, 2015). Belbin’s research on teams suggests that the contribution of the Completer-Finisher is invaluable to tasks that require close concentration, precision and high levels of accuracy. The focus on task completion has the potential to play an important role in interdisciplinary design teams’ ability to produce high standards of work and achieve timely completion. However, the lack of trust demonstrated by Completer-Finishers has the potential to create barriers to creative problem-solving and limit the opportunity for less skilled or knowledgeable team members to actively interact with key aspects of the design problem-solving process.

Belbin (2010) found that the Coordinator role is traditionally the role of the team leader. His research shows that the individuals most likely to take on this role tend to have a broad perspective and are likely to be mature, calm and have strong listening skills. Belbin (2015) argues that Coordinators who are able to quickly pair individual strengths with the needs of the team are better able to recognise the value each team member brings to the table and delegate tasks effectively, and have the ability to guide diverse teams when they are consultative in their approach. On the other hand, Belbin (2015) also finds that Coordinators have a tendency to focus on end goals and use delegation techniques to mitigate personal responsibility. The role the Coordinator plays in recognising the value of the individual and encouraging interactions that minimise potential differences in interdisciplinary team is of interest in this study.

The Team Worker is defined by Belbin as the role undertaken by individuals who primarily work to support the team. Belbin (2015) found that individuals who take on this role are more likely to have social personalities and tendencies to ensure that all individuals within the team are working together. The research conducted by Belbin shows that the Team Worker tends to be flexible, perceptive, adaptable and popular. Often they are diplomatic and they have skills that enable them to take on the role of team negotiator when required. However, Belbin also finds that Team Workers tend to prioritise team cohesion and, as a result, they can appear indecisive, making
them unpopular at critical times (Belbin, 2015). As the Team Worker contributes to maintaining positive relationships, participation in this role is considered in this study to understand the manner in which team-focused individuals influence collaborative opportunities in interdisciplinary teams.

Role six, the Resource Investigator, is described by Belbin (2010) as being held by individuals who have a natural curiosity to explore options. Belbin’s research shows that Resource Investigators have a tendency to be outgoing and are often extroverted. Individuals who take on this role contribute to the team’s ability to explore possibilities and can be effective at providing the team with the information it needs to develop ideas. Furthermore, Resource Investigators have an inclination to be receptive to the ideas of others. However, while optimistic at project inception they show a tendency to lose interest after the early stages of the project (Belbin, 2015).

In the context of the interdisciplinary design team, where innovation is integral, it might be said that the Resource Investigator plays a key role in expanding the team’s potential to explore options and resources. The influence this role has on the ability of all team members to actively interact in the early research processes and direct team solution-finding is of interest in this study.

The role that might, perhaps, be considered most relevant to creative innovation is the Plant, as this role provides suggestions and ideas for solutions to complex problems. Belbin (2010) finds that individuals who undertake this role are also the team members most likely to suggest and introduce new ideas and approaches to the team. What is also interesting about this role is that Belbin argues that many of the ideas introduced by Plants, although novel or unorthodox, are likely to be impractical and unsuitable for application. Belbin also found that Plants were often introverted and tended to be poor communicators who worked alone and found criticism hard to deal with. The innovation focus of the Plant suggests that this role may be integral to solution-finding in context of the interdisciplinary design team.

The eighth of Belbin’s roles, the Monitor-Evaluator, is the role in which analytical individuals evaluate the ideas that the team has developed. Belbin (2010) argues that Monitor-Evaluators are individuals who are shrewd and able to remain objective. He finds that Monitor-Evaluators take time to carefully weigh up the pros and cons of all the options and ideas before coming to a firm decision. Considered in this way, it can be said that Monitor-Evaluators are critical thinkers who function to analytically review problems (Belbin, 2015). Therefore, this role has the potential to play a critical part in the creative process, where the ability to evaluate ideas in an analytical fashion is important for teams to make informed decisions about idea feasibility (Merholz, 2008). The role the Monitor-Evaluator plays in managing and progressing ideas and contributions in diverse interdisciplinary design teams is not well understood and should be considered to
understand how effectively student teams are able to assess the value of ideas and identify the criteria that are important to solution-finding and decision-making.

Belbin’s final role, the Specialist, refers to individuals who have the specific expert knowledge required to complete project outcomes to a high level. Belbin (2010) finds that individuals who undertake this role tend to pride themselves on their skills and abilities; however, at times their focus on skills and production makes them overly concerned with technicalities, limiting their “big picture” thinking contribution. Belbin finds that Specialists are often recognised by colleagues as experts. Individuals who work as Specialists show a desire to maintain their professional status and are committed to their area of expertise. Belbin further finds that Specialists are inclined to accumulate new knowledge and their desire to acquire this knowledge can often be their main motivator. The Specialist role is of interest in interdisciplinary design student teams as these individuals are likely to provide the in-depth skills and knowledge required to complete the project requirements. This study aims to provide some understanding of the value that students, whose professional knowledge is still developing, place on specialist skills in teams.

2.2.2 Team Behaviours

Belbin’s (2010) research also shows that, when joining a team, individuals adapt and modify their behaviour in relation to the requirements of that particular team. This behaviour modification has been labelled “Role Learning” by Belbin, whose studies show that roles tend to naturally develop to meet the unique requirements of the collective personality, skills and knowledge of the team. Belbin’s research aligns with the principles of collaborative pedagogies, where student teams are expected to allow team roles to emerge. To better understand the role of personality factors in teams, we can look to Belbin’s six-factor behavioural model (Table 2.2). Belbin’s research suggests that the actions and decisions made by the team, at both a collective and individual level, are relational. He finds that in any newly established team, each individual must develop an understanding of the other team members as well as their place within this team. However, Belbin states that the relationships between each of the factors are complex, which often makes the arriving at a team understanding difficult.

Table 2.2 – Team behaviour factors (Belbin, 2010)

<table>
<thead>
<tr>
<th>BELBIN – TEAM BEHAVIOUR FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherished values and motivation, that provide a particular set of behaviour</td>
</tr>
<tr>
<td>Personality, psycho-physiological factors, especially extroversion–introversion and high anxiety–low anxiety</td>
</tr>
<tr>
<td>Mental abilities, high-level thinking that generates exceptional behaviour</td>
</tr>
<tr>
<td>Personal experience/cultural factors, behaviour that is based on experience or conventions</td>
</tr>
<tr>
<td>Field constraints, which depend on environmental factors</td>
</tr>
<tr>
<td>Role learning, versatility and ability to play a needed role</td>
</tr>
</tbody>
</table>
Interestingly, many of the factors identified by Belbin correlate with limitations of CoP, detailed in Section 2.4. These theories highlight multiple links between personality, knowledge, experience and team contribution. This raises further questions about the interdisciplinary design student team, such as whether individual and discipline differences are realistically manageable and whether the goals expected of these teams are achievable in short-term projects.

Since its first development in 1981, the validity of Belbin’s Team Role Model has been subject to investigation about its validity. Furnham, Steele and Pendleton (1993) and Broucek & Randell (1996) reviewed Belbin’s Self-Perception Inventory and found discrepancies in the statistical validity of the model. Broucek & Randell (1996) also found that four of Belbin’s team roles, Coordinator, Team worker, Completer-Finisher and Monitor-Evaluator could be readily interchanged. Furnham et al. (1993) further suggest that Belbin developed his Team Role Model based primarily on observations and that the model consequently lacks reliability.

Belbin Team Roles have come under further criticism as a result of the “allowable weakness”. In each of the roles, Belbin identifies personal characteristics that he considers to be allowable with individuals. However, research suggests that many of these personality aspects have the potential to control team processes and negatively impact on team performance. Fisher, Macrosson and Semple (2001) identified that certain roles such as Coordinator, Resource Investigator and Shaper were more likely to result in controlling team behaviour. Macrosson and Hemphill (2001) suggest that allowable weakness in Shapers such as “hurts other people’s feelings” or Plants “disregard for protocol” have the potential to disrupt and negatively impact on a team’s performance.

Further concerns have been raised about the conflict and disruption caused by these roles in the context of creative teams. Aritzeta, Ayestaran and Swalies (2005) found that Completer-Finishers, Implementers and Team Workers have a tendency to avoid more dominant peers while Shapers and Plants were more likely to dominate and were less obliging. The contradictory nature of these two sets of roles poses a threat to collaboration in the interdisciplinary design team and has the potential to limit the design thinking process which relies on equal participation across a range of roles and project stages.

However, despite these criticisms, Belbin Team Roles remain a widely-used framework for understanding team performance, and is considered a reliable and useful research tool that enables the interconnections between individuals’ actions and performance in a team to be reviewed and evaluated.
2.2.4 Team Leadership

As noted, in Section 2.2.1, collaborative pedagogies commonly applied in higher education provide little direction to guide the formation of roles and functional structures in student teams. Consequently, the structures that form within student teams are often individual to the team and, as a result, how leadership is formed in these teams is not well understood. In particular, the impact of the manner in which leaders form and influence teams with diverse professional knowledge and skill levels is not known and, therefore, is pertinent to this study.

In comparison, much is known about the role of the leader in professional teams. Leadership is broadly defined as involving any of the processes that guide the team towards completion of set goals or objectives (Zeidner, 2012). Studies that review team practices show that guidance in teams can be valuable (Hackman, 1990; Lee, et al., 2010). In particular, leadership styles have been shown to significantly influence the capacity of individuals to participate in the team. Research on teams has found that effective leaders are able to build the team’s ability to improve overall performance (Vecchio, Bullis, & Brazil, 2006). With this in mind, we might view the role of the leader as integral to the team.

Levi (2014) argues, however, that the specific role of the team leader often develops haphazardly based on numerous factors, including, age, participation rate, gender and task skills, highlighting again the uniqueness of each team. Further research suggests that leaders who meet the unique needs of the team improve the team’s potential to create quality outcomes (Hersey, 2008). Situational Leadership Theory (SLT) provides a way in which this phenomenon can be understood in practice and is used in this study, as it aligns with the developmental styles used in collaborative pedagogies. SLT was developed by Hersey and Blanchard on the premise that leaders, based on the skill and knowledge of the team, apply different styles of leadership to best meet the needs of the team (Hersey, 2008). SLT comprises four styles of leadership – directive, coaching, supportive and delegating – all of which emerge in direct relationship to the level of skill and the knowledge the team has to manage the project requirements (Levi, 2014; Vecchio et al., 2006). Teams with low knowledge or skill, are considered to benefit from directive leaders who apply measures to ensure that team members all work together. As the level of knowledge and skills increase, the leadership style alters too, and the level of control reduces until the team members reach a stage at which they are able to function effectively independently (Levi, 2014).

Blanchard, Zigarmi and Nelson (1993) find that, to be applied adequately, SLT requires analysis over several stages of development. Therefore, the success of the theory relies to a great extent on the ability of the team to work past the early “getting to know each other” stage to develop an understanding of how the team can work together. That is to say, team leaders respond to the specific requirements of the team in context in two steps. SLT suggest that team leaders first
assess the relative skill level of their team members and determine their needs, then respond to this need by applying the leadership style they deem most appropriate (Hersey, 2008).

Making an appropriate decision when confronted with a new team relies on time, analysis and expert judgement (Blanchard, Zigarmi, & Nelson, 1993). Team leaders need significant knowledge to determine the skill level of the individual team member and the participation “willingness” of the individual. Hersey (2008) himself considers that these qualities are rarely immediately obvious to the leader; in particular, the motivation of the individual is difficult to assess. His research shows that many team members display motivation that does not accurately reflect their true skill level due to the individual insecurities team members have about their ability to do the job expected.

Based on this research, the importance of the leader in guiding a team should not be underestimated. In short-term interdisciplinary teams, where student team members have limited time and peer knowledge, the question of what influence leadership style has on team interaction should be considered. Furthermore, the application of unstructured collaborative pedagogies in this context should be examined to understand whether interdisciplinary student teams have the ability to develop and apply appropriate leadership styles in this educational context.

2.3 Team Support Structures

When individuals are brought together in a design team, there is the expectation that they will work collectively to analyse the problem, develop alternatives and select the best solution. As noted above, the research suggests that the roles team members undertake, individual personalities and leadership styles all have the potential to influence interactions between team members and, in turn, affect the way in which the team problem-solves. However, research on teams in industry shows that effective team structures can contribute to minimising these problems. Evidence suggests that teams that have a compelling direction, a strong structure and a supportive context are more likely to achieve success (Haas & Mortensen, 2016; Hackman, 1990). Furthermore, these three factors are known to contribute to participation and project contribution in the workplace. In the context of the interdisciplinary design team in higher education, collaborative pedagogies are used and few structures are put in place to support the team. Yet little is understood about the impact this lack of structure has on team interactions and collaboration.

2.3.1 Structures for Effective Teams

The broader literature on teamwork suggests that the structures teams develop can foster positive relationships between individuals in the team and have the potential to bring teams together to work to their best joint capacity. These outcomes occur in a number of ways. The first is sincere communication with peers. Teams that communicate in a manner that encourages
and shows respect for peers are more likely to improve the overall function of the team (Pérez López, Manuel Montes Peón & José Vázquez Ordás, 2004). Studies conducted by Roberts (2006) also demonstrate that teams that develop a culture that feels genuine are more likely to undertake team discussions and encourage a deeper respect for the contribution of peers. Genuine respect has also been linked to increases in the potential of the team to shape and redirect ideas (Edmondson, 2016b). These supportive team structures, viewed in the light of the expectations of the interdisciplinary design team, might be considered necessary, yet little is known about how these structures can be fostered in student teams.

The specific way in which structures that foster sincerity and respect develop in teams is difficult to define. What is known is that for a genuine culture to develop, team members need to show evidence of deep listening by acknowledging the value of all team member contributions (Sawyer, 2008). To understand why this is important, we can look to the “team-based learning” theory developed by Michaelson, Knight and Fink (2004). These authors find that, in higher education, students demonstrate the value they attribute to their peers through the interdependence they create between team members. Michaelson et al. (2004) show that the teams that create opportunities for peer dependency also demonstrate a higher ability to value the contribution of their team peers. Conversely, teams that do not find a way to value the contribution of peers decrease dependency by applying individualist approaches. This was demonstrated by actions such as dividing project requirements into individual tasks to reduce the likelihood of interdependent relationships (Michaelsen, Knight, & Fink, 2004).

Whether students in interdisciplinary teams are able to develop this interdependence is considered important to this study, as the innovation these teams are required to achieve is reliant on team interactions that lead to collaborative solution-finding. This is particularly relevant in the design context, as research on creative teams suggests that when teams develop peer regard, they increase their creative potential. This has been shown to occur through, in part, respectful interpersonal relationships, which help individuals feel safe in teams, increasing the likelihood that peers will challenge each other and facilitate opportunities for idea-sharing and development (Anderson & West, 1998; Bain, Mann, & Pirola-Merlo, 2001; Lee et al., 2010).

Considering this research, it might be said then that a team’s ability to achieve a supportive team structure relies on the individuals that make up the team; however, how to achieve the right balance of personality and skills to achieve this in a team is not clearly understood. Edmondson (2016b) finds that interdisciplinary design teams in industry that efficiently solve difficult problems do so by harnessing the collective talent of the team. This research suggests that effective teams need to have a balance of both technical and social skills (Edmondson, 2016b). The study further finds that, to be effective, teams need to believe that the team has all the technical skills needed
to fulfil the project requirements. Considering this in the context of education, where all teams undertaking projects are still learning, we might reasonably assume that a lack of skill proficiency in teams might contribute to limiting the ability of team members to develop confidence in the ability of their team peers.

In student teams this creates a difficult problem to manage, as actual knowledge is rarely clearly visible. In interdisciplinary teams, the problem of knowledge has the potential to create further doubt, as often the knowledge required is outside the scope of any individual team member. Despite this, little is known about the effect of skill and knowledge imbalances in dividing rather than uniting teams, making the question of how skills and knowledge shortfalls influence team interactions an important question in this study.

2.3.2 Organisational Structures that Support Teams

Structures that are external to the team have also been shown to contribute to team effectiveness. Hackman (1990) has found that, in the workplace, teams that felt supported by broader organisational structures were more likely to form the perception that the activities they undertook together were valuable. Hackman (1990) argues that teams are more likely to work to achieve identified goals when organisations put in place structures that identify, support and reinforce good performance. The style of structural support also matters to the team. Research shows that teams respond positively to a number of external structures as long as these structures are acknowledged and accepted by the team. These structures range from training, information and material resources to verbal encouragement and rewards for good work, to effective information systems and the resources to complete the job (Edmondson, 2016a; Hackman, 1990).

Furthermore, Line (2000) found that teams in industry show that teams benefit most from organisational structures when the team has a shared understanding about the value of support structure. Moreover, where a shared positive perception about this value occurs, it is more likely that an increase in team performance will follow. In contrast, Line (2000) found that teams who are working on projects considered to lack meaning or value for the organisation are less motivated to contribute at a high level.

In educational settings, generally the most overt organisational reward is grades. Tasks that effectively engage the individual at a suitable level encourage students to learn as well as contribute to achieving high grades (Hennessey & Amabile, 1998; West & Hannafin, 2011). Further evidence reveals that self-allocated project tasks increase autonomy; in student teams, the individual has the potential to manage tasks autonomously and, in turn, increase both motivation and engagement with the project requirements (Campion, Papper, & Medsker, 1996). Finally, a further important organisational structure in education is the tutorial or, in design
education, the studio. In this environment, learning occurs through instruction and feedback. It is generally accepted that feedback in educational settings positively contributes to engagement. Observations of teams in industry reveal that the same is true in that context. Recent studies show that lower levels of engagement and motivation are demonstrated when teams receive little feedback about work in progress (Edmondson, 2016b). This further highlights that external acknowledgement of good work is a powerful motivator in teams. However, studies of creative teams reveal that motivation in creative individuals often occurs more intrinsically than it does in other discipline areas. This creates a potential point of difference in the interdisciplinary team that may influence the ability of the team to engage holistically towards one unified outcome. The following section discusses the issue of team unity further and clarifies some of the factors known to drive team direction.

2.3.3 Developing a Compelling Team Direction

Over time, studies of team dynamics have shown that a team’s ability to establish a “compelling direction” can contribute to team success (Haas & Mortensen, 2016; Hackman, 1990). A number of factors have been found to contribute to drive team direction. These include leader communication, shared team goals and vision, and the team’s ability to work through the early stages of team-building towards the development of a high-performing team. The first of these factors, the communication style of the team leader, is identified by some researchers as being integral to development of a clear team direction. Edmonson (2016b) finds that leaders who communicate clear, consistent, directive messages to their team increase team commitment to a common objective and facilitate collaboration (Edmondson, 2016b). Leaders who go one step further and energise, orient and engage their team members have been found to create great teams that have the ability to achieve high-level outcomes (Haas & Mortensen, 2016).

Körner et al. (2016) found that vision and clarity also help teams achieve success. This research showed that establishing clear and achievable goals helps teams to develop team vision. While Paulus & Dzindolet (2008) showed that the presence of a shared vision increases the likelihood that goals will be agreed on and contributes to the development of a positive group climate. These qualities in teams have been shown to maximise the team commitment to a common objective, forming a collective team future (Kirkman & Rosen, 1999; Zhang, Cao, & Tjosvold, 2011).

Further studies show that these commitments to joint objectives help to motivate the group, which increases the likelihood that they will achieve their goals and vision (Lynn & Kalay, 2016). Conversely, there is research that suggests that when teams lack clear goals and vision they tend to lose team momentum and motivation (Bornstein, 2003; Feyerherm & Rice, 2002). Teams that lack clear vision tend to limit the problem-solving capacity of the individuals within them. Furthermore, observations reveal that a lack of vision influences engagement and, at the individual
level, leads to reduced interactions with both the team and the team processes (Haas & Mortensen, 2016). The flow-on effects of reduced engagement have been shown to limit the team’s ability to perform at an optimum level, as the team is unable to fully benefit from the collective knowledge of all its team members (Esper, Fugate, & Rapert, 2008; Revilla & Rodríguez, 2011).

From this research, it is clear that positive leader messages can be very beneficial to teams, while a lack of team vision has the potential to negatively impact on the team’s ability to set and meet goals. All of these qualities in a team contribute to creating a holistic approach, enabling them to function effectively together. However, precisely what these team qualities add to collaboration in the interdisciplinary student team is not yet well understood. This is especially true in the interdisciplinary team, where the interactions that enable success or effective function remain unclear.

Another way of looking at how teams build joint direction and function effectively is through Tuckman’s (1965) “Forming, Storming, Norming, Performing” theory. This theory has been revised and remains a predominant way of explaining the impact of interpersonal dynamics on team development and direction. The theory is based on the premise that all teams go through four developmental stages: forming, storming, norming and performing. Tuckman’s observations of teams show that, for teams to reach their maximum potential, they need to progress linearly through each of the four stages. The forming stage provides opportunities for the team to get to know each other and build an understanding of team peers and their potential contribution. Tuckman and Jensen (2010) show that passing through this stage requires teams to develop a process for accepting conflicting views and opinions. When this occurs, teams progress to the storming stage, where individuals in teams are able to express differing views. Observations of teams in this stage demonstrate the difficulty conflicting views can cause. Tuckman finds that low-level conflict positively contributes to increase tolerance for other team members, which is likely to improve the diverse thinking ability of the team. On the other hand, high-level conflict is destructive and limiting in teams. Interestingly, Tuckman finds that only half of the teams reviewed showed intergroup conflict; this research suggests that many teams fail to go through the storming stage, perhaps to avoid conflict, and provides strong evidence that this stage is difficult for teams to manage. However, the implications of this research have not been considered from the perspective of the interdisciplinary team, where potential differences may increase the likelihood of conflict avoidance in teams.

Tuckman’s research provides significant information about the benefits for teams of navigating through the “Storming” stage. He finds that teams that move to the “Norming” stage are able to develop many of the factors required to develop a joint team direction. By working through
differences, these teams are better able to establish shared goals, a tolerance for peers and a methodology for problem analysis. Given the needs of creative teams, moving to this stage would seem critical to the interdisciplinary design team, as this is the stage where critical parts of the design process such as idea development, analysis and evaluation occur.

The final stage, “Performing”, is the stage at which the team flourishes. Tuckman and Jensen (2010) find that only teams that develop inclusive problem-solving methodologies achieve this stage. What is clearly known about this stage is that, once teams achieve it, conflict is minimised. In the “Performing” stage, teams are able to develop cooperative work processes that enable them to decide objectively on best solutions and appropriately distribute tasks for completion.

Many studies extend on Tuckman’s findings, showing repeatedly that multiple factors are at play in teams at any given time. It is commonly agreed that the passage towards an effective team is difficult and achieving consensus is vital for teams to move forward. As has also been discussed in this section, processes that enable teams to determine shared goals and directions help to reduce tension (Haas & Mortensen, 2016). At the same time, teams that experience some conflict are better able to consider a broader range of ideas; indeed, conflict is considered a necessary part of effective team forming (Tuckman & Jensen, 2010).

These contradictory factors are difficult to navigate in all teams. Interdisciplinary teams face these factors with their own unique challenges. In higher education, interdisciplinary design teams are diverse, and members are often unknown to each other. They meet minimally outside structured class time and have limited time and resources due to the short project timelines commonly used. Such circumstances have the potential to create a scenario in which opportunities for teams to develop effective team engagement and shared vision are significantly compromised, perhaps limiting the team’s potential to perform to its best standard. Despite this, short-term team project work is becoming prevalent in higher education, as interpersonal skills become accepted as key future skills. Yet the extent to which team projects facilitate effective team interaction knowledge is not clearly understood. The lack of knowledge around this pedagogical approach is central to this study and, in a creative context, highlights a need to understand the potential influence the team itself has on collaboration and learning.

2.3.4 Environments that Influence Creative Teams

The discussion so far has highlighted some of the organisational and structural issues that limit the development of effective teams. The issue of team unity is particularly important to the interdisciplinary design team, which relies on a unified approach to solve complex problems. Furthermore, achieving purposeful innovation also requires teams to have the ability to combine knowledge, skills and attitude to define a problem successfully and select appropriate solutions.
(Kozlowski & Ilgen, 2006). Where this is lacking, the team has the potential to focus effort on solutions that, while innovative, may do little to address the problem. Creative teams have been observed to apply a unique process to achieve this aim. Sawyer (2012) found that creative teams were more likely to add the ideas of individual contributors to outcome development if these ideas were acknowledged as accepted by the team. How this creative acceptance process varies when interdisciplinary student teams interact to collaboratively problem-solve, however, is not clearly known and raises an important question that this study aims to go some way towards addressing.

Sawyer (2008) also found that in creative teams, the individual’s understanding of social spaces and cultural practices contribute to assumptions individuals make about team contributions. These assumptions in individuals can also influence future actions (Sawyer, 2012). Studies conducted by Sawyer revealed that, in practice, this evolved uniquely in teams as they progressed through a project and that the contribution of peers was often assessed based on knowledge that could be acquired as the team progressed through a project. In other words, the actions of each individual contributed to help form a holistic view of what each team member was likely to contribute to the team process. This view of peers serves to guide what would be accepted or built on by the team. Sawyer’s observations indicate that in this environment, creative individuals are able to keep active multiple views until a clear solution is arrived at and accepted by the team.

Sawyer (2008) further found that creative teams need to accept the same socially contrasted beliefs to share and develop ideas as a team. Sawyer’s (2012) studies provide important insight in the context of the interdisciplinary team, by showing that creative teams apply actions and use dialogue to stabilise and accept ideas. His studies show that by making weekly contributions to the whole, teams built what he termed “collective improvisation”. In effect, when more than one member of the team accepts previous peer contributions by building on them, this signals to the team that this contribution has been accepted by the team and increases the likelihood of consensus. Studies of design teams show that they use a similar process. Ideas are discussed, analysed and reviewed until a point is reached where the idea becomes a viable solution that can be accepted or rejected by the team (Paulus & Dzindolet, 2008; Sawyer, 2012).

Authors who have reviewed design industry practice further show that a range of techniques help facilitate this creative process at a team level. One of the most commonly used techniques is “brainstorming”. This process, developed in the 1950s by Alex Osborn, refers to a process whereby team members interact to activate long-term memory and link known information to develop ideas about how to solve the problem at hand. Analysis of how this process works in action has shown that brainstorming stimulates ideas through associations; however, for the brainstorming process to be effective, creative teams need to remain open to the possibility that all ideas are viable (Brown, 2008). Where this occurs, multiple ideas can be considered and
developed. Here again, as in Sawyer’s (2012) studies, creative teams interact to develop their initial associations into a hybrid team idea. Brainstorming remains commonly used in design studios, the corporate world and education, and the process is actively encouraged as a methodology for generating innovative solutions (Wilson, 2013). Studies of brainstorming practice in higher education have shown that students find the process valuable, as it helps to reduce fear in teams which, in turn, positively benefits idea development (Tideswell, 2004). This highlights the role inclusive social activities can play in building student confidence through positive peer interactions.

Furthermore, the environment in which the creative team finds itself has been shown to influence the way in which teams interact. Reviews of design practice in industry have identified that design workspaces that provide teams with spaces for impromptu meetings improve team interactions. In these environments, teams are more likely to use these spaces to come together, which increases the potential for innovative solutions to emerge (Sawyer, 2008). Observations of design teams have shown that face-to-face meetings can provide both visual and non-visual cues from peers, which helps the individual understand the ideas, responses and interactions of peers more holistically. Edmonson (2016b) found that when individuals garnered information in this way, they were better able to make informed decisions together.

However, the literature suggests that contemporary design practice is shifting towards remote workspaces. The limitations of remote information exchange in design teams make clear the problems of distance. The isolation that results from this approach makes it difficult to accommodate diversity, as the information exchanged is incomplete. As a result, team processes have been found to be misunderstood. Edmondson (2016b) found that remote locations contributed to gaps in vital knowledge that, in turn, had the potential to limit full exploration of all ideas.

In education, many of the motivational, organisational and social factors discussed in Section 2.3 may be repeated. The studies discussed here relate to teamwork in industry and the extent to which these findings apply to interdisciplinary design teams is not well understood. Processes such as brainstorming offer collaborative opportunities for teams, as they do in industry; however, online collaboration, popular with students, may limit the potential of this process. In this environment, the ideas of students are shared remotely, and it may well follow that this reduced social engagement has a negative impact on practice, process and decision-making in education. What is known is that design and design education rely on the ability of the team to interact as a practice community. To inform this study, the following section discusses CoP theory with particular reference to creative teams.
2.4 The Design Learning Community

The solution-finding process in design relies on design principles and process that are generally imparted to students by teachers through a community of practice (CoP). This pedagogical approach, discussed in full in Chapter 3, provides opportunities for theories to be applied to ideas and form-making (Frascara, 2017; Miceli & Zeeng, 2017; Nini, 2005). Knowledge of design theory is important to the discipline and forms an important part of the practice the discipline accepts and adheres to. Discipline learning, be it through a CoP or not, is not unique to design; therefore, we might consider that interdisciplinary teams have the potential to bring together multiple participants with different theories and practice codes and could contribute to creating teams with different views and beliefs about effective practices and solutions. The following section provides some insight into how knowledge is formed in creative learning communities and discusses some of the barriers that have been found to disrupt the development of creative processes in teams.

2.4.1 Communities of Practice in Design Education

Design education relies on a community of practice to develop practical approaches. Learning in this environment combines knowledge acquisition with product development. Lave and Wenger’s (1991) “situated learning theory” has long been a dominant pedagogy within the discipline. The contemporary design classroom (studio) continues to use demonstration to teach techniques, and repetition to refine skills, until the student develops the ability to practise as a professional designer (Lawson, 2014). The success of this “situated learning” relies on the learner’s ability to make meaning through application of the design principles and techniques. In this environment, the cognitive processes applied by students to practice become inherently linked to socially constructed knowledge. Knowledge acquired in this way is fully integrated by the student and the processes learnt are repeatedly applied to future problem-solving (Lave & Wenger, 1991).

“Situated learning” involves not only the acquisition of core knowledge but also the ability to form an identity as part of this social system (Lave & Wenger, 1991). In design education, this social learning is also expected to occur in interdisciplinary teams undertaking design projects. Students in these teams are expected to learn from each other and, to a lesser extent, the tutor. For this reason, Lave and Wenger’s (1991) social learning theory has been selected to guide this study, as it provides a methodology for understanding the social codes and behaviour that influence all team participants.

Successful learning as described by this theory relies on a number of components. Lave and Wenger (1991) have shown that three elements (joint enterprise, mutuality and shared repertoire) need to be present for learning to occur. When these three elements come together to deliver
constant, repeated exposure to theory, practice and ideology, then students are able to acquire and apply the knowledge and skills required to practise professionally (Bennett, 2006).

Lave and Wenger (1991) note that the first element, “joint enterprise”, requires that members of the community share the same collective understanding. In a design learning community, terminology and theoretical knowledge are acquired cognitively and demonstrated through practice. Presentation, discussion and critique are the vehicles by which the community identifies aspects that meet, or fail to meet, the accepted codes.

The second element identified by the theory, “mutuality”, relies on the development of a community in which members engage and interact within established norms. As with “joint enterprise”, team member competence is demonstrated by the individual’s ability to engage with the established norms of the CoP. This element, albeit in a less overt fashion, also relies on the codes of behaviour displayed by leaders or tutors. Lave and Wenger’s (1991) research showed that students, through exposure, begin to interact in a manner that is accepted by the discipline. Jargon and work practices are embraced to the extent that they come to be understood as normal behaviour.

The last element required for an effective CoP is “shared repertoire”. Lave and Wenger (1991) showed that this element presents when students in a CoP develop the knowledge required to understand the culture of the discipline fully. Evidence of this in a CoP can range from demonstrable ability to apply the practices valued by the group, down to the use of specific tools valued by the discipline. For example, the design student might embrace core values that relate to the use of technology by opting to use Apple computers.

The differences in design pedagogies do not end there. Studies have shown that the discipline has long relied on visible codes to demonstrate alliance. The social learning space common to design creates opportunities for participants to overtly display the “designerly” traits and knowledge competency esteemed by the community. Gherardi, Yanow, & Nicolini (2003) found that acquiring knowledge in this way does more than build awareness of acceptability. Through immersion, the process contributes to building a strong social identity that influences the way in which a learner understands something over time.

Understanding how the overt codes come to be accepted by design students can begin to help us to make sense of the influence social learning can have on interdisciplinary teams. Design literature suggests that the mode by which these codes are acquired by creative students varies. The first way is through engagement, by doing things together, such as talking and producing artefacts. Another way the code becomes accepted is through the student’s imagination, which helps them to construct an image of themselves within the community and the world it fits within.
These views are then aligned with local activities and applied to problem-solving (Dineen & Collins, 2005; Dorst & Cross, 2001; Sawyer, 2012).

Socially constructed learning is not unique to design education; indeed, other disciplines engage in similar processes using their own unique shared ideas and beliefs, so when students from different disciplines come together to form design teams it is possible that shared or sufficient knowledge of the different disciplines and behavioural codes is absent. Considering this in terms of the interdisciplinary team, it might be reasonable to expect that contradictory factors may result. For example a newcomer, non-design team member or design student in a non-design team, may not be perceived as competent, never having demonstrated to team peers that they hold the shared knowledge the community respects. Similarly, in the design studio creativity is valued and often students express their affiliation with the discipline through the personal practices they adopt—for example, the individualistic dress codes accepted by the discipline may seem unusual to more traditional disciplines and, vice versa, the conventions adhered to by other disciplines more conservative to designers.

Bridging discipline differences in this context, as the interdisciplinary design team aims to do, may not be easy. The interdisciplinary design team brings varied students together on the assumption that what may seem like an odd process will nonetheless be embraced and that collaboration will follow. Students from other disciplines are potentially required to put aside known linear approaches and work in a less structured manner, which for some may be quite challenging (Becher, 1989; Cliff & Woodward, 2004; Farrell & Hooker, 2014).

It is easy to conclude that contrasting perceptions have the potential to cause conflict. Indeed, these differences may contribute to forming barriers that limit the potential of interdisciplinary teams to form an effective CoP that enables collaboration. Yet little is understood about how this process is actually viewed or engaged with by students of any discipline. Furthermore, there is little research that demonstrates what effect, if any, the presence of these codes has on team processes and learning in interdisciplinary design teams.

Empirical research, has, however gone some way towards understanding the negative impact of difference in CoP. Researchers who have delved deeper into the factors that lie at the core of these elements have found that the factors can be categorised into four key categories. These categories—Practice vs Community, Power, Trust, and Dispositions and Qualities—are discussed in the following section to outline their impact on CoP.

2.4.2 Barriers to Learning in Communities of Practice

Situated learning, such as that that occurs in a CoP, while widely accepted as a strong learning theory, has been criticised for under-consideration of the barriers found to present in teams. As
noted above, the diversity inherent to interdisciplinary design teams has the potential to increase the impact of these barriers. Handley, Strudy, Fincham and Clark (2006) argue that CoP theory does not adequately consider the individual’s understanding of social systems outside the community and, therefore, falls short of engaging all participants equally in the learning. This line of thinking suggests that imbalances in trust or power influence the team’s ability to form a cohesive CoP.

Studies reviewing the impact of power imbalances in CoP have identified that Lave and Wenger’s theory considers the individual only in the “situatedness” of the specific situated learning environment. Contu & Willmott (2003) argue that the “situated” view of a CoP gives little regard to beliefs and power that pre-exist the community; as a result, the influence both could exercise on any given learning situation is not taken into consideration by the theory. Furthermore, they found that the notion of community portrayed by Lave and Wenger as ‘naturalistic’, formed through ‘shared’, ‘joint’ and ‘communal resources’, implies that in all CoPs there is a clear and consistent understanding of what is acceptable practice. Roberts (2006) found that this assumption falls short of the reality, as it fails to consider the influence that dominant beliefs at an individual level may have on the practice of the community. Roberts (2006) research showed that, in practice, CoPs form divisions and fail to form effective working relationships based on past views and experiences. This evidence, considered in the context of interdisciplinary teams, suggests that these teams have the potential to develop CoPs that are precariously held together by dominant beliefs, rather than developing opportunities to build on the strengths and knowledge each individual brings to the team.

Contu and Willmott (2003) further argue that Lave and Wenger’s (1991) social learning theory itself identifies power relations as playing a part in the individual’s capacity to participate. They believe that Lave and Wenger’s application of terms such as “include/exclude”, “support/suppress”, “centralise/marginalise”, and “promote/devalue” to describe how rival forms of knowledge-in-practice is acquired, suggests that CoPs in fact serve to maintain the dominant beliefs and practices of the group. This indirect control mechanism serves to maintain the status quo and limit participation. Contu and Willmott (2003) have shown that this power imbalance in CoPs discredits rival forms of knowledge and contributes to excluding participants based on factors integral to self-identity, such as gender, ethnicity or class. Summers & Volet, (2010) suggests that, as a result of this type of exclusion, individuals who sit outside the accepted codes of the CoP have limited opportunity to fully participate in processes undertaken by the team.

Further empirical evidence supports this theory. Studies have shown that power in a CoP has the potential to “influence, force, or control” the participation of others (Orr, 2010; Roberts, 2006). This research has revealed that CoPs that control participation in this way limit the ability of
individuals to negotiate and maintain “meaning” within the community. In these CoPs, those individuals whose views align with the majority are more likely to become “full participants” and undertake significant roles within the community, while those who do not hold concordant views are more likely to be undervalued by the team (Roberts, 2006).

Research on teams has also identified that trust is a critical ingredient of collaborative relationships in working communities (Hattori & Lapidus, 2004; Roberts, 2006). This research suggests that teams that fail to form trust relationships are more likely to undertake behaviour that plays individuals off against each other, which has the potential to work against the collective pursuits of the group (Mairet, 2001). Consequently, the establishment of trust has been identified as an important factor for successful collaboration in diverse teams (Rigby, Gruver, & Allen, 2009).

How trust is formed in a CoP is not always easy to define. However, it is generally agreed that trust presents in two forms. The first form, affective trust, develops based on emotional bonds that form between individuals. Observations of teams have found that for affective trust to develop, team members must be able to demonstrably empathise and show feelings of care or concern for other members (McAllister, 1995). Teams that are respectful of multiple viewpoints are more likely to develop affective trust (Ashforth & Mael, 1989; McAllister, 1995). On the other hand, individuals who do not align with team expectations are less likely to demonstrate care or consideration of their peers and are more likely to be viewed as opportunistic. These individuals have been shown to be less effective at establishing bonds and relationships with team peers, which in turn minimises opportunities for trust and cohesiveness to build within the CoP (Jarvenpaa, Knoll, & Leidner, 1998; Remidez Jr, Stam, & Laffey, 2007).

The second form of trust is cognitive trust. This develops when individual team members form the view that they can rely on the expertise and contribution of others within the team. Studies of teams in practice have shown that individuals who behave professionally and make clear decisions taking into account all views are more likely to be trusted and relied on for their competence and ability (Johnson & Grayson, 2005; McAllister, 1995). This form of trust allows team members to create a community that increases the potential for high-level knowledge-sharing (Roberts, 2006; Whitener, Brodt, Korsgaard, & Werner, 1998). Research has shown that cognitive trust is required for creativity to flourish. Creative teams need clearly defined purposes and a respectful culture to facilitate the open communication and risk-taking needed to innovate (Druskat & Wolff, 2001; Jaskyte, 2008; Jordan & Lawrence, 2009; Pérez López et al., 2004). When creative teams form a strong trust relationship, they are able to adopt an open mind about ideas and consider diverse viewpoints. This has been found to create interdependence between individuals, which consolidates the team as an entity that works together to address the project problem (Michaelsen et al., 2004). The flow-on effect shown in this research is that when teams
trust they collaborate more effectively, which in turn leads to increased team performance, enabling increased production of creative solutions (Decusatis, 2008; Jaskyte, 2008; Martin & Hans Georg, 2001).

Trust has also been shown to play a unique role in creative teams. Risk-taking has always been a central part of creativity and is critical to innovative thinking. However, studies have shown that where trust is not established, students who are risk-averse develop strategies that enable them to “play it safe” (Orr, 2010). Further studies add to this knowledge by identifying that for risk-taking to occur, team members need to feel confident they can safely share knowledge with their team (Mairet, 2001; Schoorman, Mayer, & Davis, 2007).

This research suggests that the creative potential of the team can be hindered when trust is not established. This insight provides clarity about a factor that is likely critical to team interaction and collaboration in the interdisciplinary design team. These teams have one main aim, to use the design thinking process collectively to develop innovative solutions. However, if these teams fail to establish trust, the scope for “blue sky” thinking may not be provided, and the team may feel the need to gravitate towards “play it safe” approaches.

To understand more deeply the factors that contribute to forming trust, the characteristic of the individuals within the team must be considered. In particular, the dispositions and qualities inherent in the individual can significantly influence the individual’s perceptions, actions and interactions. Indeed, the disposition of an individual has been shown to be fundamental to the way in which they understand and engage with the world (Barnett, 2007). Dispositions have been categorised by Barnett based on the will a student has to learn, engage, listen, and explore new experiences and ideas. Barnett (2007) argues that qualities, in contrast, are part of the individual’s character and are indicators of the individual’s dispositions. That is to say, dispositions are made visible through qualities the individual displays. These qualities include, courage, resilience, carefulness, integrity, self-discipline, restraint, respect for others, openness, generosity and authenticity. In this way, Barnett’s research identifies that qualities and dispositions are fundamentally interconnected and contribute to form the core value system the individual uses to guide “life” decisions.

Barnett (2007) further hypothesises that different disciplines are more suited to individuals with certain dispositions and qualities. The implication of this hypothesis is that the individual’s dispositions and qualities may inhibit or enhance their intrinsic ability to engage in a particular discipline. Considering Barnett (2007) in relation to the interdisciplinary team, one might suggest that individuals are intrinsically hindered in their capacity to contribute across disciplines. The lack of certainty around this knowledge raises pertinent questions about the level of collaboration that can reasonably occur in short-term interdisciplinary student teams. If true, it is possible that
bringing this style of team together to form a CoP has the potential to see processes develop that enable students to allocate work to individuals team members which allows them to contribute cooperatively with minimal engagement with other team members. However, the differences at a personal level may constrain the ability of individuals within the team to expand beyond what they know and accept different ideas, unintentionally limiting the ability or will of the team to collaborate across a range of project requirements.

Another factor found to form a barrier for CoPs is the meaning and interpretation of knowledge adopted by individuals based on their previous experiences and beliefs. Roberts (2006) argues that individuals may be predisposed to constructing a reality based on what they know to be true as a result of past experience. These beliefs were shown to be strongly felt and, consequently, can play an integral role in team participation and learning (Roberts, 2006). With this insight in mind, the impact of past knowledge cannot be taken lightly in the context of the interdisciplinary team and will therefore be considered further in this research.

As shown in this section, the potential barriers to creating a collaborative team are interlinked in a multitude of complex ways. Yet empirical studies of teams in higher education—and in particular of interdisciplinary teams, where the potential for difference is increased—pay little attention to these specific issues. Little is understood about the interconnectivity between the knowledge the individual brings to the team and collaboration in interdisciplinary design teams. This lack of knowledge is, therefore, central to the research question of this study.

To understand these factors more deeply, Section 2.5 discusses interpersonal relationships and how these factors manifest in teams and contribute to working processes.

2.5 Emotional Intelligence and Creative Teams

The review of literature in this chapter has shown that team interactions contribute to how teams function in a number of ways. Research suggests teams are empowered if they are able to develop respect. Teams that develop the ability to accept difference and hear the ideas of all team members have been found to have an increased ability to make decisions that positively impact on outcomes (Bstieler & Hemmert, 2010). One way of understanding how respectful relationships develop and influence individual interactions within teams is through the literature on emotional intelligence (EQ).

EQ refers to the individual’s ability to apply knowledge and feelings appropriately. The influence and validity of EQ in teams is a developing field. The literature suggests that emotionally intelligent individuals have the ability to consider and understand feelings (including their own) and, as a result, can manage their emotions better than others. Goleman (2007) argues that EQ relies on both the personal and social skills of the individual. From this standpoint, it is easy to understand
that EQ can effect both professional and personal success (Pink, 2005). Further to this, the literature suggests that EQ is emerging as an “essential ingredient” in the workplace and that companies are seeking to employ individuals who have high levels of EQ for their potential to provide effective leadership in an increasingly “socially responsible” working environment (Zeidner, 2012).

Mayer, Salovey, & Caruso (2004) suggest that individuals with high levels of EQ are aware of both the intellectual and emotional factors that influence situations and also have the ability to analyse and adjust behaviour to best suit a given situation. Mastery of these “soft skills”, as they are commonly known, allows individuals to successfully interact with others. Further studies have shown that high-EQ individuals have several personality traits in common. These include a tendency to be more open and agreeable, the ability to engage in positive social interactions and the capacity to describe motivational goals, aims, and missions (Mayer et al., 2004). These traits have been broadly categorised into five groups: self-awareness and self-control, empathy, social expertise, personal influence and mastery of purpose and vision (Lynn, 2005).

Analysis undertaken by Lynn (2005) provides a method for viewing these categories more closely. The first category, “self-awareness and self-control”, is described by Lynn as the individual’s ability to fully understand themselves. Individuals with high EQ have been found to have an accurate perception of themselves. These individuals are also able to use this information to manage their emotions, which enables them to engage productively with others. On the flip-side, the second category, “empathy”, can be attributed to the individual’s ability to understand others. Lynn suggests that individuals who have high levels of empathy are able to view situations from the perspective of others, and this has been found to make them more open to accepting different ideas.

The third category, “social expertise,” refers to the individual’s capacity to establish genuine relationships and bonds with others. Individuals with high EQ in this category have been shown to be able to express feelings of caring, concern, and conflict in ways that enable them to manage relationships positively. Category four, “personal influence”, is described by Lynn as the capacity for leadership that inspires others. The final category is “mastery of purpose and vision”; individuals with high EQ in this category demonstrate a strong capacity to adhere to their values and consequently are more inclined to be authentic to their intentions (Lynn, 2005).

The literature suggests that EQ is very personal in nature, and managing EQ relies on the ability to recognise emotions and make links between psychological processes and physiological reactions. Goleman (2005) found that emotionally intelligent individuals also have a high sense of self-worth, a realistic view of personal strengths and weaknesses and light-hearted or relaxed
personalities. He further showed that these traits have been found to influence the ability to discuss feelings and consider one’s emotional responses from different perspectives (Goleman, 2013).

The ability to manage emotions is becoming integral to the modern workplace. Organisations increasingly require their employees to be flexible and work together to meet the ever-changing needs of the contemporary work space (Zeidner, 2012). Research about the influence of EQ in the workplace provides strong evidence that many of the individual traits associated with high EQ positively contribute to building empathy and strong trust relationships that positively influence workplace interactions (Langfred, 2004; Mohammed & Dumville, 2001).

It is becoming apparent that creative teams also benefit from high levels of EQ, as these traits help to form structures that facilitate divergent thinking and unrestricted idea flow. Studies undertaken in professional workplaces help us to understand why this occurs. High levels of self-awareness and the ability to control personal responses are known to maximise creative opportunities for teams (Hennessey & Amabile, 1998). Druskat & Wolff (2001) assert that individuals with high EQ tend to be able to be more open-minded and willing to accept divergent thinking. This has been found to contribute to an increase in emotional management in teams where the ability to tolerate differences allows divergent thinking to be accepted with less conflict. Further to this, teams that develop processes that support and acknowledge differences have also demonstrated an increased ability to reduce stalemates, which has been shown to dramatically improve the team’s capacity to arrive at consensus (Suliman & Al-Shaikh, 2007).

Viewed in light of what has been discussed thus far, it might be hypothesised that high EQ is essential to the interdisciplinary design team. To some extent, most of the interpersonal skills that EQ contributes to are integral to innovation, which implies that EQ theory may provide an effective mechanism by which we can begin to understand the influence of interpersonal relationships on collaboration in working communities. To understand EQ further, the following section presents some of the links between psychological processes and physiological reactions that are known to be especially relevant to creative teams.

2.5.1 Developing a Safe Creative Environment

A common theme throughout the literature is that trust relationships are important to teams. As discussed in Section 2.4.2, lack of trust is a barrier to CoPs; in creative teams, trust is critical as it has been found to facilitate increased idea-sharing. Environments that enable trust to develop without fear of rejection or humiliation have been found to be vital to creativity (Bain et al., 2001; Lee et al., 2010; West & Hannafin, 2011). This suggests that safe environments might be
especially vital for interdisciplinary design teams, where creative risk-taking is at the core of innovative development.

Paulus and Dzindolet (2008) argue that effective trust contributes to the development of a psychologically safe team environment, which allows the individual to believe all ideas will be supported. Their research tells us something about how trust influences individuals in teams. This research found that teams that develop trust reduce anxiety and fear in individual team members. Teams that are encouraged to trust each other feel safe, which reduces the risk of social rejection. Paulus and Dzindolet further found that teams that effectively build trust are more likely to share ideas together through a give-and-take approach, which contributes to an increase in work flow and idea development. This is a critical component for creative development, and effective teams have been observed to encourage their team members to express ideas freely whether those ideas are in agreement with the majority view or not (Dewett, 2006; Edmondson, 2016b; West & Hannafin, 2011).

A fundamental part of a safe environment is mutual respect at both a professional and personal level. In professional interdisciplinary design teams, research shows that achieving this respect is more difficult as there is a higher likelihood that differences will be present (Edmondson, 2016b). The same might be said for these teams in higher education, where student teams will almost certainly present with unique differences based on discipline and cultural knowledge. The following section discusses these two specific issues to provide some understanding of the influence that views transferred to teams might have on interaction and collaboration.

More recently, studies in industry settings are beginning to review how a safe environment affects interdisciplinary design teams. The research suggests that psychologically safe environments are critical to innovation in these teams. Evidence indicates that this is partly due to the fact that all participants in these teams are both masters and novices; that is to say, they may have expert knowledge in one aspect of the project but only superficial knowledge in others. The issue of mastery has revealed that individuals in interdisciplinary design teams feel less certain and, therefore, the team provides less safety for freedom of expression. Edmondson (2016a) found that this was due to a lack of knowledge across the range of project requirements. This lack of knowledge had the potential to limit the contribution of individuals, as it left them exposed and unsure when confronted with issues or problems that fell outside their known expertise. This research further revealed that team members were disinclined to ask questions to clarify what they did not know, for fear that their lack of knowledge may be perceived negatively by team peers (Edmondson, 2016a). This issue of different knowledge has the potential to be particularly problematic in interdisciplinary design teams, as the diverse expertise of team members may limit individual contributions for fear of humiliation.
This raises many unanswered questions about how students manage teams in this environment. What we know so far is that studies have shown that diverse membership and differing views create teams that minimally accept divergence from the norm (Freeman & Greenacre, 2011). However, the literature on culturally diverse teams suggests that teams that fail to develop an inclusive culture will create structures that support the majority view, which in turn limits the opportunity for full participation across the team to occur (Phillips, Mannix, Neale, & Gruenfeld, 2004).

2.5.2 Pre-existing Perceptions and Teamwork

As stated previously the main educational objective of the interdisciplinary design team is to combine knowledge and skills to achieve a result that addresses the needs of complex problems. However, Shen, Liu, & Sung (2014) have found that in higher education students do not work to share the knowledge they have, and minimally collaborate to share information between discipline areas in interdisciplinary situations. The reason this does not occur in student teams is not yet entirely clear; however, research does indicate that this phenomenon also occurs in industry. Edmondson (2016a) argues that discipline differences, such as variation in technical expertise and the distinct discipline language used by different professions, combined with varied views and assumptions about the way work should be undertaken, contribute to creating conflict in the workplace. Edmondson (2016a) found that the differences in work patterns influence interpersonal interactions; the effects of this were strongly felt and influenced team members to under-value peer contributions outside their field. Paulus and Dzindolet (2008) add some clarity as to why this might occur. They found that, in teams, collective judgement was powerful and contributed to the level of acceptance of creative ideas. Furthermore, Mannix and Neale (2005) found that discipline differences can pose problems for teams, as they might limit the team’s ability to find common ground. Mannix and Neale argue that teams that have diverse perspectives are less cohesive and demonstrate less joint commitment to one unified outcome. This issue has been found to manifest as a problem in diverse teams, where team members who are different to the majority are less likely to achieve consensus on the ideas they present. Considering this in relation to interdisciplinary design student teams, we might presume that the ideas presented are judged by different values or beliefs and therefore have reduced capacity to gain any real traction.

However, Rozell, Pettijohn and Parker (2004) have found that teams that build a positive rapport are more likely to support divergent opinions and have shown a stronger capacity to make unbiased decisions. This highlights again the vital role of EQ. This research suggests that the team’s ability to understand and accept peers has the potential to improve team interactions. The effect of rapport-building is especially relevant to the interdisciplinary team in higher education. In these teams, diversity abounds, so further knowledge that underscores processes that can
contribute to minimising the effects of bias are bound to provide critical insight for educators using collaborative pedagogies.

Furthermore, in the context of contemporary education the classroom is likely to have a blend of domestic and international students. Therefore, the specific influence of cultural diversity on teams is discussed in Section 2.5.3.

2.5.3 Cultural Diversity

The increase in global mobility has seen the numbers of international students in Australian higher education increase in the last two decades. Cultural diversity is likely to influence team interaction in interdisciplinary design teams and studies suggest that for diverse teams to work effectively together, they need to have a clear understanding of team processes, communicate well, and fully understand task requirements (van Knippenberg & Schippers, 2007). However, as shown in Section 2.3, achieving team structures that support all peers is not an easy task. Furthermore, evidence suggests that diversity has the potential to divide teams, which can create a negative social environment more likely to hinder than enhance innovative opportunities and engagement with the creative process (Phillips et al., 2004).

Considered in the light of global educational mobility, we might conclude that navigating culturally diverse teams towards a final destination is difficult. Across all disciplines, student teams are highly likely to comprise both domestic and international students who also come from diverse cultural backgrounds. It is well accepted that international students in higher education experience difficulties coping with learning and cultural structures that deviate from what is known to them (Arkoudis et al., 2013; Khawaja & Stallman, 2011). However, there is substantial evidence that intercultural teaching barriers can be overcome. Studies show that open and transparent dialogue between teacher and student facilitates effective learning. Research has found that to achieve effective learning and engagement in intercultural environments, an understanding of how culture influences thoughts, values, actions and feelings is required on the part of both the teacher and the student (Leask, 2008). Li, Granizo and Gardó, (2016) have shown that teachers who are committed to understanding the skills, experiences and expectations of their international students are more effective in diverse classrooms. The same can also be said for diverse teams, where it is known that safe environments are more likely to support differing viewpoints (Nakui, Paulus, & Van Der Zee, 2011).

It might be said that these relationships rely in part on EQ, as they require all parties to achieve mutual respect and accept difference. In the short timeframe within which many team projects are conducted, this may pose difficulties for students. Research shows that the learning environment is one of these problems. For international students, Leask (2008) found that where
structures that support social coherence and accept cultural diversity are not provided, the potential for students to reach their full capacity is limited. Despite this, collaborative pedagogies create situations in which teams that include international students are often left to negotiate challenges with little guidance.

Summer and Volet (2010) have reviewed how cultural differences impact teams in higher education. They argue that past experience and cultural stereotypes influence both desire and capacity to participate in intercultural teams. Their studies show that students who perceived mixed cultural team project work to be difficult were also unwilling to embrace difference in these teams. This research demonstrates that similarity is preferred across all cultural groups and the propensity to reject difference is a constant.

Other studies have also demonstrated a similar response in creative teams, identifying that cultural beliefs significantly impact on idea development and production. The evidence suggests that individuals develop creative ideas and classify the appropriateness of creative responses in line with their cultural values and perceptions, as students have little experience questioning the validity of their responses (Miceli, 2006; Niu & Sternberg, 2001). Therefore, it might be said that different cultural values have the potential to cause unrest or conflict in teams. Furthermore, when applied practically in Western design classrooms, we might say that the creative exploration and visual development in diverse teams can leave many in the difficult position of making creative decisions without the shared judgement considered integral to the design process (Dineen & Collins, 2005).

With this in mind, it is not surprising that many studies of sociocultural and contextual factors have shown that both domestic and international students prefer to work in teams with peers who are culturally similar. Volet and Ang (2012) found that these preferences were based primarily on past experiences, with the factors contributing to this preference including cultural–emotional connectedness, language, pragmatism and negative stereotypes.

What is positive, however, is that these studies provide evidence that student preferences can change. Summers and Volet (2008) showed that when intercultural knowledge increased, the team experience, as measured through the student’s desire and ability to participate, also increased. This evidence suggests that good experiences improve perceptions in teams, but the reason this occurs remains insufficiently explored. This highlights a research gap that requires investigation to clarify the specific issues that contribute to improving interpersonal relationships in culturally diverse student teams.

Many of the issues discussed so far highlight concerns about the potential negative impact views and perceptions may have on teams. Many of these concerns are likely to present together in interdisciplinary student teams, yet collaborative pedagogies, commonly used in teams, leave
students to address the influence of views and perceptions with little structured team guidance. This raises questions about the efficacy of these pedagogical approaches in the interdisciplinary context, which warrants a more systematic and theoretical analysis. This study therefore aims to understand the extent to which some of these factors contribute to the team’s ability to interact and collaborate to their full potential.

2.6 Conclusion

Tertiary education, in responding to changing industry needs and curriculum across all disciplines, now commonly includes teamwork to allow students the opportunity to tackle large societal issues. This creates increasingly complex and challenging problems for students and leaves solution-finding dependent on diverse knowledge and skills (Schwartz, 2001). From a skills perspective, the interdisciplinary design team seems well-suited to problem-solving.

The discussion in this chapter showed that a team’s ability to collaborate is influenced by its ability to work through development stages and create supportive internal structures. Creative teams that develop structures which respect the views of their peers are more likely to facilitate a safe, transparent team environment, which is conducive to idea development. Shared team visions and goals were also shown to be important, with the literature revealing that if teams worked towards a goal that was supported by a reward system, motivation was also likely to increase. However, in higher education collaborative pedagogies can leave students to negotiate complex team structural problems with little guidance.

The chapter also discussed the acquisition of discipline knowledge through situated learning and identified how this social learning approach contributes to form strong views about codes of practice. The influence of these views on practice communities were presented and barriers to participation, such as trust and power, were discussed to identify the potential impact they have on teams. The discussion also highlighted some of the known barriers diversity can create for team cohesion. One of the factors presented as influential in overcoming these barriers was EQ. The discussion showed that the ability of team members to develop respectful team relations relies on the interpersonal relationships formed, and suggested that barriers are less likely to be overcome if individuals do not bridge differences and develop a respectful team culture.

In higher education, knowledge of team collaboration and learning acquisition is much more limited. In particular, in design education—where the addition of the interdisciplinary design team is in its infancy—knowledge of what makes these teams interact to collaborate effectively is lacking. To inform the particular context relevant to this study, Chapter 3 will discuss the history of design education and developments in practice such as design thinking in interdisciplinary student teams.
CHAPTER 3

Interdisciplinary Design Teams

This chapter examines the development of design education from vocational origins to academic discipline to provide an understanding of how the discipline has adapted to meet changes in society. The changes have led to contemporary practices that rely on interdisciplinary teams. The chapter is presented in three sections. The first section discusses the history and development of unique pedagogies, principles and practice in design education. This is followed by an overview of recent changes to practice and education to provide an understanding of emerging collaborative approaches, such as design thinking. The final section presents an outline of some of the challenges facing interdisciplinary design student teams in order to understand the difficulties that students and educators must overcome when developing pedagogical approaches that aim to bring diverse students together to problem-solve collaboratively.

3.1 The Age of Design

Interdisciplinary teams are becoming an integral component of the learning experience in design education. These teams mimic industry by bringing together students with diverse professional knowledge and skills to collaboratively problem-solve. Evidence from teams in industry suggests that differences create difficulties for teams. However, few studies have interrogated how effectively interdisciplinary design student teams function in higher education. In particular, what problems manifest, and what influence they have at a student level on interaction and collaboration in design education, are questions addressed by this research.

The problem-solving approach used in design is an iterative process wherein the practices of making, reviewing and evaluating are intertwined (Cross, 2011; Lawson, 2014). Collaboration is well-known to design students, with expert opinions often sought out to develop ideas. Within the profession, interpersonal interaction is common and extensive dialogue is undertaken from ideation to execution; the designer functions as an innovator and a maker, often fluctuating between stages of reflective thinking and practical application (Orr, 2010; Prentice, 2000). Therefore, design students bring to the interdisciplinary team a unique style of interpersonal interaction that is different from traditional academic approaches. To understand how some of the processes unique to design have formed, the following section discusses the development of design education.
3.1.1 Design Education

It is generally accepted that design education has its origins in craft, and the discipline has a long history of being responsive to the needs of society. Early practices designed to meet these needs were advanced by the Bauhaus School in the early 20th century. Since the early 1900s, design pedagogies have been practice-led, rather than theory-led. Historical evidence shows that learning within the Bauhaus School relied on a master/apprentice approach to develop and teach “The Basic Course”, the principles of which remain highly valued by designers and design pedagogies today (Cross, 2011; Lupton & Abbott Miller, 1993). These principles, and the craft of the discipline, have long been passed on through demonstration and application to achieve proficiency among students. Research on design education suggests that this approach continues in contemporary design courses (Frascara, 2007, 2017; Nini, 2005). The design classroom (the studio) is transformed into an active learning community (Lave & Wenger, 1991) where professional knowledge is acquired through problem-based project work. Projects selected are designed to combine the delivery of practical skills alongside creative ideation, each, in a sense, enabling the other (Prentice, 2000).

This has, however, limited the potential of design as a discipline to become an accepted academic endeavour. The iterative nature of the process, often undertaken at the individual level, minimises opportunities for clear connections between research, testing and evaluation. Therefore, for many, the design process, when measured against more methodical linear methods, appears to lack rigour (Becher, 1989).

More recent research suggests that the design industry is also changing to establish a new position that meets changing societal requirements (McDonald, 2006). Practitioners are increasingly changing processes and replacing intuitive decision-making with user research (Bennett, 2006). In this environment, design thinking has grown in popularity (Owen, 2007). The application of this problem-solving process is growing in both industry and education, and the literature suggests that design thinking is serving the design industry well. Studies show that design thinking is contributing to new perceptions about the value interdisciplinary teams can bring to problem-solving (Buchanan, 1992; Edmondson, 2016b; Kimbell, 2011).

The literature on design development as a discipline, however, suggests that the process of change in both design education and professional practice remains slow, and practices that do not adhere to rigorous problem-solving still abound. Lawson (2014) found that designers continue to problem-solve by engaging in a unique solution-focused process. Designers propose a range of possible solutions concurrently and work through them until the most satisfactory one is decided on (Cross, 2011). For many this process appears intuitive which creates a significant hurdle for the validation of design as an academic discipline.
Furthermore, research on design education suggests that in order to meet changing societal needs, educators are developing programs that engage students with theory and practice beyond the confines of the profession. In design education, team-based project work, and interdisciplinary teams, are becoming commonplace (Barnes & Wragg, 2016). This is not unique to design; team-based work has been embraced across higher education as a method by which students can expand their horizons and build the interpersonal skills required for workplace collaboration (Donnelly & Fitzmaurice, 2005). However, the impact that discipline differences make on the role of the individual student in educational settings remains relatively uncharted. Little empirical evidence exists to understand how students engage with interdisciplinary peers and to what extent discipline knowledge, even at a novice student level, influences team interactions and collaboration.

### 3.1.2 The Role of a Designer

As problems faced by societies become more complex, the role of the designer is changing and, consequently, the aim of the commercial designer—to develop creative solutions to problems—is becoming multilayered. Increasingly, the problems designers face are multi-faceted and require the designer to step outside the realms of traditional practice. Yet relying on intuition (Lawson, 2014) remains a fundamental part of the practice. To comprehend why this continues to be the case, we need to look to research that helps us understand how the creative process is applied by designers.

Research on design practice suggests that designers use a cognitive approach that uniquely combines theory with practice through the process of creating artefacts in response to problems (Cross, 2011; Lawson, 2014). To apply this design process, the designer needs to manage a continuum of development and evaluation, where ideas are continually adapted and refined based on research and the needs of multiple stakeholders. The role of the designer in this context is constantly oscillating, and achieving a balance requires the designer to blend reflective analytical thinking with practical know-how, the result of which is that the processes of designing and creating a solution are conducted simultaneously (Cross, 2011). It is generally agreed that this process requires the designer to bring together theoretical knowledge and practice, to marry aesthetics with the functional needs of the end user (Owen, 2007). The following section provides an overview of how the process has developed from early traditions to current practice.

### 3.1.3 The Design Principles

It is generally accepted that the teaching style and principles developed by the Bauhaus School continue to guide designers today. These principles of design, when applied to practice and artefact, are visible to designers and highly valued by students and tutors (Cross, 2011; Melles,
2011). Considering this in the context of the interdisciplinary team raises an important question: do other academic disciplines place the same emphasis on the principles and processes designers value? Similarly, the question of whether the processes and practices of other disciplines are valued by designers also needs to be answered, as the use of collaborative interdisciplinary teams in industry and education brings the issue of discipline differences to the fore. The lack of empirical studies in this area highlights an important research gap in the knowledge used to inform pedagogies in this emerging area.

The legacy that contemporary design education owes to the Bauhaus School does not end with the visual language of “The Basic Course”. The School also first formally applied a master/apprentice learning process by bringing in design industry experts to guide active student participation in a shared learning environment. In effect, the School developed a “community of practice” (Lave & Wenger, 1991) wherein the process of idea development was dependent on the information exchange that occurred within the group. This learning style remains the mainstay of design education for its ability to provide learning that facilitates opportunities to simultaneously acquire the knowledge and skills required to creatively problem-solve (Frascara, 2007).

The importance of shared learning environment for design education is illustrated by the continuing prevalence of this approach. Tucker (2016) suggests that design educators continue to create interactive social environments that rely on the master/apprentice tradition and engage industry professionals to teach students contemporary discipline practices, while the design student is provided knowledge of design theories and practical application techniques by the teacher. In contemporary settings, to achieve full reflective immersion in theory and practice, student-centred experiential problem-based learning is commonly used in the curriculum (Schön, 1984). The visual language of the Bauhaus School formally guides students to make judgements about the success of the creative outcomes (Dineen & Collins, 2005).

More recently, the development of design as an academic discipline, particularly in light of the complexity of contemporary design problems, has called into question the validity of allowing traditional design principles to lead decision-making. Design research suggests that intuitive approaches are increasingly losing regard and have been termed “self-serving” by design experts (Frascara, 2017). This trend is influencing change in design education and pedagogies are transitioning away from craft origins and the dominance of the visual form. However, some researchers suggest that change is slow. New pedagogies and assessment processes that add rigour to the process are emerging, but the success of these approaches is largely unknown (Frascara, 2017; Tucker, 2016). New pedagogical practices, such as design thinking using collaborative interdisciplinary teams, are in their infancy, leaving problem-solving interdependent on visual design elements and intuitive processes. The following section discusses the changes...
in design practices and pedagogies to clarify the factors that have influenced the development of design as an academic discipline.

### 3.1.4 From Vocation to Academic Discipline

Over the last 25 years, design education has moved from its vocational origins into university settings. The need for academic rigour in this setting has required that the discipline move away from craft-based practice towards thinking-oriented approaches. As noted above, this shift has been slow and the discipline continues to rely on intuitive problem-solving approaches and stylistic practice immersed in the Bauhaus traditions (Frascara, 2017).

It is generally agreed that validation in higher education of ‘soft’ disciplines is not easy (Becher, 1989; McCulloch, 2002; Sarangapani, 2011). Design shares the interpretive ‘soft’ and applied boundaries that exist in many of the social sciences. Results or findings in both areas are open to interpretation and lack the formal standardised structures of the scientific fields. Further to this, in academia prestige has traditionally been attached to what Becher (1989) refers to as ‘hard’ knowledge. Within this domain both pure and applied forms of knowledge exist, where research and investigation aims to establish clear findings and solutions to important societal problems through known systematic and definable processes. The nature of such research has enabled traditional ‘hard’ academic fields to expand by attracting most of the research funding and, consequently, obtaining and maintaining a prestigious status (Becher, 1989).

The literature suggests that design education is still developing in terms of processes that might validate its research and, consequently, position it as a respected academic discipline. Students in interdisciplinary design teams are being asked to apply the Design Thinking process to add rigour to the discipline (Bennett, 2006; McDonald, 2006). However, changing pedagogical practices in design education has been slow and opportunities for students to effectively apply the rigorous research and development processes in collaborative teams remain limited (Frascara, 2017).

A number of reasons can be assigned to the discipline’s slow development. Historically, design schools have a history of operating in a contrary fashion to traditional universities, where the focus tended to be on theoretical knowledge and research (Prentice, 2000). Design pedagogy has focused on the applied nature of the creative arts and centred learning on intuitive knowledge, visual styling and technique application (Bennett, 2006). This intuitive approach is considered to present a theoretical shortfall and Frascara (2017) suggests that theory and knowledge acquisition in design have failed to develop beyond the implicit. This makes it difficult for the discipline to ratify processes and outcomes specifically correct, as the discipline remains shrouded by its creative intuitive approaches, leaving the design process a poor substitute for the
more structured scientific fields. The flexible scope of design problems binds the discipline to ‘soft’ boundaries (Becher, 1989) and immediately classifies it as being of lower value in an academic sense. This problem is compounded by the nature of the problems tackled by design professionals, which, while important, are less often critical and tend to have fewer clearly definable or absolute solutions.

Ironically, the research indicates that while this characteristic is problematic from a validation perspective, it is in fact these ‘soft’ boundaries that provide opportunities for creativity development within the design discipline (Hung, 2015; Nakano & Wechsler, 2018). In addition, the lack of absolute right or wrong answers, as often found in design project briefs, increases the potential for divergent thinking. Design processes typically have less structure and fewer analyses to ensure broad development. Viewed from this angle, design processes and practices may appear to lack reliability. This issue is a pertinent one in the changing design context, and in particular in the interdisciplinary team, where processes applied by designers may seem invalid to collaborators who work in more structured ways.

The importance the academic discipline places on these changes has had a flow-on effect. The endeavour to attain academic authenticity has shown that, within the discipline, there has been a deprioritisation of traditional craft skills, which are felt to lack value in university settings (Lewis, 1999). This development is not unique to design. Discipline-specific skill-based courses are no longer the mainstay of undergraduate study. Instead, universities move to offer students broad study options that foster diverse learning and create flexibility between discipline areas. For design education, this has led to an upsurge in courses that use practice-led research and design thinking to substantiate the development of solutions.

Much of the misalignment in processes and expectations discussed above are replicated in the collaborative team pedagogies adopted by the design discipline. The success of the approach relies on the selection of appropriate problems. The tasks at hand need to ensure that the student has opportunities to engage in a number of problem-solving activities. The model is self-directed and, within it, the teacher becomes part of the design team, contributing to facilitate the design process and function as a design contributor as well as an instructor.

The design processes expected of interdisciplinary teams are no different to those expected of design students. However, the interdisciplinary team in this context is not a team of designers. Students come to the process from different disciplines and no doubt bring with them significantly different priorities and processes.

Furthermore, the application of team processes in this context is uncharted. This creates a conundrum for design educators, who are charged to develop pedagogies of which they have only scant anecdotal knowledge and, in effect, are teaching collaborative practice they have little
experience in. Yet little is known about how this impacts on non-discipline students in the interdisciplinary team, or what influence it has on the collaborative potential of teams. This research gap further highlights the need for this study. Educators need to understand how different processes and pedagogies manifest in practice to bring out the best in interdisciplinary teams.

Perhaps the most widely accepted developmental change in design is the formalisation of design processes using what has come to be known as design thinking. The shifts in educational requirements in the design discipline have popularised design thinking more broadly. This flexible problem-solving approach is considered to be well-placed to cope with the ever-changing challenges of society (Brown, 2008; Kimbell, 2011). The following sections discuss the inclusion of design thinking in curricula and explore the process itself to provide clarity about what is expected of interdisciplinary design teams in educational settings.

3.2 Teaching and Learning in Design

Changing requirements in society are reflected in design practice and education. Increasingly, designers and design students need to learn to apply methods for creative development and innovative solution that first and foremost address user needs (Frascara, 2017). As discussed in Section 2.1.1, problem-based learning (PBL) provides increased opportunities for creative application which result in broader based learning (Shreeve & Smith, 2012). This pedagogical approach has been accepted by many academic disciplines.

Donnelly and Fitzmaurice (2005) argue that authentic PBL relies on a combination of key requirements to create learning opportunities. They describe this learning process as reliant on three key components: real-world learning, complex problems and multilayered problems. In design education, problems that have these three components are sought out for use in interdisciplinary learning (Oliver, Herrington, Herrington, & Reeves, 2012). Furthermore, Chandrasekaran, Littlefair, Joordens and Stojcevski (2014) believe that for real-world learning to occur, project briefs need to provide real-world relevance. This approach to PBL is valued in education, as industry-relevant learning is a high priority for the discipline. As a result, projects that replicate real-world processes are often integrated across design curricula (Galford, Hawkins, & Hertweck, 2015; Taffe, Pedell, & Wilkinson, 2018). However, to be effective these projects need to provide opportunities for students to take risks and explore diverse solutions, as well as to enable the production of final products. Research suggests that this does not always occur. Melles (2011) found that design educators were more likely to select projects that aligned with their knowledge and direct students to apply processes that are more closely linked to design traditions than those of contemporary applied design research and design thinking. In the
interdisciplinary design team, the teacher or facilitator’s approach has the potential to restrict the team to design practice, potentially placing limitations on the contribution non-design students can make to the collaborative interdisciplinary process.

Another factor Donnelly and Fitzmaurice (2005) considered important in PBL is project complexity. They argue that PBL is likely to be effective only when the projects selected are able to benefit all students. In theory, this requirement aligns with problems common to design education, where briefs presented to students are complex and rarely result in solutions which are singularly correct. Furthermore, project complexity in PBL often requires interdisciplinary collaboration (Wragg & Barnes, 2016). This line of thought suggests that the success of the pedagogy depends on both project and team selection. Therefore, it might be argued that when used with interdisciplinary teams, project briefs need to provide adequate scope for students in all participating academic learning areas to contribute.

Another aspect found to be relevant to PBL is the level of engagement expected from students. Glasgow (1997) argues that PBL is student-centred and, consequently, provides opportunities to positively immerse learners in the learning activities. Often undertaken in teams, it is accepted that PBL will engage students in active discussions that help them to share knowledge and ideas (Cohen, Sampson, & Boud, 2001; Kloppenborg & Baucus, 2004). However, this process has been found to be both difficult and frustrating for students (Cumming et al., 2014). As discussed in Chapter 2, many interpersonal factors and past experiences have been found to influence team participation, but the influence of these factors on student interactions and the collaborative design thinking processes in the interdisciplinary team is not yet well understood.

As the interactions of students applying design thinking to PBL in interdisciplinary teams is the main focus of this study, it is important to understand the nature of the work processes expected. The following section outlines the application of design research and design thinking methodologies to PBL to provide an understanding of the benefits of the approaches and consider some of the problems that might occur when the processes are applied to interdisciplinary teamwork.

3.2.1 Working Together in Design Teams

The potential advantages the interdisciplinary team offers are clear. Design research suggests that team-based projects in education have the potential to improve industry-ready practice skills and increase interpersonal skills. Studies show that projects undertaken by teams benefit from the knowledge of each individual contributor. Teams have been found to provide a coherent way of dealing with project problems from a broader viewpoint (Owen, 2007; Wragg & Barnes, 2016).
The potential the team offers for innovative thinking is high, so it is easy to understand why a move towards interdisciplinary problem-based project work is becoming popular in design education (Barkley et al., 2005). The design disciplines add a unique perspective to the team, as design education has long encouraged students to explore and share creative ideas. The practice of openly expressing ideas through discussion, critique and visual development is a mainstay of the discipline. For many design academics, there is the (untested) view that the fluid nature of this process will flow across to the interdisciplinary team and collaboration will occur seamlessly (Melles, 2011).

However, the interdisciplinary team has a number of obvious differences to contend with, which have the potential to limit the collaboration processes. First, for non-designers the consolidation of solutions in an unstructured way may present as invalid and create difficulties and tensions (Becher, 1989). It is possible that collaboration with other disciplines may create an uncomfortable learning environment that highlights difference rather than facilitating opportunities to build knowledge (Becher, 1989). To add to this, the literature suggests that iterative problem-solving processes can be problematic for teams. Levi (2014) argues that teams use such processes to support what they already believe, rather than to expand on ideas to develop the best solution. Albeit unintentionally, teams have been shown to ignore negative evaluation or feedback that does not align with the team majority view. Furthermore, research on teams suggests that they will collectively progress problems at the discretion of the team and hide identified mistakes to minimise the potential of these problems to halt progress (Levi, 2014). Other studies show that many of the ideas generated in the early design stages are never fully considered, as the process has the tendency to produce more questions than answers, making it difficult for teams to progress if all ideas are fully investigated (Sawyer, 2008).

Research on design students has found that individual students are likely to arrive at solutions based on views about form and aesthetics (Nini, 2005). This outcome-driven approach is known to be grade-focused and has been found to limit creative risk-taking and innovative solution-finding (Visser, Chandler, & Grainger, 2017). Finally the team in an educational environment is significantly restricted by time which may limit trust-building or alienate participants in interdisciplinary teams (Edmondson, 2016b; Roberts, 2006). For the most part, PBL in interdisciplinary teams is restricted to semester timeframes, which has the potential to minimise opportunities for interdisciplinary peers to engage in design research and the design thinking process.

At the same time, the design industry has matured and now commonly uses problem-solving processes encompassing both traditional ‘craft’ and research skills. Cross (2011) reviewed design practice and showed that, in professional environments, conceptual practice skills are
combined with strategic thinking to create high-level outcomes. Research shows that design thinking is becoming increasingly formalised and teamwork is emerging as an integral component of the professional design studio. The application of the process across a range of disciplines has increased exponentially, and collaborative interdisciplinary design teams are being employed to implement iterative design approaches to generate innovative ideas and solutions across a wide range of projects and industries (Clark & Smith, Summer 2008; Owen, 2007).

3.2.2 The Design Thinking Process

Looking more closely at design thinking methodology provides one way of understanding the potential problems interdisciplinary teams may face when they tackle a design problem. “Design Thinking” describes an iterative methodology wherein designers use research, design development, product creation and testing to develop innovative, viable solutions (Brown, 2008; Owen, 2007). The focus of this process is on the end user and, as a result, this process aims for the designer to develop a solution that is target-appropriate (Brown, 2008; McDonald, 2006).

The process is non-linear and combines application knowledge and divergent thinking to discover appropriate ideas (Brown, 2008). This distinguishes design thinking from more scientific approaches, as it produces possible solutions rather than identifying specific causes and providing specific answers (Owen, 2007). The outcomes of the process rarely directly meet project requirements and, as a result, are difficult to substantiate. The design thinking methodology often relies on findings from user-centred research to identify whether proposed solutions are addressing the design problem successfully (Fraher & Martinson, 2011). The aim of user-centred research is to clarify the needs of the user groups by using methods that test groups and prove that the proposed solution addresses the problem requirements (Nini, 2005). Not surprisingly, many professional design studios are adopting user-centred research methodologies, which is shifting the design process away from the individual craft-based practice that was omnipresent in early design education.

As stated in Section 3.2.1, teams—and, in particular, interdisciplinary teams—are integral to design thinking. The design processes rely on team collaboration, where broad knowledge at an individual level is shared and consolidated to generate appropriate solutions. The design thinking process in practice suggests that the success of this approach is dependent on the team’s ability to build on each other’s ideas. Some of the techniques commonly used to facilitate the design thinking process are brainstorming and visual interactive approaches. Design teams often use these techniques to share ideas and consider the viability of solutions. Brown (2008) argues that effective design teams consider the ideas of all participants fully and discard ideas only after formal collaborative processes that review and assess the value of the idea against project criteria. Evidence suggests that the application of design thinking in this way has resulted in design
practice that can be validated (Barkley et al., 2005; Nini, 2005). Furthermore, Razzouk and Shute (2012) found that teams that used prototyping and user testing to address the needs of the community or user more directly were better able to practically and purposefully solve design problems.

Design thinking has gone a long way towards legitimising design as a profession capable of contributing to solving large-scale societal problems. As a result, design thinking is no longer exclusive to the design discipline, and interdisciplinary project teams are increasingly using this approach for problem-solving (Boni, Weingart, & Evenson, 2009). However, the adoption of design research and design thinking in tertiary education is still in the early stages. Until recently, the teaching focus in design education has been on skill acquisition and practice-based research (Melles, 2011). Not surprisingly in this context, teaching academics have been employed for their practical and applied knowledge. This focus on skill acquisition, while necessary for industry, creates a situation that does not align with the traditional values of universities. Design research shows design academics are less likely than other disciplines to focus on theory and writing, which may further add to the perception that the discipline lacks academic rigour (Prentice, 2000). Melles (2011) argues that, in the design studio (class), the processes of design research remain misunderstood or misinterpreted by design educators lacking the knowledge to conduct research and consolidate findings to validate proposed solutions.

In addition, Melles (2011) suggests that teacher knowledge can limit the design thinking process, as processes stipulated by design educators minimally require review of contemporary literature or applied user-centred research methodologies to investigate problems. Instead, they rely on visual analysis and conduct research primarily using visual comparison or competitor analysis. This approach informs the solution at a superficial level rather than investigating the complexity of problem; therefore, it is argued by some that this process is a less effective way of addressing societal needs (Nini, 2005; Prentice, 2000). This pedagogical practice may also be applied to interdisciplinary design teams, where it may create further points of difference in processes and decision-making that increase the difficulty for these teams of interacting and working collaboratively. The influence of these discipline differences on teams is not well understood, particularly the impact of differing practices and processes on the interdisciplinary team community. To understand the unique problems that can emerge in design teams, the following section analyses one interpretation of how design teams use the design thinking process.

3.2.3 Design Problem-Solving in Teams

As stated earlier, design thinking requires teams to combine knowledge and skills using an iterative process to develop a solution. Design research shows that design practitioners typically apply a cyclic problem-solving approach, whereby the solution is determined, developed and
refined through reflection and iteration. Stempfle and Badke-Schaub (2002) analysed design team processes and found that solution-finding using this iterative approach is undertaken in four stages: generation, exploration, comparison and selection. Their study further showed that when design teams come together, they operationalise a five-step process (Figure 3.1) to problem-solve and create tangible solutions. The model shown is one example of the design thinking process and is presented here to give clarity to the stages typically undertaken by designers and design teams.

Figure 3.1 – Five-step design process

(Adapted from Stempfle & Badke-Schaub, 2002)

Stempfle and Badke-Schaub’s (2002) model makes evident that designers and design teams, in common with most teams, begin the process with planning. Designers start the process with “Goal Clarification” to “unpack” the project requirements. During this stage, teams typically define and scope the project requirements and decide on work stages. Observations of teams by Stempfle and Badke-Schaub (2002) revealed that decisions made by teams in this early stage tended to guide team function. Further scrutiny of design practice shows that teams then generally move to the next stage, “Solution Generation”. At this stage, teams tend to focus on the development of ideas. Early solutions are created and proposed to the team.

Stempfle and Badke-Schaub argue that once ideas are presented, the team moves on to the “Analysis” stage. This stage is conducted at a team level and the discussions about the appropriateness of proposed ideas referred back to the requirements previously defined by the team in “Goal Clarification”. From here, the team moves to the “Evaluation” stage. Review of this stage has shown that teams collaborate to consider the positive and negative aspects of the proposed solutions. At this stage, teams decide on which solutions will be developed and how they will be developed. This leads to the next stage, the “Decision”, the stage where the fate of the idea is decided. Design teams review and then categorise the solutions presented as successful or not successful. Successful solutions are then progressed to completion. Importantly, it was noted that the process for unsuccessful designs was not finished at this stage.
Instead, designers used an iterative “design thinking” process to reconsider ideas in the “Solution Generation” stage; this approach allows all ideas to remain active until all possibilities are exhausted (Stempfle & Badke-Schaub, 2002).

Studies show that to undertake each stage successfully, the team requires significant knowledge, skill and rational problem-solving strategies (Campion et al., 1996; Martin & Hans Georg, 2001). Hackman (1990) argues that teams generally displayed a tendency to rush towards a solution and project completion with scant research or investigation. This approach is contrary to the requirements of complex design projects, where research and user-analysis are ideally used to clearly understand the problem and identify the needs and requirements of the specific audience (Frascara, 2017). The contradiction between effective design practice and typical team processes noted here has the potential to pose a barrier to team collaboration processes known to be integral to creative solution finding (Brown, 2008). This issue will be investigated in this study to obtain some understanding of the way in which different disciplines engage with the design thinking process.

As noted in Section 3.1.4, there is a tendency for designers to apply intuitive processes to expedite decision-making. Minimal problem interrogation has a number of benefits for the team. Research has shown that when teams achieve consensus quickly, the potential for conflict diminishes (Bornstein, 2003; Parks, Joireman & Van Lange, 2013). However, Dayan and Elbanna (2011) found that teams who apply this process display a propensity to rely on what they know and are more likely to focus on the symptoms of the problem rather than identify the cause of the problem.

It is easy to see that this approach is unreliable and can lead to the development of invalid or inappropriate solutions. The process is also contrary to the design thinking process, where consideration and evaluation is required at all stages of problem-solving. Observations show that misaligned processes in the “Solution Generation” and “Analysis” stages contribute further to poor problem classification. Teams that do not spend sufficient time on the problem in the early project stages have been found to develop solutions that meet the identified goal but fall short of addressing the problem (Chandrasekaran, Littlefair, Joordens, & Stojcevski, 2014). This issue is pertinent to the interdisciplinary team in an educational context. In these teams, students are expected to solve large problems in short timeframes. It might follow, then, that time and goals (product and assessment) may present as conflicting factors to problem analysis and solution-finding. The connections between this issue are again not well understood by educators and will be explored in this thesis.

Further research provides some understanding of why this problem occurs. Levi (2014) argues that problem complexity contributes to it and suggests that teams are inclined to over-simplify
problems that are multi-layered and difficult to understand. This simplification process is considered by Levi (2014) to be applied by teams to create opportunities for the team to tackle only the component of the problem that is known to them. It is possible, then, that in interdisciplinary student teams, short timeframes and limited knowledge may make this simplification approach appealing and, in turn, limit the opportunity for teams to work collaboratively to address the design problems through the iterative process they are brought together to apply.

The discussion in Section 3.2 has provided some insight into the design process and the knowledge and skills that have the potential to minimise a team’s capacity to identify problems and develop appropriate solutions. The discussion showed that teams can demonstrate a tendency to limit processes to existing skills and knowledge at the expense of core problems. In light of this research, we might consider that interdisciplinary student teams who may be minimally ill-equipped to navigate complex problems have the potential to undertake inadequate problem-solving. We might further consider that the knowledge, skills and rational problem-solving of students are likely to be developing, which might increase the likelihood of this problem occurring. Nonetheless, in higher education interdisciplinary design team students are expected to provide “expert” knowledge based on what is often limited discipline learning while the impact of knowledge shortfalls in this context remains sparsely addressed in the literature.

This issue focuses attention on the specific gap in empirical research in the design context. With this in mind, this study evaluates whether and when students are able to appropriately contribute to proposing and analysing solutions in interdisciplinary teams. Section 3.3 discusses this problem further, exploring literature that underlines a number of barriers to creative problem solving in student design teams.

3.3 Responding to Creative Tasks

Of further interest in this study is the way in which knowledge transfer occurs between team participants in unstructured interdisciplinary teams. Ettington and Camp’s (2001) research showed that learning can be transferred to others in three ways. The first, “positive transfer”, occurs when the learner is able to appropriately apply the acquired skills and knowledge to a new situation. The second, “negative transfer”, occurs when the learner demonstrates the acquisition of inappropriate skills and knowledge by applying both inappropriate to learning to new situations. The third, “no transfer”, occurs when the student does not demonstrate application of learning to a new situation.

We already know from Section 2.3.2 that motivation in teams is linked to organisational structures, so it may follow that learning in teams is more likely to occur when structures support it. Several
studies suggest that, in order to achieve this, the support structure that rewards the team needs to be meaningful to both the team and the individual within the team to effectively motivate both (Haas & Mortensen, 2016). As previously noted, motivation in teams is linked to extrinsic and intrinsic rewards depending on project stage; this makes the development of learning activities suited to interdisciplinary design teams more difficult. Some authors have found that at the creative and ideation stages, which are integral to innovative development, individuals need higher levels of intrinsic rather than extrinsic motivation (Eisenberger & Byron, 2011; Hennessey & Amabile, 1998; Sansone & Harackiewicz, 2000). However, the specific nature of the intrinsic reward is relative to the individual and not yet well understood. In the interdisciplinary student team, we can assume that a common thread will be grades; however, what best motivates creativity is unclear, leaving educators with a vexed problem. This issue raises many questions about the role assessment plays to facilitate positive learning transfer in creative teams.

Studies of design teams in higher education also link motivation to the task difficulty (Frascara, 2017). If tasks are too difficult in the early stages of the project, and failures are experienced, frustration can result. Frascara’s (2017) research on design education suggests that, in the classroom, tutors have traditionally displayed a tendency to create “falsely simple environments” to minimise difficulty. This learning approach encourages students to rely on problem simplification which, in turn, may contribute to increase motivation. However, from a learning perspective this approach does not contribute to positive learning transfer. Instead, this simplification process, if applied by interdisciplinary teams, may limit innovative exploration and encourage students to revert to intuitive design processes to develop their outcomes (Frascara, 2017). The issue calls into question the effectiveness of projects and pedagogy used for interdisciplinary design student teams and might leave us wondering whether interdisciplinary projects have the potential to unintentionally minimise the very learning they are aiming to achieve.

In simple terms, we can consider that a team reward is required for a team to be motivated to achieve a goal. However, understanding what type of reward is likely to be effective in interdisciplinary teams is more complicated and has been minimally researched. For this reason, this study is interested in the motivational potential of assessment tools to understand dissonance, if any, between the learning expectations and learning transfer.

3.3.1 Assessment of Teamwork

Design research has revealed that design students focus their attention on previous successes and choose processes that have been proven to achieve high grades over best practice (Visser et al., 2017). In this context, students display a tendency to focus on tasks that will achieve the best artefact, as measured by the tutor, rather than engage in the iterative design thinking process holistically. Further research has demonstrated that, in practice, teams apply processes that focus
on criteria which have the potential to impede rather than add to the holistic engagement of the team with the project (Geske, 2009). Yet few studies have explored what changes, if any, occur in the design process when different discipline groups come together to form interdisciplinary design teams. An important question associated with this research gap is: Do students in these teams interact to collaborate or merely follow what they assume the tutor’s criteria for assessment are? This raises further questions about the effectiveness of team assessment processes, in particular whether assessment criteria limit the need for student teams to interact and collaborate.

Numerous factors that impede the assessment of teamwork have been documented (Isaac, 2012; Nesbit & Burton, 2006). The team make-up and subsequent team practice create situational challenges unique to each team, making the process of assessment uniquely difficult in each team. Assessment of creativity adds further difficulties to the situation, as subjective value judgements may create disparity in expectations between team members and the teacher (Orr, 2010). In creative teams, students and tutors have been shown to have differing views as to what can and should be assessed in teams. For example, Geske (2009) found that teachers who were focused on assessing teamwork aimed to develop tools that allowed them to assess the individual student contribution across a range of design activities, alongside their contribution to the team. Geske (2009) argues, however, that students do not feel this process is justified. He found that this style of assessment left students feeling limited by the team dynamic and created concerns that the individual contribution to the team product, actual or potential, was not fairly attributed. This research highlights a conundrum for educators, as the value students place on assessing team learning may differ from the value assigned by the teacher. This further highlights the importance of understanding what motivates the team and contributes to positive team interactions and collaboration.

Studies investigating this issue in more detail have shown that students express deep concerns about equitable acknowledgement of contribution in team projects. Students are apprehensive about assessment measures and tools, and this leads to distrust and feelings of injustice, both of which add tension to team relationships (Clegg, 2014; Orr, 2010). This research suggests that assessment equity in teams is an ongoing challenge in higher education.

Some authors suggest that it is important to consider student expectations of equity (Isaac, 2012; Orr, 2010). Perceptions of fairness in teams develop as a result of the value given by the team to the technical knowledge and skills demonstrated (Orr, 2010; Stobart, 2005). This leaves students dissatisfied when team members perceived to have made contributions of lesser value receive equal acknowledgement (grades). The potential of this constructed view of contribution value to deter equal participation in interdisciplinary teams has been under-explored and is therefore of interest in this study.
Studies reviewing assessment tools and process show that different measures have the potential to both negatively and positively impact on equity (Isaac, 2012; Orr, 2010). This underscores the lack of clarity around assessment in team learning. Research on teams in education indicates that students want to be recognised for the individual effort they have contributed to the team outcome. When equal recognition is given to peers, regardless of effort, students feel dissatisfied and disillusioned with team work (Isaac, 2012). This research suggests that assessment tools and measures need to have a method by which contributions can be measured in a fair and equitable way. On the other hand, significant research supports the benefits of using team-based assessment. Falchikov (2005) found that individuals make greater contributions to the team where the importance of the team is emphasised. Additionally, research has shown that the use of individual assessments sends a message that the individual is more important than the team (Orr, 2010; Smart & Dixon, 2002), which reduces the value team cooperation offers to individual team members.

Another form of assessment common to teamwork, peer assessment, is used to create equity. The literature suggests that peer assessment offers increased opportunities for recognition of the work of the individual within the team and benefits the team by providing opportunities to evaluate the contribution of peers (Kollar, 2009; Topping, 2009). Where the tutor has provided clarification of both the criteria and the evaluation processes, peer assessment is an effective measure and can contribute to provide both formative and summative feedback (Sibley, 2014). Peer assessment provides students with the opportunity to classify the contributions made by their peers by grade; therefore, peer assessment has the potential to function as a vehicle for expressing team discontent. Further research has shown that students generally assign higher grades to the work of peers with whom they align themselves; therefore, this form of assessment contributes little to acknowledging what the individual has truly brought to the team and the project outcome (Tuckman & Jensen, 2010). Loyalty to friends has also been found to influence peer evaluation. Students identified that, for reasons of loyalty, they were more likely to offer positive feedback and praise for peers than provide critical appraisals (Falchikov, 2005). This highlights a further limit on the effectiveness of peer assessment in teams.

Research also suggests that student perceptions about the fairness of the actual assessment measures influence participation. The manner in which grades are attributed to the project outcome has been found to pose a significant barrier for students. Nordberg (2008) argues that tension is more likely to occur in teams where students believe contributions have not been appropriately apportioned or when the individual loses visibility within a team. Furthermore, assessment tension is more likely to occur in newly formed teams because, at early project stages, team members have not yet determined the quality and quantity of contribution their team peers are likely to make (Visser et al., 2017). Assessment tools have also been shown to
ameliorate tension in teams. Orr (2010) identified that assessment tools that highlight the contribution of the individual improve perceptions of equity and guide teams more effectively through the design process. These varied responses to assessment tools and criteria highlight the need for educators to consider carefully the assessment requirements in teams to select the assessment measures most suited to motivating the required learning.

Research on creative disciplines in education has also found that, due to subjective judgement, the visual nature of the discipline has long posed assessment difficulties (Demirkan & Afacan, 2012; Frascara, 2007). Creative students have been found to have a tendency to take this into consideration and to make decisions about design solutions based on what they anticipate will achieve a high grade (Visser et al., 2017).

How these contrary factors can be brought together to increase team interaction and creative potential in interdisciplinary design teams is not fully understood. What is known is that in creative education, feedback received informally by the group contributes to building student confidence and supports efficacy in creative problem-solving (Visser et al., 2017). Feedback-centred approaches in design education have also been shown to provide holistic discipline knowledge acquisition that is more likely to carry forward to subsequent learning (Miceli & Zeeng, 2017). The clarity of this style of feedback has also been found to rely on a safe, judgement-free environment (Visser et al., 2017), highlighting from another perspective the vital role of trust in the creative process.

The research presented in Section 3.3 highlights some of the challenges educators face when assessing team project work. The lack of clear, conclusive research in this area suggests that there is still much to learn about assessment in teams and that the style of assessment that works most effectively is not easily defined. Further to this, a gap exists in the research about the specific influence of assessment on team interaction and collaborative practice in diverse interdisciplinary design teams.

3.4 Conclusion

The principles that guide design knowledge and practice stem from the early 20th century. Common learning structures in design education retain strong links to traditional practice and rely on social learning and CoPs to engage students in practice-based learning. More recently, design education has adopted more rigorous pedagogies and the discipline has embraced problem-based learning using design thinking approaches that rely heavily on teamwork.

The aim of these pedagogies is to increase creative thinking using the collaborative design thinking process to problem-solve. In higher education, the literature shows that while much is known about team pedagogies, in design education—where the interdisciplinary design team
model is still in its infancy—there is little research on the effectiveness of this learning process and assessment. Few empirical studies have reviewed the effectiveness of this collaborative process in interdisciplinary design teams in higher education. The specific questions arising from this research gap are central to the study presented in this thesis. Chapter 4 will discuss the research design and methodology used in this study to address this knowledge gap.
CHAPTER 4

Research Design

This chapter discusses the methodological perspectives and conceptual framework that informed the research. The research sought answers about the manner in which students interacted and made sense of the collaborative team experience. A qualitative research method was adopted to enable a deep understanding of the student experience (Creswell, 2011). To delve deeply into the phenomenon, four data sets were collected, analysed and triangulated. Early data analysis used an interpretive paradigm to enable a holistic view of the perceptions, feelings and values students believed contribute to the team experience (Patton, 1990). These findings were then compared to understand the factors that encouraged or inhibited collaboration and learning in interdisciplinary design teams. This chapter provides a detailed description of the methods, data sources and data analysis instruments.

4.1 Research Aims

The research aimed to investigate the factors that support and limit collaborative group work in interdisciplinary team projects. More specifically, the study sought to identify factors that students perceived as integral to teamwork in order to understand the relationships between these factors, team interaction, collaborative participation and success as measured by both the tutor and the team. The goal was to provide valuable insights that would augment what is known about team interaction in education and contribute to pedagogical development in the area of interdisciplinary teamwork.

The main research question in this study was: What factors influence collaborative practices and working relationships in interdisciplinary design teams in higher education? To examine this, the research considered several subsidiary questions:

- What perceptions about team projects do individual students bring to the team?
- What perceptions influence team interactions?
- What perceptions influence student engagement with the project?
- What perceptions influence student perceptions about the contribution of peers?
- What learning occurs between individual team members?

4.2 Methodology

This study adopted a qualitative case study approach using multiple sources of data to understand the team interactions that influence the collaboration processes in interdisciplinary
design student teams. This case study inquiry used qualitative methods—interviews, observation, and artefacts—for data collection. The data collection aimed to reveal the actual working processes of each individual in each team in order to understand the factors that influence collaboration in interdisciplinary design teams. The data sets were collected over 14 weeks in three stages: Stage 1 (Pre-project), Stage 2 (Concurrent with Project) and Stage 3 (Project Completion).

4.2.1 Qualitative Case Study Approach

Understanding team interactions and students’ experiences of these was integral to this study, therefore a qualitative research method was adopted (Creswell & Clark, 2007). Qualitative research provides a framework that allows key themes, not known or understood to emerge through the analysis process. Extensively used in the social sciences and education, qualitative research aligns with methodologies commonly applied to study team project work in tertiary education (Patton, 1990). This interpretivist approach was selected for its ability to make sense of relationships through social constructs such as language and shared values and beliefs.

The qualitative case study approach used provided opportunities to review and understand the changes that occurred as relationships between peers developed. In this study, case study methodology has been used to examine student interaction and collaborative engagement in a real-world setting to understand the phenomenon in a natural context (Yin, 2014). Four data collection tools were used to investigate questions about how and why students interact and what these interactions contribute to the collaborative design thinking process. The variables identified within the research context were examined from multiple viewpoints and triangulated to enable the theoretical propositions to emerge as the data was examined. Data analysis applied an interpretive paradigm to enable a holistic view of the perceptions, feelings and values students believe contribute to the interaction and collaboration that occurred (Patton, 1990). The agile qualities of case study inquiry are known to create multiple occasions for the researcher to discover patterns and trends as they present. This facilitated opportunities to investigate whether and why perceptions changed. This ability to respond to the data as it emerged provided opportunities for the factors that contribute to the phenomenon to be discovered and understood as they occurred (Timmons & Cairns, 2010).

4.2.2 Research Site

The cases occurred in a module of study, a unit, in a current undergraduate course. For the purpose of this study, this unit has been named Design in Teams (DiT). This unit, conducted in a design school in Australia, was available to any undergraduate student undertaking any course at the university. At the time the study was conducted, the unit had been adopted by the business
school in the same university as a core first-year unit. As a result, the student participants in this study are from the design and business schools.

The project used in the unit was based on a real-world brief that aimed to address social problems defined as integral to urban living. The problems had been identified as of concern through public forums and had been grouped together into ‘Talking Points’. Table 4.1 shows the themes and talking points available for selection by the interdisciplinary student teams. The full project brief is provided in Appendix L.

**Table 4.1 – Project brief, talking points**

<table>
<thead>
<tr>
<th>Talk Business</th>
<th>Talk Global</th>
<th>Talk Public Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk Culture</td>
<td>Talk Knowledge</td>
<td>Talk Service</td>
</tr>
<tr>
<td>Talk Destination</td>
<td>Talk Living</td>
<td>Talk Sport</td>
</tr>
<tr>
<td>Talk Environmentally Sustainable</td>
<td>Talk Moving</td>
<td></td>
</tr>
</tbody>
</table>

The unit used problem-based learning to emulate contemporary industry practice based on the epistemological underpinning of collaborative learning. As defined by Savin-Baden (2007), discussed in Chapter 3, using this approach problems are presented by the tutor and while the tutor applies some element of control to the process project completion and learning relies on student engagement with the team and the team processes. The project used in DiT was presented by the tutor and the learning structure was designed to allow the tutor to facilitate but not control student learning. To achieve learning and project completion the teams were required to select and research an area of concern or interest from the ‘Talking Points’. Once selected, teams were required to select a specific problem area from within this ‘Talking Point’ and then research and address the problem as it related to the specified target audience. The tutor expected that project teams would each propose a range of solutions, these might include products, services or community initiatives that were designed to address the problem and meet the identified needs of target audience.

The unit learning objectives that related specifically to this research were: (1) enable innovation; (2) foster interdisciplinary learning; and (3) teach generic team skills. To meet these learning objectives, the interdisciplinary student teams were required to collaboratively solve an issue they self-selected from the talking points. The themes provided were inherently complex in order to provide the team with the opportunity to meet academic targets through research, while the design proposal (assessable outcome) required innovative design thinking, which made the project well-suited to interdisciplinary project teams with diverse knowledge and skills (Barkley et al., 2005; Beckman & Barry, 2007).
DiT was conducted over a 14-week period; this included 12 three-hour weekly classes and two non-attendance weeks. Curriculum planning, content and instructions combined traditional design educational pedagogies with contemporary approaches such as design research and design thinking. Nine classes included a tutor presentation (approx. 30 mins) that discussed practices such as design thinking and project management. One session presented Tuckman’s four-stage team development theory; “Forming, Storming, Norming, Performing” (Tuckman & Jensen, 2010) to students, but beyond that no theory about team working processes was provided. Tutor presentations were directly followed by studio classes. The nine studio classes required the interdisciplinary design teams to participate in the design activities shown in Table 4.2, as required by the project brief. The unit primarily used a collaborative learning pedagogy, where the expectation was that, through interactions with tutor and peers, the teams would develop a solution and learning would emerge (Bruffee, 1999). In line with practice typical of this pedagogy, little guidance was provided to structure either the teams or team roles.

The studio was set up informally and each team was required to work together to progress and share ideas using the design activities shown in Table 4.2. The shared nature of some of the activities aimed to facilitate collaboration through studio-based learning that encouraged team knowledge-sharing, idea development and concept evaluation. To achieve this, the studio was used to review work in progress within and across teams.

Table 4.2 – Design activity list

<table>
<thead>
<tr>
<th>DESIGN</th>
<th>PROJECT MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thumbnails</td>
<td>Gantt Chart</td>
</tr>
<tr>
<td>Brainstorming</td>
<td>SWOT Analysis</td>
</tr>
<tr>
<td>Position Matrix</td>
<td>Budget Planning</td>
</tr>
</tbody>
</table>

Outside the studio, teams were expected to continue to share and develop their team project through an online community (Facebook groups). Studio classes at Weeks 4, 9 and 12 required teams to present a design pitch. At Week 4 they presented ideas; Week 9, solutions; and Week 12 the final design proposal. A cooperative learning approach was applied to these presentations, with graded assessment used to force formal sharing. The final design pitch (proposal), self-reflection journal and peer reviews were all submitted at Week 14.

Assessment at each stage was weighted towards ideas and/or product outcome. These assessment criteria made the visual presentation component of the proposed solution integral to high grades. Interpersonal skills and team management, while deemed core to project completion, were minimally assessed in DiT by peer assessment (10%). Tutor assessment was
moderated to ensure parity at the final presentation in Week 12 and at final review of the design proposal after Week 14. This validation process authenticated the grade and therefore increased the reliability of the grade as a measure of success.

4.2.3 Study Participants

The research participants in this study were 18 undergraduate students and their tutor (Table 4.3). The participants, referred to as the students, were from design and business schools within the university where the research was conducted. Each discipline was equally represented across the study sample, with nine from each discipline.

The interdisciplinary design teams were assigned by the tutor during the first studio class. Students had little or no prior knowledge of their team peers. The process used to assign students to teams had one aim, to create teams that provided discipline diversity. Other variables found in individual teams, such as gender, age and culture, were minimally considered in the team allocation process.

All interdisciplinary design teams reviewed in the research were drawn from one class group to ensure consistent tutor interaction. The tutor participated to provide project advice and facilitate progress. The outcome that was required for the unit was a design proposal, or creative pitch, where research (problem and target audience), budget requirements, marketing initiatives were presented alongside the proposed solution. Each week, after the presentation, the tutor met with each team for approximately 15 minutes. During this time, formative feedback designed to guide team processes and facilitate idea development was provided. The tutor was not a designer and the studio time was not used to demonstrate design practice. Nor was the studio used to prototype or develop design artefacts as might be more common in studio-based learning in design education.

Table 4.3 – Study participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Year</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sally</td>
<td>F</td>
<td>3</td>
<td>Interior Design</td>
</tr>
<tr>
<td>Greg</td>
<td>M</td>
<td>3</td>
<td>Communication Design</td>
</tr>
<tr>
<td>Tony</td>
<td>M</td>
<td>1</td>
<td>Business/Advertising</td>
</tr>
<tr>
<td>Chris</td>
<td>M</td>
<td>1</td>
<td>Business/Advertising</td>
</tr>
<tr>
<td>Tania</td>
<td>F</td>
<td>3</td>
<td>Interior Design</td>
</tr>
<tr>
<td>Sasha</td>
<td>M</td>
<td>3</td>
<td>Business/Advertising</td>
</tr>
<tr>
<td>Matt</td>
<td>M</td>
<td>2</td>
<td>Communication Design</td>
</tr>
<tr>
<td>Kathy</td>
<td>F</td>
<td>2</td>
<td>Industrial Design</td>
</tr>
<tr>
<td>Aaron</td>
<td>M</td>
<td>2</td>
<td>Business/Advertising</td>
</tr>
</tbody>
</table>
4.3 Methods of Data Collection and Analysis

Project stages are shown in Table 4.4. These three stages provided a complete view of the actions and thoughts of each individual in each team as the design process unfolded.

Table 4.4 – Data collection stages

<table>
<thead>
<tr>
<th>STAGE</th>
<th>DATA</th>
<th>TO UNDERSTAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-PROJECT Week 1</td>
<td>• Recorded one-on-one interviews with each individual participant 18 x students – 9 x design and 9 x business 1 x tutor</td>
<td>• Predisposition, attributes and traits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• View of collaborative project work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Learning expectations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Attitudes to teamwork</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Perceptions of factors that influence team efficacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Motivation for participation</td>
</tr>
<tr>
<td>PROJECT Weeks 1–12</td>
<td>• Transcripts of individual team Facebook group posts 4 x Design Teams</td>
<td>• Ongoing engagement with the project</td>
</tr>
<tr>
<td></td>
<td>• Journal entries of each individual participant throughout the project 18 x students – 9 x design and 9 x business</td>
<td>• Factors that influence participation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Factors that influence decision-making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Roles undertaken in the team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relationships that contribute to establishing a community of practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Learning that occurs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Changes in perceptions and predispositions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Factors that influence success</td>
</tr>
<tr>
<td>POST PROJECT Week 14</td>
<td>• Assessment 4 x Design Team (tutor) 18 x students – (peer) 9 x design and 9 x business</td>
<td>• Measures of success</td>
</tr>
<tr>
<td>(after project submission)</td>
<td></td>
<td>• External perceptions of team success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Internal perceptions of team success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• External perceptions of individual success</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Internal perceptions of individual success</td>
</tr>
</tbody>
</table>

Stage 1 provided an understanding of past experiences, personal beliefs and learning expectations. Stage 2 facilitated an understanding of participation through roles to understand interaction, function and collaboration across the team. Stage 3 enabled Stages 1 and 2 to be aligned to assessment to understand the drivers of collaboration and learning in teams.
Combined, these data sets provided a comprehensive tool for understanding the factors that influenced individual and team behaviour. Facebook posts showed evidence of actual participation, while interviews and journal entries provided self-reflective evidence that clarified the feelings and experiences of each student. These two data sets when triangulated provided a view from both student actions and reflections that created a holistic method for understanding the collaboration that occurred in DiT. These data sets were cross-referenced to tutor and peer assessment and both sources were used to identify the value attributed to the individual and the team by external (tutor) and internal (student) sources.

4.3.1 Pre-Project Stage Data Collection

Stage 1 of this research, pre-project individual interviews, was conducted at project onset and examined the perceptions and knowledge of students based on previous team experiences. The aim of the interviews was to understand in depth how team experiences in higher education influenced students’ perceptions of team project work. The interview questions were designed to understand the students’ views on processes, norms, decision-making, belief systems, mental models, interpretations, motivations, expectations, hopes and fears. The interviews were conducted using an informal conversational style. This interview style is known for its capacity to extract personal data from the participant and was consequently deemed an appropriate method for gaining a holistic view of the personal experience of each participant (Guest, Namey, & Mitchell, 2013).

The pre-project phase used recorded interviews with each individual participant and the tutor. In total, 18 students across the four design teams and one tutor were interviewed. The interviews were conducted during Week 1 of the semester and were 30–45 minutes in duration. As the nature of the data sought was highly personal, the pre-project interviews were conducted one-on-one in a private meeting room on campus. The researcher used open-ended experience and perception questions to facilitate probing inquiry (Guest et al., 2013). As discussed in the literature, creative teams rely on a team structure that balances power and trust to develop a safe environment. Therefore, the interview questions sought to extract student opinions about what structures they believed contributed to effective team management. In addition, the questions sought to elicit views on professional practice processes perceived to be common to the team as well as the learning expectations of each individual student in all four teams. This data provided a complete picture of views and perceptions across all teams. The data were manually analysed for common patterns to build an overarching understanding of student views. The data was also analysed to determine factors that influenced these views. The list of questions used to guide this inquiry is shown in Table 4.5.
Table 4.5 – Pre-project interview questions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What previous experience have you had with collaborative projects?</td>
</tr>
<tr>
<td>2</td>
<td>Reflect on a past team experience and tell me what you think it contributed to your learning?</td>
</tr>
<tr>
<td>3</td>
<td>What do you expect this unit will contribute to your learning?</td>
</tr>
<tr>
<td>4</td>
<td>Tell me about one of your teams, what type of communication did you have?</td>
</tr>
<tr>
<td>5</td>
<td>What can you tell me about how the communication styles in the team affect you, the process and the team outcome?</td>
</tr>
<tr>
<td>6</td>
<td>Reflecting on the learning environment for this project do you think it provided a positive learning environment? If so, how? If not, why not?</td>
</tr>
<tr>
<td>7</td>
<td>Reflecting on past projects can you identify ways in which these projects provided opportunities for you to learn skills relevant to your discipline?</td>
</tr>
<tr>
<td>8</td>
<td>Reflecting on past projects can you identify ways in which these projects provided opportunities for you to expand theoretical knowledge as relevant to your discipline?</td>
</tr>
<tr>
<td>9</td>
<td>Reflecting on past projects can you identify ways in which these projects provided you the opportunity to learn skills relevant to the expectations of your potential workplace?</td>
</tr>
<tr>
<td>10</td>
<td>Overall has working in collaborative projects been a positive experience for you? If yes, why? If no, why not?</td>
</tr>
<tr>
<td>11</td>
<td>Reflecting on previous teamwork how fair do you feel the assessment process was?</td>
</tr>
<tr>
<td>12</td>
<td>Reflecting on previous team projects how do you feel about levels of contributions made by peers in teams?</td>
</tr>
<tr>
<td>13</td>
<td>Have you experienced difficulty with team peers? If so, how have you managed conflict?</td>
</tr>
<tr>
<td>14</td>
<td>How do you feel right now about participating in another collaborative project?</td>
</tr>
</tbody>
</table>

4.3.2 Pre-Project Stage Analysis

The data were reviewed, and specific factors identified by students as attributable to participation and contribution value were tabled. In line with a qualitative case study approach, key factors that emerged were used to lead categories and themes identified in the data. Analysis of the student responses revealed themes that aligned to common threads shown in Chapters 2 and 3. These threads were divided into seven categories and five themes (Table 4.6) to provide the scope to accommodate the diverse interview responses. Appendix 1 provides a detailed example that demonstrates how typical responses were categorised.

Table 4.6 – Pre-project interview categories and themes

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Beliefs</td>
<td>View of teamwork</td>
</tr>
<tr>
<td></td>
<td>Personal qualities that impact on teamwork</td>
</tr>
<tr>
<td></td>
<td>Workload distribution</td>
</tr>
<tr>
<td></td>
<td>Learning expectations</td>
</tr>
<tr>
<td></td>
<td>Beliefs about others</td>
</tr>
<tr>
<td>Idea Development</td>
<td>Process for development</td>
</tr>
<tr>
<td></td>
<td>Process for selection</td>
</tr>
<tr>
<td></td>
<td>Selection stage</td>
</tr>
<tr>
<td></td>
<td>Value placed on idea</td>
</tr>
<tr>
<td></td>
<td>Ownership of idea</td>
</tr>
<tr>
<td>Communication Methods</td>
<td>Online tools</td>
</tr>
<tr>
<td></td>
<td>Preferred style</td>
</tr>
<tr>
<td></td>
<td>Face-to-face (in class)</td>
</tr>
<tr>
<td></td>
<td>Face-to-face (outside class)</td>
</tr>
<tr>
<td></td>
<td>Studio feedback</td>
</tr>
</tbody>
</table>
This analysis provided a broad overview of responses; however, a specific analysis of the pre-project data was required to achieve a deep understanding of the influence of past experience on perceptions about team collaboration. It is widely accepted that the presence or absence of a range of environmental and personality factors influence participation (Belbin, 2010). For this reason, this study selected to adopt Belbin’s Team Behaviour Factors, as shown in Chapter 2, Table 2.2, to guide a more detailed review. Critical differences in the adaptation processes were that high-level thinking was defined as innovative thinking and behaviour defined as contribution to the design process.

Further scrutiny of the interview responses was undertaken to identify views about collaborative opportunities or impediments in teams. The data showed alignment to three categories known to contribute to form participation barriers: perceptions, trust and decision-making power. Appendix B provides a sample of this analysis. The final Stage 1 analyses used these categories to interpret student responses and data were coded to identify the personal and professional perceptions, views and attitudes deemed to contribute or inhibit effective teamwork. Instances that showed how or where perceptions, views and attitudes of individual students about their personal traits and attributes contributed to their working processes in teams were aligned to statements students made about their discipline. The data were further interrogated to identify factors students believed contributed to trust and decision-making relationships between peers in teams.

The results of Stage 1 were used to guide the analysis of the collaborative engagement in the team and team processes of each student. Data from Stage 2 (Concurrent with Project Stage), Facebook posts and journal entries were triangulated with Stage 1 data to understand connections between past experiences and collaboration in the DiT. The analysis was also used to understand the practices students and teams applied in DiT to overcome perceived challenges and/or barriers to the project.
4.3.3 Project Stage Data Collection

Stage 2 data collection was undertaken concurrently with project development in the DiT unit during the course of the semester. This approach was selected as it was considered that a review of actual practice would provide a clear method for understanding the processes and experience of students. To achieve this, two data sets were collected: Facebook group transcripts and self-reflection journals. Based on both, the contributions of each individual student were reviewed and the nature and value of contribution was considered in light of the collaborative design process central to DiT.

Facebook group transcripts were manually reviewed and categorised by role (Belbin, 2010) to interpret the contribution each individual student made to work in progress. This analysis was conducted at two levels. The first level identified broad patterns of participation across all teams. The second level delved into analysis of the type of contribution each student made. To achieve this, the data were scrutinised and tagged, as appropriate, to Belbin Team Roles. Appendix C provides a sample of this analysis.

Categorisation of team roles facilitated attribution to function (Appendix F). This provided visibility of actions that enabled the contribution to the design process to be evaluated. These findings were augmented by data from the self-reflection journals. Individual student journal entries were manually reviewed and matched to Facebook posts to provide knowledge about the actions of the team and the felt impact of these actions at the individual level. Appendix D provides a sample of this analysis. Factors within the team that motivated or impeded participation were noted and correlated with actual participation. The combination of these two data sets provided a holistic and honest window of actual collaboration in interdisciplinary design teams. The rationale for selection and application of both data sets is addressed in the following discussion.

The use of Facebook groups to facilitate online communication is commonplace in design teams in the study context and more broadly. Generally, student teams create and use these groups as a primary method of off-campus information sharing and exchange and students find Facebook or other social media tools highly effective for teamwork and creative learning (Pektas, 2012; Oh, 2018). It was therefore considered that transcripts of the Facebook group would provide access to the professional conduct and participation of students for the duration of the project. This created a unique opportunity to look closely at student collaboration and interaction within the project. Based on observed knowledge of previous design teams, it was anticipated that student teams would use the Facebook groups on a regular basis, and for this reason, it was expected that the post threads would provide insight into student contributions to their team’s discussion, processes and artefact development. This proved to be true and all four teams regularly contributed to the team group.
Furthermore, the transcript provided a window to the communication and social engagement that occurred between team members in practice. This view of actual interaction was considered vital to the study, as it provided insight into the student experience. To avoid bias, the researcher was added to the Facebook group of each team but did not post to reduce visible presence.

The data collected via the Facebook group provided analysis of:

- the level of participation of each individual team member;
- peer interaction and responses;
- negotiation techniques;
- conflict management techniques;
- the communication styles that influenced peers.

As discussed in Chapter 3, the design process is iterative and historically focused on artefact development and refinement. In this artefact-driven process, it is known that collaboration across multiple design stages does not always occur (Prentice, 2000; Frascara, 2007). With this in mind, it was considered necessary for student participation to be viewed in relation to the place and contribution it made to the design process. To understand where the student focus is in interdisciplinary teams, the team role analysis was triangulated to identify under which function and at what frequency contributions were made at each design stage (Appendix E).

The analysis of the team roles and correlation to the design process in this study provided a unique window into the actual participation and contribution patterns and trends of the students. However, to understand fully the student experience it was considered that team analysis at an individual level was required. Self-reflection journals were used to meet this need.

The individual self-reflection journal was included in this study as this data set gave visibility into the unspoken or less visible components of the team experience. These journals were private and contained written responses, they were not the visual design development journals, commonly used in design education. (See Appendix L for full project brief). This data obtained from these journals was considered to be particularly important as it provided the opportunity to understand the individual’s self-reflection process and identify specific views and feelings about participation and peers. It was considered that this type of personal data would not be obtained from the Facebook group transcript as students have been found to not to make self-reflection posts on social media groups (Morkel, 2011).

The journal data were used to shed light on the feelings of each individual team member and draw inferences to relationships found to exist between past experiences and current practice. To facilitate the journal, students were asked to respond to weekly targeted questions and prompts, shown in Table 4.7. The reflections, while self-directed, were guided by probing
questions designed to extract responses that would clarify how each student experienced the team interaction (Guest, Namey, & Mitchell, 2017).

Table 4.7 – Self-reflection journal questions

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What influences do you believe contributed to idea selection in your group?</td>
</tr>
<tr>
<td>2</td>
<td>What influences do you believe contribute to learning in this collaborative project</td>
</tr>
<tr>
<td>3</td>
<td>What influence has the communication styles of your team members had on the process, outcome and learning?</td>
</tr>
<tr>
<td>4</td>
<td>How does the learning environment provide a realistic design studio environment?</td>
</tr>
<tr>
<td>5</td>
<td>How does the project provide what you consider a realistic design studio problem?</td>
</tr>
<tr>
<td>6</td>
<td>Can you identify ways in which the project provided opportunities for you to learn skills relevant to your discipline?</td>
</tr>
<tr>
<td>7</td>
<td>Can you identify ways in which the project provided you the opportunity to learn skills relevant to the expectations of your potential workplace?</td>
</tr>
<tr>
<td>8</td>
<td>Have you and/or the team demonstrated a commitment to professional practice through this project?</td>
</tr>
<tr>
<td>9</td>
<td>Has the collaboration increased your knowledge and understanding of professional practice?</td>
</tr>
<tr>
<td>10</td>
<td>Overall has working in an interdisciplinary team been a positive experience for you? If yes, why? If no, why not?</td>
</tr>
</tbody>
</table>

As with the pre-project interview questions, the journal entries were designed to elicit personal reflections and perceptions aimed at understanding each student. However, unlike the pre-project interviews, the self-reflective journal was an assessed unit outcome. For this reason, it was considered that weekly contributions to the journal might be reliably made.

The journal gave students the opportunity to express frank responses to the team situations confidentially. Consequently, the questions sought honest views from students about themselves and their peers in order to identify:

- opportunities individual students had to express ideas in their team
- personal contributions students felt they made to the team
- contributions students felt their team peers made to the team
- views of personal behaviour
- views of team peer behaviour, and
- learning that was achieved through the team.

4.3.4 Project Stage Analysis

The Facebook group data were used to identify participation on two levels: (1) quantity, by discipline and year level, and (2) team roles. Manual analysis methods were used for both levels
of data analysis. The first level, shown in Table 4.8, reviewed and coded posts to align frequency with team, student, discipline and year level.

Table 4.8 – Level one team analysis (example only)

<table>
<thead>
<tr>
<th>Team</th>
<th>Student</th>
<th>Discipline</th>
<th>Year level</th>
<th>Number of posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>Business</td>
<td>3</td>
<td>78</td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>Design</td>
<td>3</td>
<td>67</td>
</tr>
</tbody>
</table>

This analysis provided a broad overview of team participation patterns. Findings gave visibility to the discipline and year level similarities or differences in and across teams. Data provided insight into the posting patterns at a discipline level; however, these alone were considered too superficial to understand the contribution each student made to the collaborative process in the interdisciplinary teams. Therefore, a second layer of analysis was deemed necessary to understand the function contribution of each of the posts. To achieve this, all posts in all teams were manually coded using Belbin’s (2010) nine team roles: Shaper, Implementer, Completer-Finisher, Coordinator, Team Worker, Resource Investigator, Plant, Monitor-Evaluator, Specialist. This enabled an understanding of what individual posts contributed to the team. This data was then aligned with the five design stages discussed in Chapter 3: goal clarification, solution generation, analysis, evaluation and decision (Stempfle & Badke-Schaub, 2002). Appendix C provides a sample of this analysis. This gave clarity to the value individual contributions added to the design process.

Combined, these two analysis sets provided a clear picture of the style, function and value of the students’ contribution to collaborative professional practice across all stages of the design process. The analyses applied to both processes are presented in the following section.

In the interdisciplinary team context of this study, it was expected that known codes and skills would contribute to collaborative participation and in turn influence the student learning experience. To identify the extent to which this occurred, Belbin’s Team Roles were selected as a diagnostic measure in this research. The nine roles describe both function and behaviour attributable in each role as well as the interpersonal strengths typical of the individual undertaking this role. Therefore, many aspects identified by the roles were considered appropriate in the context of this study, as in combination they provided a method for simultaneously understanding the individual student and engagement within the team.

To achieve this understanding, student Facebook posts were tagged to Belbin’s nine roles, as shown in Table 4.9 and discussed in full in Chapter 2. Belbin’s research has identified that each role makes a unique contribution to the team and that team success relies on achieving a balance between these nine roles. Therefore, analysis using Belbin’s roles provided a cross-team view of
role distribution that gave visibility to comprehensive data that were used to evaluate imbalance between each individual and each team across the entire project.

Table 4.9 – Belbin team roles overview (2010)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ROLE</th>
<th>CHARACTERISTIC</th>
<th>DESIGN STAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Oriented Roles</td>
<td>Shaper SH</td>
<td>Challenges the team to improve</td>
<td>Goal Clarification</td>
</tr>
<tr>
<td></td>
<td>Implementer IM</td>
<td>Puts ideas into action</td>
<td>Solution Generation</td>
</tr>
<tr>
<td></td>
<td>Completer-Finisher CF</td>
<td>Ensures thorough, timely completion</td>
<td>Solution Generation</td>
</tr>
<tr>
<td>People Oriented Roles</td>
<td>Coordinator CO</td>
<td>Acts as a chairperson</td>
<td>All stages</td>
</tr>
<tr>
<td></td>
<td>Team Worker TW</td>
<td>Encourages cooperation</td>
<td>Decision</td>
</tr>
<tr>
<td></td>
<td>Resource Investigator RI</td>
<td>Explores outside opportunities</td>
<td>Goal Clarification, Solution Generation</td>
</tr>
<tr>
<td>Thought Oriented Roles</td>
<td>Plant PL</td>
<td>Presents new ideas and approaches</td>
<td>Goal Clarification, Solution Generation</td>
</tr>
<tr>
<td></td>
<td>Monitor-Evaluator ME</td>
<td>Analyses the options</td>
<td>Analysis, Evaluation</td>
</tr>
<tr>
<td></td>
<td>Specialist SP</td>
<td>Provides specialised skills</td>
<td>Decision</td>
</tr>
</tbody>
</table>

Belbin’s roles have clear demonstrable individual characteristics. This enabled accurate categorisation of individual Facebook posts to the nine roles. In each interdisciplinary design team, the content of all Facebook posts was analysed and matched to the role characteristics shown in Table 4.9. Examples of Facebook posts are shown in Appendix D to demonstrate how the research tagged posts’ roles in this research.

While Belbin’s coding gave visibility to the actual contribution made by students, it did not sufficiently provide evidence for understanding the value attributed to the contributions. To understand the students’ true feelings about the actions that occurred, journal reflections were viewed alongside correlating Facebook posts (Appendix D). These feelings and reflections provided deep insights into the way in which the posts and comments made by team peers influenced individual participation and the level of contribution each student was able to make to the team. To identify tendencies to reapply existing perceptions to practice, journal data were correlated with Stage 1 Pre-project interviews (Appendix E). This provided a view of the variations in student actions, attitudes and perceptions that occurred throughout the project.

Finally, the analysis of the interdisciplinary design team in an educational setting would not be complete without a method for understanding how assessment criteria influenced process and practice. The third stage of the data analysis therefore reviewed perceptions and actions found attributable to assessment motivation. The process used for data collection and analysis in this stage is outlined in Section 4.3.5.
4.3.5 Project Completion Stage

The Project Completion Phase reviewed the two graded measures of success, tutor and peer assessment, used in DiT as an indicator of team success. Tutor assessment was used as it was an organisational measure (grades for artefact developed) that gave value to the team. The peer assessment was used to understand interpersonal interactions through the value attributed by peers to individual contributions. The following section outlines both assessment measures.

The tutor assessment in DiT used both formative and summative feedback at Assessment One, Assessment Two and Assessment Three. Table 4.10 shows the assessment criteria used at each assessment stage, this constituted 80% of the assessment in the unit. Summative assessment only was provided for Assessment Four, as this assessment fell after unit completion. In addition, in line with common design educational pedagogies, weekly critiques were used to provide informal formative feedback to each team. Only the composite grade is used in the analysis of the team to show the success each team achieved in direct relation to the entire project.

Table 4.10 – Tutor assessment rubric (example only)

<table>
<thead>
<tr>
<th>ASSESSMENT ONE 10%</th>
<th>ASSESSMENT TWO 10%</th>
<th>ASSESSMENT THREE 15%</th>
<th>ASSESSMENT FOUR 45%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Design Pitch 35%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Workbook 10%</td>
</tr>
<tr>
<td>Creativity</td>
<td>Ease of use</td>
<td>Present clear and</td>
<td>Title page</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>succinct information</td>
<td>Introduction and</td>
</tr>
<tr>
<td></td>
<td>appearance</td>
<td></td>
<td>project aims</td>
</tr>
<tr>
<td>Originality of</td>
<td>Attention to</td>
<td>Organise presenters</td>
<td>Research into the</td>
</tr>
<tr>
<td>idea</td>
<td>detail</td>
<td></td>
<td>idea</td>
</tr>
<tr>
<td>Understanding of</td>
<td>Effective use of</td>
<td>Achieve effective</td>
<td>Strategy</td>
</tr>
<tr>
<td>creative strategy</td>
<td>graphics</td>
<td>time and flow</td>
<td>Costing</td>
</tr>
<tr>
<td></td>
<td>Strong visual</td>
<td>Effective voice</td>
<td>Design fees</td>
</tr>
<tr>
<td></td>
<td>impact</td>
<td>tone and projection</td>
<td>Design methodology</td>
</tr>
<tr>
<td></td>
<td>Effective eye</td>
<td>Effective eye</td>
<td>Team details</td>
</tr>
<tr>
<td></td>
<td>contact</td>
<td>contact</td>
<td>Use of effective</td>
</tr>
<tr>
<td></td>
<td>Engage audience</td>
<td>Engage audience</td>
<td>language</td>
</tr>
<tr>
<td></td>
<td>Use effective</td>
<td></td>
<td>APA referencing</td>
</tr>
<tr>
<td></td>
<td>visuals/multimedia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dress appropriately</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presents in a</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>professional</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>manner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The peer assessment tool used in DiT is based on Professional Skills developed by Winger-Haunty (1990). The full list of criteria, shown in Table 4.11, shows that the peer assessment gives peers opportunity to measure interpersonal interactions and contribution value. Composite team grades were used in the analysis of the team to identify anomalies between actual participation and peer-attributed value for the team member.
Table 4.1 – Peer assessment criteria

| Quality of work contributed meets your expectations | Quantity of work contributed meets your expectations |
| Communicates with respect and consideration for others | Initiates ideas and makes positive contributions |
| Works effectively to agreed deadlines | Works effectively with all group members |
| Timely and regular attendance at meetings | Demonstrates enthusiasm towards the project |
| Makes effort to contribute positively to the project | Can be depended on to complete work as required |


4.3.6 Project Completion Stage Analysis

The judgements made by the teacher in the graded tutor assessment provided a measure for determining the level to which each team had met the unit requirements. As it was external to the team, it had limited scope for understanding the collaborative process undertaken by students. On the other hand, the peer assessment reviewed interpersonal and practice contributions to the collaborative process; therefore, the peer review scores were reviewed in relation to the Facebook posting patterns and the self-reflection journals. The cumulative score attributed to each individual in the team was used to understand what students valued in team peers and to highlight any anomalies that existed between participation patterns and team perceptions.

The three stages of data analysis used in this research provided a method for giving visibility to various aspects of the collaboration that occurs in interdisciplinary design teams. Multiple sources maximised opportunities to understand the team in action from a number of views. When combined they provided a holistic picture of the numerous factors students navigate in team projects and offered valuable insight into the collaboration that occurs. The final section of this chapter outlines the ethical consideration phase.

4.4 Ethical Considerations

A number of ethical issues were considered in this research project to ensure that all data collection abided by the values and principles outlined in the National Statement on Ethical Conduct in Human Research. Before the fieldwork commenced, an Ethics Application was prepared and submitted to the Graduate School of Education, following the University of Melbourne guidelines.

Student teams and the tutor were invited to participate in the research at the start of semester. During the first class, the researcher discussed the study with all students enrolled in the unit (approximately 6 teams x 3 classes = 18 possible teams). The researcher sought to investigate four design teams, and four teams were selected from volunteers. At this time, both student
teams and the tutor were briefed on the semester-long research requirements. The purpose of the study and the rights of all student participants were verbally explained by the researcher and outlined in a plain language statement. All participation was voluntary and participants were able to withdraw from the study at any time.

All study participants were promised confidentiality and assured that no reference would be made to either the participant or the university in which the study was conducted in any report or publication based on the study’s findings. All research processes were conducted with integrity to ensure that participants were treated in a just and fair manner through the research study.

Informed consent was obtained from the school, each design team participant (18 students in total) and the tutor (See Appendix J for Plain Language Statement and Appendix K for Consent Form). All team participants consented to participate in recorded interviews at the Pre-Project Stage, and provide access to the design team’s Facebook group, individual self-reflection journals and assessment measures at the conclusion of the project.

4.6 Limitations

The study was conducted using a small number of case studies (4) in a university with a technical focus and strong commitment to design research and creative thinking. Teaching academics within the faculty where the study was conducted have varied levels of practice experience and different ideas about the value of teamwork. The uniqueness of this environment may limit the application of the study findings more broadly across higher education.

The interdisciplinary team was also limited to two disciplines, design and business; therefore, the findings in the study may not be applicable to interdisciplinary teams with a wider range of disciplines represented. Furthermore, the varied year levels among participants created greater differences in knowledge and skill sets than might be normally expected in teams. This variation, which was present in all teams and unique to the study context, potentially limits the opportunities to generalise the findings across teams where year levels across disciplines might be more equal.

In addition, the interpretive analysis undertaken in qualitative research increases the potential for research bias, meaning that the researcher’s personal viewpoints and values may influence the interpretation of findings. To overcome this limitation and enhance the trustworthiness of the findings, the research triangulated multiple data sources. It combined data collected in situ in three phases, which included interviews, records of actual practice, and artefacts and assessment measures. This range of data sources was selected for the potential it provided to examine contemporary practice more broadly (Yin, 2014).
4.7 Conclusions

This chapter outlined the research approach used in this study. A case study methodology was selected as it afforded the researcher opportunities to gather diverse data that, when combined, provided a holistic picture of the numerous factors students navigate in teams.

Four data sets were obtained to understand collaboration and learning at a student and team level. These data sets provided a method by which the perceptions of the students both before and during the team project could be reviewed. This method allowed for identification of what and how individual views influenced team interaction and provided a means to understand what factors contributed to change the style of interaction and collaboration in interdisciplinary teams. To achieve this, data were analysed in three stages using an agile approach in which findings from one stage informed the next. To gain insight into the student experience at the individual level, detailed interviews (conducted pre-project), self-reflectional journals (produced throughout the project) and peer assessment at project completion were analysed to reveal the factors that contributed to collaboration. Transcripts of Facebook group interactions provided insight into the experiences at a team level. This data were analysed to understand how each individual student functioned in the team, then correlated to the individual to understand the collaboration that occurred. Finally, the team grades were analysed to identify how formal measures of success influenced motivation to collaborate.

The findings from this study are presented in the next two chapters. The first, Chapter 5, provides a detailed analysis of the pre-project views of the students across each team, followed by a broad overview of project participation trends. The second, Chapter 6, focuses on the processes applied at a team level. The analysis interprets team interactions and correlates them with individual views to provide an understanding of how in practice both professional and personal beliefs and knowledge contribute to the collaboration that occurs in teams.
CHAPTER 5

Developing a Collaborative Community

This chapter presents an analysis of student views about team experiences in educational settings. The analysis shows that these views influenced their perceptions about peers and guided the interactions that occurred between team members. In all teams, these perceptions influenced the individual student’s ability to interact with peers and participate collaboratively in the problem solving process.

The findings in this chapter are presented over four sections. The first section, Designing in Teams, shows the team make-up and pre-project attitudes and learning expectations of student participants. The second section, Creating a Community, outlines student views about team cohesion and beliefs about the contribution that personal and peer attributes make in practice. The third section, Contributing to the Team, shows student perceptions of team roles, discipline knowledge and optimum team make-up, and the final section, Individual Participation in Teams, presents a summary of Facebook participation patterns.

5.1 Problem-solving in Teams

The unit at the centre of this study, referred to as Design in Teams (DiT), requires interdisciplinary student teams, in this context design and business students, to bring together disparate discipline knowledge to propose a solution to a complex societal problem. The philosophy of the tutor was that diverse interdisciplinary student teams would increase the team’s potential to achieve this on the assumption that the team would interact effectively and work collaboratively. Conversely, the students, all of whom had previously engaged in team-based learning, believed that diversity created problems that limited the team’s ability to interact and collaborate. Based on their previous experience many students believed that diversity created discord and slowed progression. Section 5.1.1 identifies the points of difference within and between teams. A number of variations were found in team make-up, attitude to teamwork, and learning expectations in each team. The views and expectations expressed by each student pre-project are presented to highlight the influence students thought these disparities would have on team cohesion. In addition, misalignments between the unit content, tutor perceptions and student expectations are identified and discussed.

5.1.1 Team Imbalances Created by Random Team Assignment

At the time this study was conducted, DiT was an elective (non-compulsory) unit for design students and a core (compulsory) unit for business students. All business students stated they
were taking DiT because it was compulsory. Teams were assigned by the tutor based on the discipline the student was enrolled in. This approach was applied by the tutor to maximise professional knowledge and increase skill competency. The tutor stated that she believed that,

[It]he more the class is mixed up the better it is. This particular class group seems to be half business students. That’s good because design students might think about the problem from a different perspective and not just put together an outcome that looks good.

The tutor expected that all team members would interact to contribute their disciplinary knowledge and skills to the project. She anticipated that cross-pollination across disciplines would facilitate “situated learning”. In particular, she hoped that business students would show design students processes that would shift team efforts away from aesthetically driven approaches known to be applied by design students.

Table 5.1 shows the composition of the four interdisciplinary design teams. These teams have been labelled Purple, Green, Yellow and Blue. The tutor achieved discipline balance only in Purple. This team consisted of four students: Sally and Greg, design; and Tony and Chris, business. The three other teams had disproportional discipline representation. Green and Yellow each had five team members, which logistically contributed to an imbalance. Green had a stronger design representation: Tania, Kathy and Matt design; and Sasha and Aaron, business. Yellow was the only team to have higher business representation: Ted design; and Briana, David, Gill and Paul business. The final team, Blue, also had a higher design representation: John, Max and Tina, design; and Kelly, business.

As noted in Chapter 4, this research was conducted in a design environment and required interdisciplinary teams to develop a design proposal (artefact). The tutor stated that she valued diversity in teams for the opportunities it presented for design students to interact and use the design thinking process to consider the problem broadly and evaluate the ideas collaboratively. The tutor’s aim was to shift the student focus away from the “look” or production value of the end artefact towards an informed design solution. However, analysis of assessment criteria shows that unit requirements were heavily weighted towards design knowledge and production techniques. This finding suggests that a marked difference existed between tutor expectations and grade requirements.
Table 5.1 – Team demographic make-up

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Gender</th>
<th>Year</th>
<th>Discipline</th>
<th>Enrollment type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>F</td>
<td>3</td>
<td>Interior Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>M</td>
<td>3</td>
<td>Communication Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>M</td>
<td>1</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>M</td>
<td>1</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>F</td>
<td>3</td>
<td>Interior Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>M</td>
<td>3</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>M</td>
<td>2</td>
<td>Communication Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>F</td>
<td>2</td>
<td>Industrial Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>M</td>
<td>2</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>F</td>
<td>4</td>
<td>Business/Social Science</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td>M</td>
<td>1</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>M</td>
<td>4</td>
<td>Product Design Engineering</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Gill</td>
<td>F</td>
<td>1</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>M</td>
<td>3</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td>Blue</td>
<td>John</td>
<td>M</td>
<td>4</td>
<td>Product Design Engineering</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>F</td>
<td>1</td>
<td>Interior Design</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Kelly</td>
<td>F</td>
<td>1</td>
<td>Business/Advertising</td>
<td>Core</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>M</td>
<td>2</td>
<td>Communication Design</td>
<td>Elective</td>
</tr>
</tbody>
</table>

The team allocation process also highlighted the potential for random team allocation in interdisciplinary student projects to create teams that were misaligned with assessment criteria, leaving some teams poorly equipped to complete project requirements. This misalignment—most apparent in Yellow, with only one design student—has the potential to create teams with significant knowledge and skill shortfalls that may handicap them in terms of grade achievement. The processes undertaken by Yellow therefore present an opportunity to identify points of difference between disciplines. The findings are discussed in Chapter 6 to understand how this variation influenced artefact development, grades and learning.

5.1.2 Student Learning Expectations

Review of individual interview data identified that the learning expectations of the students were misaligned with the curriculum design of DiT. Table 5.2 shows that the “situated learning” expectations of all students were primarily focused on team skills. All students believed that participation in DiT would positively contribute to improve their interpersonal skills and their ability to interact collaboratively with their peers. In contrast, no student anticipated that participation in
DiT would achieve discipline-specific learning, be that in their own discipline or that of their interdisciplinary team peers. These beliefs were contrary to the tutor expectation of achieving learning through “peripheral participation” between peers.

Table 5.2 – Student learning expectations

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Team Skills</th>
<th>Industry Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Communication</td>
<td>Confidence</td>
</tr>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Gill</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Blue</td>
<td>John</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kelly</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>✓</td>
<td>–</td>
</tr>
</tbody>
</table>

In particular the responses showed that students expected to see improvement in communication skills (n=18), interpersonal negotiation skills (n=14) and general confidence (n=9). These team skills were valued by students, as they were considered vital to industry knowledge and integral to future employability. For example, David stated that he believed, “the unit will teach me how teams work together which is important in the field I want to work in”. David’s view was typical and echoed by others. Paul stated that, “in the real world, outside of any academic group you need to be prepared for teamwork in life”. Paul believed that participation in DiT would provide opportunities to learn and practically apply the team skills required not only for work but also for life more generally. The team skills identified by students as important were all represented in the unit learning outcomes; therefore, it was not surprising that students expected to acquire improved interpersonal team skills from the unit.

Students identified they expected minimal learning beyond interpersonal team skills to occur in DiT. Based on past experience, most students had formed the view that team-based units were
unlikely to contribute valuable discipline content learning. For example, Briana stated that, “in terms of content I can’t really think of anything that jumps out, I think it is really more just the team element that is going to be useful and will help a lot”. Sally, however, acknowledged that teamwork added to professional knowledge in a different way; she stated, “I think the focus shifts from the content of the unit to something else and maybe that’s just more of a time thing and ideas sharing thing”. This statement acknowledged that team projects improved skills such as time management and information sharing in teams. This finding showed that, albeit difficult to define, students valued the interpersonal skills acquired through the processes and interactions that naturally occur in teams.

A number of students (n=8) echoed the tutor’s belief that diversity would help expand solution-finding processes. These students expected that participation in DiT would improve their ability to problem-solve (n=8), develop ideas (n=7) and enhance skills that contribute to innovation (n=7). Many students (n=7) agreed with the tutor and believed that difference could benefit the team. For example, Paul stated, “when you disagree, it works to refine an idea and build confidence in the group rather than submitting to one person. It also gives you good insight into people’s perspective”. Consistent with Ettington & Camp (2001), Paul’s example showed that the team process itself can facilitate positive learning. Through teamwork, he learnt that while disagreement posed difficulty, the discussion that ensued had learning benefits. Therefore, Paul had formed the view that where teams actively engaged in discussion improved outcomes would follow.

In contrast, two students clearly stated that the “needs” or “agenda” of the individual in team-based project work had the potential to limit idea exploration. These students reflected that peers who were “very pro their own ideas” typically applied practices that aimed to limit or exclude consideration of the views of others.

The learning objectives that met the expectations of students shown in Table 5.2 were found to be minimally assessed in DiT. Review of assessment rubrics demonstrated that the assessment criteria diverged from the team learning objectives, with only 10% of the assessment directly focused on assessing team skills. Similarly, the unit content revealed that limited information was provided about teamwork theories or interpersonal team skill building. Instead, the assessment focus was on design and artefact development (80%). With this in mind, it is not surprising that all teams focused their collective efforts on high-level design development and production, as they believed this would increase their potential to achieve a high grade. Chapter 6 further discusses the influence of learning expectations and grades on team processes in order to understand how these factors inhibit or facilitate collaboration.

5.1.3 Attitudes to Teamwork in Higher Education
Analysis of interview data showed that students had the view that teamwork would improve their ability to interact effectively with peers and provide opportunities to work collaboratively. All students demonstrated an appreciation for the potential benefit of the team experience and prioritised learning of interpersonal teamwork skills. These skills were considered integral to becoming a “work-ready” graduate. The data showed that past experiences had allowed students to form the view that, while valuable, teamwork was stressful. Team processes were found to be linked to grade expectations, which led to the development of negative practices. These processes limited the team’s ability to create a cohesive working community.

Review of pre-project interview data showed that to achieve a high grade, students would commonly apply specific processes or strategies. The evidence suggests that student teams establish power and control in unorthodox ways, using tactics such as exclusion or dominance, often without awareness or consideration of the flow-on effect on peers. The perpetual application of these approaches shows how the ambition of the individual can influence learning and create negative transfer to practice (Ettington & Camp, 2001).

Further analysis of student responses showed that maladaptive practices—such as dismissing peer ideas and discarding or re-doing peer work without permission—were used by many to achieve one primary aim, high grades. Despite the prevalence of these practices, teamwork was primarily viewed positively by students. Table 5.3 shows that many students (n=10) had a positive attitude towards teamwork, while only a few students (n=3) reported negative attitudes. Some students (n=5) remained undecided; however, these students did believe team learning was valuable, regardless of the difficulty teamwork posed. Interestingly, pre-existing views of teamwork did not translate to a fixed team dynamic, which might suggest that this attitude is dependent on the team itself.

### Table 5.3 – Attitude to teamwork

<table>
<thead>
<tr>
<th>Purple</th>
<th>Green</th>
<th>Yellow</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ve</td>
<td>+ve</td>
<td>+ve</td>
<td>+ve</td>
</tr>
<tr>
<td>-ve</td>
<td>-ve</td>
<td>-ve</td>
<td>-ve</td>
</tr>
<tr>
<td>Not sure</td>
<td>Not sure</td>
<td>Not sure</td>
<td>Not sure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sally</th>
<th>Tania</th>
<th>Briana</th>
<th>John</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ (E)</td>
<td>✔ (E)</td>
<td>✔ (C)</td>
<td>✔ (E)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Greg</th>
<th>Sasha</th>
<th>Paul</th>
<th>Tina</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ (E)</td>
<td>✔ (C)</td>
<td>✔ (C)</td>
<td>✔ (E)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tony</th>
<th>Matt</th>
<th>Ted</th>
<th>Kelly</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ (C)</td>
<td>✔ (E)</td>
<td>✔ (E)</td>
<td>✔ (C)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chris</th>
<th>Kathy</th>
<th>Gill</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ (C)</td>
<td>✔ (E)</td>
<td>✔ (C)</td>
<td>✔ (E)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aaron</th>
<th>David</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ (C)</td>
<td>✔ (C)</td>
</tr>
</tbody>
</table>

Across all four design teams, students (n=10) stated that their previous team experiences had been good. Good experiences had allowed these students to form a positive view of teamwork.
A few students (n=3) identified that “bad” team experiences had resulted in a negative view of teamwork. The primary factor found to contribute to this negative view was the lack of confidence students had in their peers’ capacity to contribute effectively to the team. In one way or another, all students lacked confidence in peers and had experienced inequity. They had consequently formed the opinion that team peers commonly under-contributed and were often unreliable or uncooperative. Some students (n=3) focused on these negative aspects and saw peers as a significant problem. However, most students (n=15) understood the difficulties but focused on the potential opportunities. The factors that influenced perceptions about peer contribution were found to be linked to personality attributes and are discussed in Section 5.2.

Indeed, the presence of “unreliable” students had often been experienced negatively, mostly because it inadvertently shifted the work burden to the more capable or competent team members. This suggest that although students are still novices in their disciplines, they have already found alliance with expected standards and practices. For example, Tania stated, “I don’t really trust people, probably because of bad experiences in the past it ends up being more work for some students than it should be”. This view was echoed by Sally, who stated, “I don’t like group work generally, just wanted to put that out there, I don’t know what would make it a more pleasurable experience really as team projects just give me anxiety”. The impact of under-contribution was often considered a byproduct of the team. Briana demonstrated an acceptance of participation disparity and stated, “there are certain circumstances where no matter how hard you try you get in a ‘dud’ group. You know that’s just life you get the good and the bad”.

Further analysis of student experiences showed that perceptions of under-contribution were relative to quality expectations. Student responses showed that negative perceptions developed when students formed the view that peers were incapable of creating high-level outcomes. Where this occurred, distrust followed and, in turn, resulted in feelings of stress. This stress felt uncomfortable and made students nervous, so, not surprisingly, strategies to alleviate this stress were developed. In practice, when work that did not meet the standards students had come to accept as required by their discipline was contributed by peers, students applied strategies to revise, adjust or disregard the work of others. These strategies, were applied with little regard for the individual, limiting the opportunities for further contributions and indirectly increasing the problem of inequity rather than reducing it.

This work practice was typical and widespread across all teams. However, an anomaly presented in Purple, where Greg clearly stated he had experienced the challenges of under-contribution in teams. Greg identified that teams lacked adequate process to develop and share ideas. He stated,
The unit was strategy-based so there was a lot of talk about best options. It was a bit jumbled running through people’s different ideas and collaborating it all into a single uniform approach.

However, further analysis revealed that Greg viewed this problem as a learning opportunity. He had specifically observed the difficulty teams had when they tried to inclusively integrate ideas and stated that the team had a “jumbled” approach that made collaboration difficult. He noted:

Something needs to be done to give people direction, to pull us together as a single entity. I never really understood structures around things I was more of a ‘free spirit’. I realised I needed to draw things out of people to get them out of their shells a bit and say “hey, come on let’s go with that, it’s an awesome idea”.

This reflective observation was found to provide a catalyst for changed practice. For example, Greg here recognised that a different structure was needed to engage the whole team and guide integration of all ideas and contributions. This shows that the problem of under-contribution viewed in a different way could help students to understand peers and develop methods to manage equity. Greg, rather than view participation inequity as a negative, saw it as an opportunity to develop a different approach that fostered inclusion.

It should be noted that Greg made these observations pre-project. Greg clearly stated his intentions to apply his insight to practice in DiT. He did fulfil this intention and in practice Greg’s insight informed positive practice and contributed to positive learning transfer. A detailed review of the practices and process developed and used by Greg is provided in the Purple team analysis in Chapter 6.

5.2 Characteristics of Effective Team Communities

This research aims to achieve a deep understanding of team interaction and the influence this had on the collaborative design thinking process; therefore, in pre-project interviews students were asked to discuss their views about the development of trust and power in teams. Students identified that individual personality attributes and the value attributed by the team to contributions influenced the development of trust and power relationships in teams. This suggests that both individual and social factors, not considered by the tutor when allocating teams, have the potential to significantly hinder student interaction within the team and result in negative team experiences.

As noted in Chapter 2, Communities of Practice require social processes that enable links between the perceptions of the individual and the practice of the team (Lave & Wenger, 1991). Further research, has shown that the trust and power relationships, contribute to create barriers to participation in team communities (Roberts, 2006), while personality attributes and the
dispositions and qualities of the individual have been found to influence interactions and contribution capacity (Barnett, 2007; Belbin, 2010).

Student responses presented in the following section align with this research and add to it a ‘close-up’ knowledge and understanding of some of the factors that directly or indirectly influence how interdisciplinary student teams interact to develop work processes. The factors identified in this section are used to understand the team interactions. Chapter 6 identifies congruence between the factors identified here and team interaction, collaboration and learning.

5.2.1 Factors that Contribute to Team Cohesion

In pre-project interviews, students were asked to identify the factors they believed contributed to team cohesion to provide an understanding of which factors had the potential to influence the students’ ability to interact freely with team peers. Responses showed that students had clear opinions and could identify specific factors that they perceived influenced the opportunities for individuals to interact and participate in team project work. Analysis of core patterns and themes enabled data to be categorised into four main factors: (1) Equal Participation (work ethic); (2) Social Interaction (friendliness of team); (3) Similarity (views and personality); and (4) Diversity (Views/Age/Culture). Table 5.4 shows the alignment each student acknowledged between the factor and team cohesion, where (✓) indicates positive alignment, (✗) indicates negative alignment, and (n) neutral or no alignment. These four categories are considered throughout Chapter 6 to understand where pre-project beliefs are transferred to collaboration and learning.

When considered in light of past experiences shown in Section 5.1.3, it is not surprising that concerns about participation equity were significant to all participants. Students linked equal participation directly to trust relationships and equity was therefore considered critical to team cohesion. Further analysis also showed that numerous layers of practices and interactions contributed to influence the development of trust.

Social interaction was the second factor considered by most students (n=14) to be a critical team requirement. Numerous students believed that where friendly team relations developed a team rapport followed, and this positively contributed to team processes. Conversely, students (n=2) identified that where teams were “too social”, they showed a propensity to focus on social rather than project matters. This was perceived to adversely affect team efficiencies. For example, Max believed that if team members knew each other there was “less engagement with the project” as friends were more likely to “sway off topic”. He believed that friends were also less likely to force accountability for non-contribution.
### Table 5.4 – Factors for a cohesive team

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Equal Contribution</th>
<th>Social Interaction</th>
<th>Similarity</th>
<th>Diversity Age/Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Gill</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
</tr>
<tr>
<td>Blue</td>
<td>John</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kelly</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>✓</td>
<td>✓</td>
<td>n</td>
<td>✓</td>
</tr>
</tbody>
</table>

Similarity was also deemed important by many students \((n=11)\), who identified that where team participants shared views and personality they engaged more cohesively. Students at all levels of study used visible social cues that they aligned with appropriate practice in their discipline to make early value judgements about the attitudes and capacity of team peers. For example, Sally stated “I thought one guy in our group dressed well, based on that I thought he might be able to handle our graphics well”. Sally used a shared repertoire, Greg’s design flair demonstrated through dress, to conclude they are aligned aesthetically \((Lave & Wenger, 1991)\). Sally anticipated that Greg’s “look” would transfer to design practice and he would contribute to the communication “graphics” design aspect of the project to her satisfaction. This finding shows that visual cues are noted and valued and influence the development of trust within the team.

Analysis of interview data showed that several students \((n=7)\) believed that diversity contributed to create contrary opinions and views, increasing the potential for conflict. These differences made it harder to achieve consensus and slowed team processes. This finding, congruent with previous research, suggests that experience has taught students that team processes are more efficient in homogeneous teams. This finding suggests that student understanding of efficiency is
focused on completion time and may not take into account the benefits diverse thinking adds the development of novel ideas. In contrast, as stated in Section 5.1.1, the tutor held the view that diversity benefited the team and increased innovative potential and, as a result, aimed to create a heterogeneous team. This contrary view of diversity highlighted the misalignment that existed between tutor expectations and student experiences.

5.2.2 The Impact of Trust and Decision-Making Power on Engagement

Diversity was also found to contribute to the levels of trust that could be established, and analysis of the interview data showed that differences that were difficult to bridge contributed to limit the collaborative interaction that occurred in the interdisciplinary teams. This is not surprising, as the establishment of trust and decision-making power relationships are known to affect opportunities for team members to interact fairly and make equitable contributions. In pre-project interviews, students were asked to state their views about the trust and power relationships they experienced in previous teams. All students considered trust and power relationships pivotal to establishing effective team processes. Students believed that trust and power were dependent on a number of interconnected variables, many of which were outside the control of either the individual or the team. Students associated trust and power directly with the factors considered essential for team cohesion: equal contribution attributed to maturity, grade expectations, team roles, and ideas; social interactions attributed to forming social connections with members with whom they share views and attitudes; and similarity attributed to personalities, culture and discipline.

These responses aligned with CoP requirements: joint enterprise and mutuality (Lave & Wenger, 1991) and suggest that for students to establish trust and power they need to make connections to known values and codes. However, when placed in teams with unknown peers, students had minimal ways to reference the extent or type of contribution their peers were likely to make. This type of team situation was typical and created high levels of uncertainty. Students managed this uncertainty by taking actions considered necessary to complete project work to a standard deemed successful.

Analysis of the interview data revealed that most students felt that trust developed when reliability was confirmed. Responses from specific interview questions, summarised in Appendix A, showed that equal contribution and similarity were considered integral to team cohesion. Students identified that reliability was made visible to team peers in two ways; (1) level, quantity, and (2) value, perceived quality, of the contribution. For example, Ted (Yellow) stated that, “completion leads to trust, those who don’t fulfil their obligations, you can’t really trust”. This was echoed by Matt (Green), who stated he trusted those he could “rely on to get things done”.

Reliability was often made visible through online group tools such as Facebook. Matt stated:
Some take a few hours to respond to messages, others get back to you straight away even if just to tell you okay I’ll do it later. The time it took people to get back to me showed me who I could rely on.

Further responses showed that while the student’s ability to meet team obligations facilitated trustworthiness, this alone was not enough. Students believed that shared values were needed for trust to fully form. These values were directly connected to discipline knowledge and codes. For example, Sally (Purple) directly linked quality to shared design views. She stated that trust occurred quickly where alliances were formed: “we’re both the same, both high achievers trying hard to do well. We were on the same level from the start”. Sally valued team peers who shared her values and beliefs, as this enabled her to trust that team peers would meet her work expectations.

Many students shared this view and identified that for team members to be fully trusted, they needed to demonstrate both the ability and will to achieve team standards. Max (Blue) stated he had difficulty trusting team peers because in past projects team members had not “cared about pulling their weight” and, as a result, they had produced “sloppy work”. Max’s comment might imply that in teams there is a propensity for individuals to “tick off” completion with little regard for quality. Alternately Max’s expectation may be a misalignment and his notion of quality and quantity not shared by his peers.

Sasha (Green) was the only student to start the project from a position of trust. He stated that in past projects he thought,

Everyone was good and I could trust them but then towards the end I realised I couldn’t trust everyone. So, I thought I probably need to keep an eye on what’s going on a little more.

In this instance, the experience of the team had created negative transfer for Sasha, who has learnt that team members were not to be trusted and he needed to “keep an eye” on them. The Facebook posts by Sasha in DiT showed he repeated this learnt pattern in direct relation to assessment requirements. His posts increased dramatically in Assignments Three and Four to ensure that quality was achieved in the parts of the assignment that contributed most significantly to grades.

Students believed that the factors that contributed to establish power were more directly related to personality attributes and traits. Perceptions about confidence levels and stress responses contributed to form this view. These traits were considered particularly important and are therefore individually discussed in detail in Section 5.2.3.
In addition to personality traits, student responses showed that an active presence in a team increased decision-making power. For example, Gill (Yellow) stated that effective peers “won’t let something go by the wayside”. Her previous team experiences have allowed her to form the view that active and visible students had a heightened awareness and commitment to project requirements. This awareness contributed to build trust through reliability, reinforcing the interconnected nature of the variables that contributed to perceptions about peers in teams.

Only one student, Ted (Yellow), stated that the “idea developer”, the person who initiated ideas, had increased power due to idea knowledge. This response, however, suggested that Ted allocated idea ownership to the individual rather than the team. This view is of interest because it is contrary to the collaborative aims integral to teamwork. Work practices observed in Facebook posts confirmed that idea development, as noted by Ted, was generally conducted as an individual activity and that little team interaction to develop ideas collaboratively occurred in most of the teams. The influence of this on the design process is discussed in Chapter 6.

Analysis of interview data showed students made minimal connections between social factors and the ability of the individual to interact with the team to influence decision-making. Only one student believed that friendships were used to garner support and influence decision-making in teams. All students, however, agreed that contributions made to the team were judged based on the level of trust and decision-making power the individual achieved within the team.

Examination of the make-up of the team, shown in Table 5.1, shows that, beyond discipline difference, there was diversity in student age and to a lesser extent culture in the interdisciplinary teams. All teams had participants at different study levels by year. Purple had two students in final year and two in first year. Green had two in third year and three in second year. Two students in this team were also international students. Yellow had three students in final year and two students in first year. Blue had one student in final year, one in second year and two in first year. There were more male participants in the study, which created a gender imbalance in Purple, Green and Yellow.

The findings showed that students believed that year level was likely to influence the manner in which students would interact and contribute to the team, in terms of both quality and quantity. As a result, students believed that team peers who were studying at a higher year level made more trusted contributions, which led to increased decision-making power. Students (n=5) specifically identified age as an important variable in team make-up. These students were all slightly older (22–26) and stated that younger students participated less and required more instruction and direction. In addition, these students believed that older team members were “more committed to projects” and that this commitment was demonstrated through an active
project presence. Others (n=2) believed that age and life experience created knowledge differences that positively contributed to idea development and work processes.

Facebook posts (Figure 5.1) suggest that student perceptions that more mature students contribute more in DiT were perhaps true. In all groups, students in their final year of study participated at higher levels by quantity (26 per student) than their less experienced first-year (19 per student) and second-year (17 per student) peers.

**Figure 5.1 – Facebook posts by year level and discipline**

At a team level, this pattern was most apparent in Blue, where John—furthest away both in age and year level from his team peers, Tina, Max and Kelly—made 124 posts compared to a combined total of 148 from the rest of Blue. Similarly, in Purple Sally and Greg, both two years ahead of Tony and Chris, made 259 posts compared to 142. These findings demonstrate that maturity and knowledge, or mastery, assumed to exist more substantially at high year levels, contributed to increased participation. The reasons for this finding are discussed in detail in Chapter 6.

### 5.2.3 The Influence of Personality Traits

Investigation of pre-project interview data revealed participants believed that having certain personality traits contributed to influence power and made team interaction and collaboration easier for the individuals who had those traits. Most students considered that the presence, or absence, of certain traits varied both the balance of power in a team and the value the team placed on the individual’s ability. This also influenced perception about work quality where individuals with certain traits were more likely to influence the team towards their personal discipline expectations. Specific responses to questions about trust, presented in Table 5.5, illustrate that students perceived four traits at the individual level—overbearing, shy, nervous, and
stressed—contributed to the level of participation a student was likely to make. The table is divided in two; the first section shows whether the student identifies with the trait (√) and the second section shows the student’s view of the influence the trait has on participation, positive (+ve) or negative (-ve).

Many students identified that overbearing individuals were likely to have decision-making power, while most considered that shy students were less likely to take on key roles and contribute fully. Some students identified as nervous and/or stressed; in both cases there was a common view that both of these traits contributed to create a controlling presence in the team. Interestingly, these terms were commonly used by students to describe traits they applied to both themselves and their peers. Consequently, the terms have been used here and at later stages of the analysis.

Analysis of the responses showed that students identified that these four personality traits were interdependent and, where present, created feelings of uncertainty within the individual and the team. These traits formed barriers that limited participation and negatively contributed to the team community. These feelings were strongly felt and openly expressed by numerous students (n=13). Not surprisingly, to minimise stress students developed and applied strategies that, “controlled, directed or systemised” team processes. Students discussed (pre-project) and demonstrated (during the project) repeated patterns of strategy application affirming negative learning transfer of these strategies to ongoing practice.

Table 5.5 – Personality traits

<table>
<thead>
<tr>
<th>Team</th>
<th>Student</th>
<th>Perceptions of self</th>
<th>Impact on participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nervous</td>
<td>Stressed</td>
</tr>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Gill</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>John</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kelly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The data presented shows that team project work made several students (n=8) feel nervous or stressed. Students attributed these feelings to personality traits. Many students (n=9) identified that shy team members lacked participation confidence, while overbearing team members hindered full participation by team peers. Both traits were considered deficits in a team. This finding is reflected by Belbin (2010), who found that personality factors such as “extroversion–introversion” and “high anxiety–low anxiety” influenced the manner in which individuals engaged and acted within a team.

Further scrutiny revealed that many students believed that overbearing peers applied strategies that made equal participation difficult. Some students (n=6) stated that their experience in teams had led them to form the view that power was relinquished to the most outspoken and/or dominant individual. These students believed that overbearing team members “pushed their own agenda” and used approaches that “shut down ideas they do not consider appropriate”. Students openly admitted they applied strategies in teams. For example, in pre-project interviews, Tania (Green) identified that she used “controlling tactics” to ensure high grades. In her experience, no team peer had ever contributed work that met her expectations. Consequently, she had little interest or regard for the views or contributions of team peers and stated she took action to “push her ideas forward”. She considered these manoeuvres necessary and made no apology for her actions. For Tania, these strategies have transferred to learning; she applied these same techniques to practice in her team, Green. In DiT, Facebook posts showed Tania applied techniques such as quick response rates to achieve a dominant voice and put forward her view about appropriateness which aligned to her discipline knowledge. The persistent nature of her actions helped facilitate control and her omnipresence worked to limit peer participation. Green experienced Tania’s strategies negatively and as a result she received the lowest peer ratings in the team.

In addition, team peer Aaron appeared to be negatively influenced by Tania’s behaviour. His journal showed a low regard for Tania’s ideas and approaches but he failed to limit her impact. As the project progressed Aaron’s Facebook contributions dwindled and he became the lowest participant across all teams. Despite this, peer assessment showed that Green valued Aaron’s contribution and rated his contribution to the team higher than Tania’s. This finding shows in practice one way by which views held by some students (n=6) that dominant behaviour can be detrimental to the team community that forms.

Interview responses (n=9) further showed that numerous students believed that overbearing, outspoken or controlling team peers presented a threat in teams. This created feelings of stress for individuals within the team and consequently students developed counter actions to minimise impact. For example, Kathy (Green) identified that teams that have controlling team members
need to be managed, stating, “it is rude when people talk too much and show off. You need to make some moves to avoid that”. This behaviour in teams has taught Kathy that individual team members will take credit or control at the expense of the team. Kathy’s statement shows that the actions of overbearing students are strongly felt and require counter actions, “moves” or strategies to address the balance of power.

Further analysis revealed that students who feel stressed or nervous in teams also actively develop and apply strategies to minimise risk. For example, Sally (Purple) was focused on high grades and stated she “got anxious” when this ambition was at risk. To minimise this risk, Sally acknowledged she applied techniques to “control the situation” and systems that enabled her to “keep an eye on things”. Similarly, Briana (Yellow) feels “anxious” and “panics” if she feels the team is “not on track to complete the work”. Like Sally, Briana liked to “keep on top of things” as this helped to manage her stress levels. These measures alleviated feelings in one student yet presented as negative or oppressive to team peers. Sally and Briana were aware that these strategies were sometimes misread by team peers and could present as “controlling” or “overbearing”. However, their feelings of stress, caused by concerns about the team’s ability to meet discipline requirements, were so strong that they trumped concerns about the impact of their actions on others. As a result, these approaches contributed to create a conundrum for students in teams, where many were left to face the difficult job of navigating their participation around controlling personalities.

Facebook posts in DiT showed that students who expressed feelings of “anxiety” or “stress” or identified as “high achievers” commonly used strategies identified pre-project, such as quick and multiple postings, to solidify their position in the team. Sally (Blue, 120 posts) identified that she did not like team work due to previous experiences that had caused her “stress”. These experiences had led her to form the view that task work was rarely “completed to her standard”. Tania (Green, 73 posts) identified she did not like team design work and stated “when it comes to the design process I like to take it on myself”. Tania felt that work completed by team peers was not good enough or “portfolio” worthy. Briana (79 posts) stated that when others “don’t contribute I take it upon myself to re-do their sections”. Other high contributors, Greg (137 posts), John (129 posts) and Sasha (62 posts), all stated that they completed work to compensate for perceived shortfalls in peer task work. The common factor found across all these students was quality assurance, where action was taken to ensure the artefact produced by the team met the unit grading criteria to achieve the grade aspired to.

As identified by Sally and Briana, these actions were indeed felt by team peers. In particular, the findings showed that shy or less-confident individuals felt disempowered by overbearing personalities and were handicapped by their controlling behaviour. This effect was noted both by
shy students and by others who had observed these processes in action. Gill (Yellow), who identified as shy, was concerned about her capacity to contribute to her team intellectually; she believed that her “shy personality” would minimise her participation. Tony (Purple) similarly acknowledged that his personality impacted on his behaviour and limited his participation in teams. He believed his personality gave his team peers the impression that his contribution was less valuable.

Tina (Blue) strongly identified as shy and was aware that her participation was impacted by controlling team peers. In teams, she had experienced “stress” as a direct result of her “shy” personality. These experiences had caused feelings of inner turmoil within her. Tina stated she would think to herself, “I'm afraid to give my ideas, I think it might be a dumb idea or what if they don’t like that idea”. Tina’s negative self-talk assumed harsh judgement which, in turn, limited her ability to contribute ideas and collaborate freely. To compensate for concerns about team peer judgements Tina stated she had developed and applied positive self-talk scripts such as, “I think it will be alright, you have got to stay positive” to help her through the process. Tina, however, had not developed a strategy to improve participation; she simply hoped that team projects in education would help to “build up the skills to talk to people and present ideas to the group while we are still not in the professional world”. However, review of Tina’s Facebook posting patterns in DiT showed that this did not occur. Instead, team peers responded minimally to Tina’s posts and requests and by the late stages of the project the number of posts Tina made dramatically reduced.

The extent of this problem was highlighted further by students who, while not shy themselves, had observed these clear behavioural patterns in team peers. For example, Max (Blue) stated that shy individuals did not contribute because they did not “want their head cut off by everyone else if they suggest an idea”. Max’s comment implied that controlling team members could be ruthless and for that reason shy individuals avoided exposure. David (Yellow) expressed a similar view and stated that controlling team members “limit the participation levels of shy students”. He reflected on how he felt when two of his team peers controlled work flow:

I don’t think they thought I could do the work; there was no real verbal abuse, it was more that I wasn’t really contributing to the work. It did kind of hinder the group work experience for that project.

David’s comment suggests that subtle cues are used to limit participation and that this behaviour leaves less-confident students feeling disenfranchised. In this instance, the perceived potential grade value of the individual contribution led to a lack of trust and created a negative team experience for David.

Greg (Purple) also believed that shy students tended to under-contribute.
I was in a group of three people and I probably did two-thirds of the work. I don’t put it down to anyone being more intelligent or less intelligent or not having the right work ethic or any of that sort of stuff. Both the other students were quite shy, so I took the reins early on. That led to the inevitable lumping of work at my end. That’s something I’m going to try not to do this time but I will still try to appropriately direct things in a positive way.

Greg, as mentioned previously, was reflective and showed insight about the problems shyness could cause. He acknowledged an awareness of his contribution to this problem.

The views identified in Appendix G show the complex interplay between attributes, trust and power. Where poorly balanced, this interplay contributes to non-participation. Freeman and Greenacre (2011) identified that shy students, like Tina, David, Gill or Tony, are misread by team peers like Sally and Briana as non-contributors or free-loaders, which in turn inadvertently minimises their potential to fully participate in the project. Student responses supported this, and all students acknowledged they had felt the effect of non-contribution in different ways. Chapter 6 provides a detailed review of the interplay discussed in this section, to understand how personality traits identified here manifested to contribute barriers to collaboration in DiT.

Overall findings showed that students sought alignment with team peers to enable easy establishment of trust relationships. Similarity in views, work aspirations and general attitude contributed to form trust relationships, while power relied more directly on personality traits. The relationships between these factors influenced the team. Chapter 6 discusses these relationships as found in DiT to understand where they facilitate positive learning and advanced knowledge and skills of peers through “peripheral participation” (Lave & Wenger, 1991).

5.2.4 The Influence of Individual Dispositions and Qualities

Student responses were analysed to determine each student’s natural style of engagement. Findings demonstrated a range of dispositions and qualities in each student and showed that the actions and contributions of students were linked to inherent dispositions and qualities. In particular, the students who demonstrated a will to motivate participation influenced the style of team engagement that developed. These findings have been summarised in Appendix H. As mentioned in Chapter 2, Barnett (2007) defined dispositions as being based on will and qualities as demonstrations of personal attributes. Combined, dispositions and qualities are indicative of the way the individual “engages within their world” and, for this reason, are used here to understand the interaction style the student was comfortable with.

As identified in Section 5.1.2, students demonstrated that they expected to learn real-world interpersonal team skills in this unit. They were motivated to learn based on the perception that
teamwork was integral to future professional work placements. However, the focus of the learning reflected more directly the inherent dispositions and qualities observed in the individual. For example, Paul (Yellow) was respectful of his team peers and showed a strong will to engage with others. His approach to learning was seemingly motivated by his will to engage through communication; he stated, “group work is part of everyday and I think you’ll find most jobs have group work in them, communication skills to relaying ideas is important in every job”. Paul’s dispositions and qualities were echoed in his Facebook posts, which showed that Paul, in line with the views expressed here, communicated significantly with peers and contributed to cooperative work practice in his team.

On the other hand, almost half the students (n=8) demonstrated a will to learn interpersonal skills for the opportunity these skills provided to improve idea development. For example, Chris (Purple) identified that teamwork created possibilities to explore and expand ideas beyond individual knowledge.

When you are in a group, you start throwing around ideas about what you can do and you hear one good idea and then another one. People throwing around ideas can lead you to different things.

Paul (Yellow) echoed Chris’s view and stated that team projects helped develop the skills required to “build ideas”. Teams provided opportunities for participants to “bounce ideas back and forth”. Both students also showed a will to broaden perspective and engage with novel ideas. This was contrary to views expressed by many students (n=11) about similarity and diversity, where in practice students had found that differences in teams reduced cohesion and limited the team’s ability to arrive at a consensus.

In addition, only six students demonstrated respect for others. These students were the only ones who expressed the view that they believed they had made time to listen to and review ideas of all peers. Analysis of Facebook posts showed that, in practice, all teams worked together minimally to develop ideas. Ideas were instead developed at an individual level, nominally evaluated and “pushed forward” based on consensus. This finding reveals a direct contradiction between actual student interaction and the collaborative aims of the unit.

Further analysis of pre-project interview data showed that many students (n=6) had dispositions that could potentially hinder consensus. These students had strong views that their ideas were superior to those of others and demonstrated a clear lack of respect for peer contributions, which posed a potential threat to team cohesion. For example, Tania (Green) stated, “I believe my ideas are better ideas”. Some students also appeared to hold contrary dispositions and qualities. Chris (Purple) displayed a disposition to engage with the ideas of others; however, he also demonstrated qualities such as “stubbornness” and used this quality to justify his lack of will to
engage with the views of others. He stated, “I am a bit stubborn so I will clash if someone is doing something I don’t completely agree with”. Again, Facebook posting patterns showed that these students’ interactions held true to the dispositions noted, demonstrating that in practice they were less willing to compromise than team peers.

On the other hand, the will to learn did not always correlate with the development of interpersonal skills. Almost half the students (n=8) showed self-discipline qualities and a strong commitment to producing high-level team outcomes. These students were motivated by a desire to achieve high grades. Sally (Purple) stated, “I’m a high achiever and I try hard to do well”. Sally’s view of herself was reflected in her Facebook posting patterns. She showed a strong motivation to drive design direction and ensure quality control through active participation.

In addition, the findings demonstrate that in student teams, students can disrespect their peers. For example, a few high-achieving students (n=3) demonstrated a lack of respect for the contributions of their peers by, without consultation, re-doing work they perceived to be unacceptable. This action was accepted by many and, indeed, perceived as necessary to produce an outcome that aligned with the discipline views and would receive the grade aspired to. This finding revealed that, despite inherent dispositions and qualities, grade value was the main driver of action and processes in teams. The influence of dispositions and qualities are considered further in relation to FB posts and journal reflections in Chapter 6.

5.3 Contributing to the Team

This research aims to provide a holistic view of the student team participation to understand the factors that influence collaboration. In line with this aim, the factors students identified as integral to team effectiveness are considered. Findings presented in Sections 5.1 and 5.2 showed that the student experience was influenced by four factors: equal participation, social interactions, similarity and diversity. These factors were interlinked with personality attributes, dispositions and qualities, which in turn influenced the team’s ability to achieve trust relationships and positive power balances. Pre-project interviews showed that students preferred to work in homogeneous teams where they shared views, professional discipline knowledge and social connections with peers. This type of team was perceived to positively contribute to the four critical factors and, in turn, facilitate team cohesiveness. These findings align with what is known about effective CoPs, reinforcing the value of known codes and behavioural norms in team communities (Lave & Wenger, 1991).

However, findings revealed that achieving a cohesive, connected team community was a complex process. Student pre-project interview responses demonstrated that effective practices and project quality were perceived to be dependent on a combination of variables that fit into four
categories: team roles, team contributions, interpersonal communication skills and work flow management.

5.3.1 The Impact of Team Roles

As discussed in Chapter 2, research has revealed that effective teams contribute purposefully across nine roles (Belbin, 2010). These roles are universally acknowledged and accepted as an effective measure of team contributions. Due to the necessary nature of participation across these nine roles, it was hypothesised that in student teams where skills and knowledge are still developing, shortfalls or absence in roles might exist. Where this occurs, the potential for participation inequity or neglect of core processes might arise. To understand whether and where this occurs, students in pre-project interviews were asked to discuss the processes they had used in previous teams to determine, allocate and guide workflow.

Student pre-project responses (Appendix I) revealed a general consensus that the leader or Coordinator role was critical to effective workflow, as this individual guided and managed team peers. The findings showed that students identified that little discussion was given to allocating this, or indeed any, role. Additionally, typical of team projects experienced by students, little significant theoretical knowledge or guidance was provided for role allocation. In the absence of clear processes, roles were haphazardly allocated based on the actions and skills of the individuals.

Review of the data suggested that, based on previous experiences, students (n=17) believed that without a “leader” the team would fail to complete the project effectively. Findings further revealed that student experiences indicated that team projects created learning experiences that challenged students and forced them to participate in team roles outside those they were naturally inclined towards. Over half the students (n=10) identified that they had undertaken leadership roles in team projects, yet only a few students (n=4) identified that this was their preferred role. This finding suggests that team projects place students in roles they have neither the experience nor confidence to participate in effectively, and minimally foster opportunities to build interpersonal skills or individual confidence.

In the absence of clear role allocation processes, individual personalities were considered to be the most significant determinant of roles. Over half the students (n=9) identified that dominant team members were most likely to take on “leadership” roles. Generally, these students “stepped up”—that is, self-assigned—or naturally emerged as “leaders” or “coordinators”. Gill commented on her team peer in Yellow:

There is one person in our group that has been posting like every day and you can see that they’re sort of like an unofficial group leader. They just make sure everyone is on
the mark with what they’ve done, and they always read posts and make comments on it. The student is also very vocal in class and that sucks you in and you believe what they say is the right thing.

Analysis of work distribution practices showed that in all teams, students believed that teams worked more effectively and efficiently when workload was distributed to the strengths of the individuals based on the discipline knowledge they brought to the team. For example, Greg stated:

Ideally you produce an outcome where you have some of the people doing research, some people doing the strategy and some people doing the financial thing based on people’s individual skill sets and personal interests.

Analysis showed that many students felt that when individuals worked to their strengths, a high standard product was cooperatively achieved in teams. For example, Greg, who had high-level design skills, explained that he was often allocated to visual production or finishing roles. However, these roles, often time-intensive, were undertaken near project end and left the individual allocated this role inadvertently responsible for quality assurance. Consequently, this role had both decision-making power and responsibility. Greg identified that often he had been left to complete large amounts of work on behalf of the team as peer engagement dwindled. He stated,

I took all the graphic stuff and for about two weeks that was sweet, everyone was doing the same sort of amount of work they were doing the research and I was doing the layouts, making some of the graphs and things. Then in the last week it started going really badly and I had to put together 45 pages of work from the two pages that had two lines of text and really big pictures they had supplied me. That was their semester’s work.

Further investigation shows that Greg’s experience was shared by other students. In pre-project interviews all students, to some extent, stated that where they had been responsible for creating the final artefact they had contributed to the team at significantly higher levels than their peers. With these experiences in mind, it is not surprising that students expressed concerns and reservations about unequal participation.

Student responses showed that, regardless of the extra workload and responsibility, there was always someone who “stepped up” and took control of the project outcome. The influence and decision-making ability of the individual in charge of production is of particular interest in this study. In Chapter 6, this individual is analysed in detail relative to their team peers to understand how the working machinations of the leader influenced collaboration in each team.
5.3.2 Achieving Equitable Team Combinations

Analysis of pre-project interview responses repeatedly showed that achieving work parity was very important to all students. Findings suggest that, for numerous reasons, the potential burden of the team on the individual is high. Students identified that participation in team projects caused pressure and stress, which created unease that often shifted the burden of work responsibility to the most willing team members.

Findings presented in Section 5.2 showed a consistent view among students that homogeneous teams were more efficient. As mentioned, in DiT the teams were interdisciplinary and allocated to maximise diversity. In effect, the teams presented the antithesis of the student ideal, which potentially posed numerous difficulties for students. As professional discipline was the most significant difference contributing to diversity in the teams, the balance of participation is analysed and discussed with particular reference to discipline knowledge and the relative relationship to project and assessment requirements.

The data revealed that over half the students (n=11) believed that individual, professional or cultural differences in teams posed problems. For example, Chris (Purple) stated, “different views among team members causes chaos”. Two business students raised this issue with specific regard to discipline knowledge. Aaron stated that “tackling projects where students have mixed knowledge is difficult. You don’t have confidence or the background knowledge and they may not be right.” In this example, difference added uncertainty to the process and Aaron felt he did not have the specific knowledge needed to make a quality judgement about the artefact; nor did he trust his peers to make an unbiased decision. He commented further that, in his opinion, “design students create personally preferred outcomes not the best response”. David (Yellow) concurred with Aaron. He believed that design students were “overbearing, had high expectations and controlled processes” and stated that design students “focus on final outcome” seeking the easiest, not best, option.

David also identified another work process that was unique to design students. He stated that these students were more likely to “dominate team members by controlling workflow”. A similar concern was noted by Greg, who had experienced this as a design student. However, from Greg’s perspective he felt he had shouldered the burden of project completion. These comments suggest that professional biases exist and contribute to the perceived value of individual contributions in student teams. The work delegation process used by teams can help explain this phenomenon. Discipline knowledge positions design students in the Specialist role that brings together the contributions of others to complete the final team artefact. It could be assumed that David and Aaron may not have the same skill level as their design peers, making them reliant on others, which may contribute to feelings of being controlled.
Facebook posting patterns (Figure 5.2) showed a significant variation in participation between disciplines, with design students making 708 posts compared to the business students’ 508 posts.

**Figure 5.2 – Facebook posts by discipline**

Analysis of the data found a number of variables that might explain the differences between the design and business students. Many of these variables relate to the factors students identified as integral to team cohesion. The first was year level, with most design students in the study in the final semester of their degree. These students also identified as high achievers; however, this factor was not unique to design students, as all final-year students wanted to achieve a high mark in DiT. The second variable was that all design students were enrolled in DiT by choice, as an elective unit, while business students completed this unit because it was core to their studies. It is possible therefore, that the intrinsic motivation levels between disciplines might be different. Third, and perhaps most significantly, the unit was run by the design school and the final grade requirement was 80% dependent on design-based skills and knowledge. Therefore, it was likely that project requirements themselves might call on the knowledge and skills of the design students more often. Furthermore, in this environment third-year design students might reasonably be expected to have the highest level of expertise to contribute positively to grades. Both of these factors may have inadvertently contributed to increased participation opportunities for design students and, in turn, limited the potential for business students to achieve participation parity.

Given the felt impact of diversity in teams, it is not surprising that, where possible, students took measures to help ensure similarity in team make-up. For example, Tony (Purple) stated, “if I know someone thinks differently to me, I probably won’t sit next to them on a day I know we are going to be organised into groups”. Greg (Purple) confirmed this practice and stated that, “I see people put themselves into sort of groups by sitting and associating with similar people”.
Overall, pre-project interviews showed that negative experiences in diverse teams had transferred to learning. Most students believed that diversity complicated team management and caused problems that outweighed any benefits. As a result, students took measures to avoid diversity. Facebook contributions showed that, in practice, professional diversity influenced participation levels in student teams. Design students in DiT did contribute a greater number of posts to Facebook groups. The influence of the differences found in each team are analysed and presented in depth in Chapter 6.

5.3.3 Effective Communication in Teams

Interview data showed that students valued team project work experiences for the potential they had to improve communication skills, perceived as critical for employment. Students were asked to reflect on previous experiences and identify the mode of communication they believed worked most effectively. Analysis revealed that students believed that both face-to-face and online communication modes were commonly used. Across all teams, opinions about effective modes of communication were evenly distributed and neither face-to-face nor online modes were clearly preferred.

Further review demonstrated that it was the style and tone of the communication that was critical to students. There was unanimous student agreement that friendly informal communication between team members was important. Informal chats—described as “a relaxed friendly banter”—were found to positively contribute to the team’s ability to form trust relationships, as they increased the potential for students to feel comfortable with team peers. For example, Tina (Blue) stated,

You can’t always talk about work with these people you need to have a bit of a laugh have a bit of a talk to get to know them as a person and I think that’s really good. Then you can give them honest criticism in a nice way.

This team experience felt positive for Tina and her shy personality benefited from increased familiarity. The relaxed discussion that familiarity allowed facilitated opportunities for Tina to participate. She was comfortable sharing her true views and opinions with others and, as a result, was able to participate more authentically.

The evidence also suggested that there was a strong view among most students (n=14) that face-to-face meetings were valuable for understanding the views of team peers. This finding is consistent with the literature, which shows that face-to-face meetings provide increased opportunities to understand non-verbal cues (Dennis & Kinney, 1998). These students believed that stronger work processes were established when teams met in the same physical place. In
addition, many students (n=9) identified that face-to-face meetings were critical to early idea development. For example, Sally (Purple) stated,

I’m kind of a face-to-face person and learning is greater just because you can see the people. I mean Facebook is great because we can keep in touch but I don’t know how far you can actually progress just in that medium.

Students also linked participation to visibility in face-to-face meetings, while student absences were correlated with project contribution. Gill (Yellow) stated that students “who don’t actively participate in face-to-face meetings don’t feel like active contributors to the project”.

Analysis showed that the success of face-to-face meetings relied on the students’ ability to follow societal listening codes. Team peers’ ability to listen respectfully was identified repeatedly by students as critical to validating the individual’s contribution to the team. For example, Kathy stated that it was important to,

[respect the space when people are talking and respect what they are saying. Do not interrupt or say an idea is not valid. It is important not to be rude and listen to others.]

Kathy’s emphasis on the importance of listening was echoed by the tutor, who reflected that,

sometimes groups could spend more time listening, I think that’s part of the problem with teams that often they don’t listen.

This tutor comment supported Kathy’s statement and indicated that ineffective listening was a recurring problem for teams.

Face-to-face meetings, however, were not always perceived to positively contribute to workflow and many students (n=16) considered face-to-face meetings to be an ineffective use of time. In particular, a few students (n=2) identified that face-to-face meetings encouraged high levels of social interaction and, as a result, had the potential to become too social or friendly. This suggests that students may not have processes or strategies to adequately moderate the social engagement element in team meetings. For example, students state that in face-to-face meetings they were more likely to “muck around” and waste time on other topics.

In contrast, online communication tools, such as Facebook groups, were perceived by almost all students (n=16) to be an efficient way of managing team processes. Students perceived that Facebook forced the team to shift away from informal communication and apply a more professional tone. This tone was perceived to contribute positively to time management. A few students (n=4) stated that Facebook posts provided a transparent record of participation. Posts worked as a log of work in progress, “an ongoing diary that you can go off”. The transparent nature of Facebook posts made all team members aware of “what everyone was doing” and this,
in turn, made participation easier. Briana (Green) went as far as suggesting that online communication was a “stalking” device that visibly identified contributions. The constant visible nature of the online tool was “always in your mind” and this, combined with the active engagement most students had with social media, left little opportunity for students to say they “didn’t receive it”. For these reasons Facebook, or other online tools, were perceived as valuable for the management of team processes.

5.3.4 Managing Workflow in Teams

Section 5.2.1 revealed that all students considered equal participation a critical factor of team cohesion. However, based on past experience, students had formed the view that equity in teams was rarely achieved. Consequently, they had come to expect disproportional work completion in teams as normal. As noted above, online tools such as Facebook provided a method for tracking participation; however, the problem of equity was far from addressed in most team projects. As identified earlier, in pre-project interviews all students stated that in one way or another they had contributed more work than their team peers to complete projects.

The collaborative pedagogies used in DiT provided minimal structural guidance. This approach left the teams to self-manage problems and students were encouraged to allow team roles to form naturally. The tutor believed her role was to facilitate “team focus, keeping the team on track by reminding them that the process drives the outcome”. Analysis of pre-project data showed that this was typical in team projects in higher education. For example, Sally (Purple) stated that in “team projects we’ve really been left to kind of stumble our way through towards the deliverables”. Student teams faced the difficult task of formulating methods to compensate for unequal contribution with little guidance and, therefore, developed methods to facilitate completion. Sally stated further that, ultimately, actions were “driven by time” and as deadlines approached, she would do “what she needed to do to get things done”. This included completing or re-doing work deemed unsatisfactory in order to achieve her desired grade.

Analysis of patterns of experience showed that Sally’s response was a common approach. In teams, additional workload was often completed by “willing” team members who would “pick up the slack”. The commonality of this approach suggested that many students (n=13) have inadequate processes for managing unequal work distribution, which has led to negative learning transfer (Ettington & Camp, 2006). These students have learnt that the most efficient solution to non-contributor problems was to complete work requirements on their behalf. For example, Chris (Purple) stated,

I was pretty pissed off, yeah, I was a really annoyed. A team member who had the easiest part, or the smallest part, to do didn’t do it. She had some family thing happen,
which we understood but then she needed even more time. It’s hard for me to understand because I didn’t go through her situation but I believe she had commitment to the team to get things done. This caused internal conflict, an argument, as to whether I should let her off but I didn’t confront her I just did the work for her and we all got the same mark.

The findings clearly demonstrate that grade distribution was central to the issue of participation equity. Often, team members received the same mark regardless of contribution; for this reason, team peers would begrudgingly complete work on behalf of non-contributors to ensure high marks. John identified that he “scooped work up and distributed it between the people who are actually doing the work” to ensure that work was completed to “a pretty good standard”. This process, which compensates for students either unwilling or unable, is considered to be the lesser of two evils by many students.

At pre-project interviews, students were also asked to identify strategies and solutions they had applied in teams to manage perceived peer shortfalls. Beyond the completion of excess work by the “willing”, strategies were scarce, and all students stated they rarely addressed poor participation directly with the team members. Two students, Briana and Gill (Yellow) identified that where necessary they sought teacher intervention; it is not clear whether this impacted positively on the process. One student, Aaron (Green) stated that he applied “work-around strategies to outmanoeuvre rogue students”. The details of this strategy were not made clear; however, Facebook posts in DiT showed that Aaron attempted to “shut down” Tania’s ideas. Gill (Yellow) was the only student who identified that she had used a contract or agreement negotiated by the team to outline obligations and consequences. She believed this was an effective way of managing a team. However, she did not suggest or apply this approach in DiT.

The responses provided by students in pre-project interviews indicated that minimal consideration was given to developing process or strategies to prevent problems in teams. This pattern was repeated in DiT. Facebook posts and journal entries showed that where work delivered fell short of expectations, team peers compensated by creating or adjusting work. Chapter 6 gives visibility to the influence of these processes on collaboration.

5.4 Individual Participation in Teams

The final section of this chapter summarises Facebook posts by number and roles to provide a broad overview of participation patterns shown in each team. Table 5.6 presents the participation posts of each student by number. To account for variation in team numbers, the participation is also shown by percentage. This table shows that, as identified by students in pre-project interviews, the number of posts made by individual students varied significantly in each team. The
The largest number of Facebook posts were made by Purple (n=401). These posts by quantity exceeded the other teams by 25%. The number of total Facebook posts made by the remaining three teams were similar. Yellow as a team made the next highest number of posts (n=296), Green made 272 and Blue 247. Making allowances in Blue for team members (n=4) the per person average in this team (n=62) was higher than both Yellow (n=59) and Green (n=54). The average across all team was 67.5 posts.

Two factors students identified in the interviews as important to effective teams, discipline and year level make-up of the teams, might be responsible for this contribution variation. Purple differed from the other three teams demographically, as it had equity in discipline representation, with two design and two business students. It was also the only team that had multiple final-year design students (n=2), who had self-selected to enroll in this elective unit.

Table 5.6 – Individual Facebook posts by team

<table>
<thead>
<tr>
<th></th>
<th>Purple</th>
<th>Green</th>
<th>Yellow</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Posts</td>
<td>401</td>
<td>272</td>
<td>296</td>
<td>247</td>
</tr>
<tr>
<td>Sally</td>
<td>120</td>
<td>67</td>
<td>78</td>
<td>58</td>
</tr>
<tr>
<td>Greg</td>
<td>139</td>
<td>60</td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>Tony</td>
<td>77</td>
<td>56</td>
<td>56</td>
<td>42</td>
</tr>
<tr>
<td>Chris</td>
<td>65</td>
<td>72</td>
<td>50</td>
<td>26</td>
</tr>
<tr>
<td>Aaron</td>
<td>17</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 5.3 shows Facebook posts by team role (Belbin, 2010). Analysis revealed that students participated most significantly in one main role, Team Worker. This pattern suggests a strong will for students to work cooperatively. Interestingly, this finding demonstrates that student participation is aligned with their learning expectation of improving interpersonal skills—in this case, cooperative teamwork.

Not surprisingly, role participation patterns also revealed that students had a tendency to divide tasks by discipline relevance to maximise the existing skills of individual team members. The prevalence of this process across all teams may go some way towards explaining why students felt that discipline learning rarely occurred in teams. Sharing of skill-specific roles, in particular design application, was minimal, allowing little “situated learning” through “peripheral participation” to occur. Instead, roles that required participation in specialist discipline-related activities were controlled by the students who had mastery. These students revised and completed work until it met the quality standards they aspired to.

Across all teams, review of Facebook posts showed that working processes that contributed to ongoing accord among peers were typical. By participating as a “Team Worker”, team cohesion
and cooperation, albeit at different paces and to varying degrees, emerged strongly in each team. This reflected the pre-project findings, which showed that students wanted to improve interpersonal skills that would facilitate effective team processes.

**Figure 5.3 – Distribution of the roles by team**

The study findings further revealed that the combination of participation in Teamwork and Coordination roles together contributed to effectively managing workflow. In all teams, without prompting, individuals “stepped up” to coordinate teams and applied process that regulated workflow to meet deadlines. Analysis of pre-project interviews revealed a consensus that the “leader” or Coordinator was the most important role in the team. The reason typically given for this was that this role “organised” the team. For example, Tony stated that, “the leader checks up and makes sure that everyone is meeting the deadlines otherwise the work needed won’t be completed”. In practice, posting patterns revealed that participation in this role also aligned with student pre-project interview responses. This was made apparent by the concentration of posts in the Coordinator role that used activities such as friendly reminders and action plans to keep the “team on track”.

Sally, Tania, Briana and Tina/John made most of the initial coordination-oriented posts. Except for Tina, all of these students were in the final semester of their degree. However, contributions in the Coordinator role did not remain fixed in any of the teams. Instead, team members interacted responsively with this role to manage their team needs. Across all teams, more experienced team members showed greater participation as Coordinators; in Green, the only team without a first-year student, the Coordinator posts were the most numerous. This suggests alignment of
processes with core “situated learning” principles (Lave and Wenger, 1991), where leadership and direction are provided by the more experienced students, “masters”, to guide the less experienced students, “novices”.

At the other end of the spectrum, team roles that contribute significantly to idea development — Shaper, Plant and Resource Investigator—were the least represented roles. This finding was surprising given that the project intention was to achieve creative thinking and that, pre-project, many students felt that working in teams increased opportunities to broaden ideas. For example, Tony stated, “Sometimes another person will have a really good idea and that will make me click because sometimes I will have like no ideas. So that’s always good”.

Journal entries confirmed that the task of idea development was delegated to all participants and occurred primarily at the individual level. This correlated to preliminary interview data, where Paul stated,

I guess in the past what has sort of happened has been that we’ve developed ideas individually and then come back together as opposed to getting together and developing ideas.

Therefore, while analysis did identify that students believed teams provided opportunities to develop and expand ideas collaboratively, in DiT the teams generally did not avail themselves of these opportunities and did not work together to expand on ideas.

Similarly, the Monitor-Evaluator role was minimally engaged with online and journal entries showed that little interrogation of solutions or idea development occurred face-to-face. Instead, ideas and work were progressed at an individual level and little discussion that evaluated quality was undertaken holistically by the team.

The contributions presented broadly here are evaluated in Chapter 6 to understand how each individual team member collaborated in the design process and how the contributions made were valued by the team, as well as to identify alignment with early learning expectations and personal perceptions.

5.5 Conclusions

The analysis of the pre-project data found that personal and discipline values and beliefs of students influenced the teamwork experience. Findings showed that perceptions and views that students develop about themselves and others do contribute to creating barriers to collaborative participation in teams. These barriers were found to be attributable to personality traits,
dispositions and qualities, and skill proficiency and were shown to pose significant difficulty for teams. These difficulties appeared to contribute to students feeling stressed and overburdened in teams.

The findings also indicated that negative teamwork experiences were common, however students generally held positive attitude towards teamwork. Team projects were primarily valued by students for the potential opportunity to improve interpersonal skills, considered integral to future work roles. On the other hand, students held little or no expectation of gaining discipline-specific knowledge through team project work. All students identified that work tasks were generally allocated in line with discipline knowledge, allowing the task to be completed by the most experienced student. This process was perceived by most students to be beneficial to the team grade. As a result, students rarely experienced cross-discipline “situated learning” in teams.

Unsurprisingly, grades were found to be a major motivator for high-achieving students and, consequently, achieving high-quality project outcomes was an important factor. This encouraged students to take indirect measures deemed necessary to achieve a high grade. As mentioned above, this included discarding the views, opinions and work of peers where deemed necessary.

Chapter six examines the practices and experiences of each team in relation to the design process undertaken by the team. The analysis focuses on participation in team roles and shows where personal views and past experiences influence collaborative practice. The analysis of these processes provides a unique opportunity to expand knowledge of how inclusive processes influence student teams.
CHAPTER 6

Interactions and Collaboration in Teams

This chapter analyses student participation patterns in order to provide insight into the practice environment created within four interdisciplinary design teams. The analysis reveals that the team dynamic, team leadership and curriculum design all influence team interactions and collaboration in interdisciplinary student teams.

Based on analysis of Facebook (FB) entries and self-reflective journal data, the factors shown to facilitate or inhibit collaboration are discussed. Belbin’s nine team roles are used to code FB posts to analyse individual participation patterns. Analysis of the interplay between leadership styles, based on the situated learning model (SLM) (Hersey & Blanchard, 1993), and the trust, decision-making power and learning relationships found in each team are presented.

The following sections discuss in detail the leadership styles and Communities of Practice (CoP) found in each team to examine the professional practice and personal perceptions that influence collaborative participation opportunities in the Design in Teams (DiT) unit.

6.1 Working in a Team with a Supportive Leader

Section 6.1 presents findings of the practices and processes found in the Purple team. Analysis of the Facebook entries demonstrated that the leadership style applied in this team, supportive leadership, contributed to encouraging the team to interact and work collaboratively through the design process. Participation patterns demonstrated in Purple revealed that Greg applied processes that aligned with supportive leadership styles. Greg’s inclusive techniques, unique to Purple, showed high levels of emotional intelligence (EQ), demonstrating a strong will to self-reflect and build relationships to understand his peers. In this way, Greg helped foster a CoP that encouraged collaborative problem investigation, idea development and evaluative reflection. The students benefited from their experience in Purple and all stated that they felt proud of the contribution they made to the team and to the project artefact, which achieved the highest grade of all teams.

6.1.1 Team Member Participation by Role

Pre-project interviews revealed that all students had clear expectations about what their contribution to the team was likely to be. Greg stated he often completed significantly more work than team peers. Sally identified that she managed stress through a constant online presence, Tony believed his “shy” personality would limit his participation and Chris identified that he liked
to explore broad possibilities. Facebook participation patterns in Purple revealed that student contributions reflected personal perceptions identified pre-project.

**Figure 6.1 – Purple roles by student**

The FB patterns in Purple (Figure 6.1) show that, typical of all teams, participation in the Teamwork role was predominant. Uniquely, Purple was the only team to make posts that could be attributed across all of Belbin’s nine team roles. The reasons for this unique FB posting pattern may be attributable to the leadership style that emerged in Purple. Greg, the team leader, used a “softer” supportive style to engage less experienced peers. Greg was able to apply this style of leadership because he was both highly skilled and had a strong regard for the opinion of others. These two qualities formed the backbone of trust in Purple. In particular, Greg contributed significantly in the Specialist role (n=29), where his discipline prowess and willingness to listen positioned him to both undertake and guide high-level artefact development.

Contrary to Belbin (2010), Greg was not limited by his high-level specialist skills to “dwell on technicalities” and “overlook the big picture”. Instead, FB patterns revealed that Greg’s high-level skills helped facilitate a CoP that supported collaborative engagement across a broader range of project activities than any other team. This finding suggests that an experienced and expert leader who has personal qualities, such as a willingness to listen and a capacity to empathise, has the potential to broaden the team’s perspective and in turn increase the motivation of peers to interact collaboratively.

The findings in Purple suggest the role of the leader and the Coordinator are experienced differently and might lead us to consider that highly directive coordination styles in effect inhibit,
rather than engage, individuals in team collaborative processes. Analysis established that Greg, considered by the team to be the team leader, made the highest number of individual FB posts across all teams. Yet, interestingly, Greg made only eight posts in the Coordinator role, less than one-third of the posts he made as a Specialist. This was also significantly fewer than team peer Sally (n=26) and the average of other leaders (n=24). Sally in her pre-project interview identified as nervous and her FB posts demonstrated that, as she had predicted, she monitored processes “to keep everyone on track”. However, these processes did not motivate the team; indeed, both Tony and Chris considered her “overbearing” and FB posts showed their participation reduced in response to Sally’s actions.

Greg’s participation patterns reveal further the blend of knowledge and skills required to be a respected team leader. True to Belbin’s profile for effective Coordinators, Greg was able to delegate well. However, as noted above, Greg also brought to Purple two co-factors: discipline expertise and a willingness to listen. Both factors may have enabled him to influence the team to interact and allowed him to lead the team in a considered, diplomatic manner more closely aligned to the Teamwork role (Belbin, 2010).

In addition, the large number of FB posts made by Greg suggests that supportive leadership styles that encourage team interaction and participation across a broad range of roles bring with them a high work demand for the leader. This finding is important to note in relation to the high value students attributed pre-project to equitable participation; the strong need to achieve contribution equity expressed by all students perhaps explains why the supportive leadership approach was minimally used by other teams.

6.1.2 Developing Team Trust

The participation pattern and personal reflections in Purple show that this team was able to establish strong trust relationships. Purple’s CoP respected and valued the contributions of all team members and, as a result, collaborative participation increased. Analysis showed that Greg facilitated this trust through three unique qualities he brought to Purple: high-level discipline knowledge, self-awareness and willingness to listen to the views of others. Greg repeatedly demonstrated these qualities to team peers in Purple.

Further investigation of FB posts and student journals demonstrated that Greg’s design ability and capacity to represent the team were highly visible to all team members in Purple. For example, Tony posted that Greg’s design work “looks awesome, I love it, beautiful” and reflected that Greg “created everything to the highest possible standard”. Sally posted “Greg I love, love, love your work” and stated in her journal, “Greg put in a lot of effort and came up with great
ideas”. Chris’s journal also showed a high regard for Greg’s ability, which helped to cement trust. Chris reflected,

Greg is creative and very good at speaking about our design. This talent came in very handy during presentations. Greg was able to beef up what the rest of us were saying and relate it back to the topic in an intriguing way.

Chris’s comment suggests that Greg’s contribution to Purple extended beyond design knowledge. Greg demonstrated the ability to appropriately support the team in difficult situations. This ability led Chris to form the view that Greg could be trusted to contribute expert design skills and communicate concepts. These comments further show that Greg’s capacity was consistently proven and respected in Purple.

Additional investigation of student journals revealed the manner and pace at which trust was established varied between students. In all teams, each student required evidence that the CoP supported their particular requirements and allowed them opportunities to make connections to shared views. In Purple, for example, pre-project interviews revealed that shared design codes and beliefs were vital to Sally. She aspired to achieve high grades and believed that design students were better able to meet the assessment criteria in DiT. Greg provided Sally overt evidence of a shared discipline repertoire (Lave & Wenger, 1991). Sally identified that Greg “looked the part”. His visual dress cues formed the foundation for trust. From Greg’s “look” Sally was able to establish the view that the pair shared common ground.

Visual evidence of Greg’s design ability was authenticated for Sally through “joint enterprise” (Lave & Wenger, 1991). The work Greg produced allowed Sally to develop confidence and trust in Greg’s ability. The distinct combination of qualities demonstrated by Greg allowed Sally to form the reassuring view that the pair were “on the same wavelength”. Further analysis confirmed that with this reassurance came trust, which helped moderate domineering behaviour. This enabled the CoP that formed in Purple to focus on the project requirements, unencumbered by controlling tactics. The benefit of trust was highly evident in the changed practices of individual students in Purple. For example, Sally reduced her Coordinator presence online and minimised practices that undervalued peer contributions such as “re-doing” the work of others. Sally stated in her journal that her changed practices were a direct result of “trust in Greg”, which, once formed, enabled her to “step back” from the team.

The findings reveal that in interdisciplinary teams, the variation in knowledge between the design and business students generally formed a barrier to trust. However, Purple was able to bridge this gap primarily because of Greg’s skill and demeanour. Pre-project evidence demonstrated that Greg was reflective and had the “will” to listen to others. These core traits influenced the relationships that occurred in Purple. For example, Greg’s actualisation of this “will” in practice
allowed Tony to form the view that Greg could be trusted. Tony described Greg as “a laid-back type of individual” who “worked hard”. These comments suggest that Tony believed that while Greg was relaxed, he was by no means lazy. Instead, Greg’s participation, albeit unconventional, reassured Tony that he could trust Greg’s commitment and contribution to the team. Tony stated, Greg has great leadership qualities and has been instrumental in bringing everything together in our team. I must praise the design work that Greg has done for us.

Posting patterns showed that as Tony’s trust in Greg increased, so did his collaborative participation. To illustrate, Tony, who had significant design skills, actively posted design work which Greg acknowledged and considered. Greg offered constructive feedback, which benefited Tony, who was shy and less experienced. This supportive approach encouraged Tony to engage with various aspects of the project.

This finding focuses attention on the value of humility in a team. Greg used an egalitarian approach to demonstrate his “will” to listen to others. The findings suggest that Greg’s ability to accept critical review contributed further to establish Tony’s trust in Greg. Tony stated that Greg was “accepting of any criticisms we had for him”. Greg made himself equally vulnerable to criticism and in practice showed he would integrate the ideas of others. Greg, true to his pre-project commitment to “appropriately direct things in a positive way”, used his vulnerability to foster a safe environment. This enabled increased communication and encouraged individuals to understand and respect the contribution of team peers. The CoP Greg facilitated minimised participation barriers and allowed all team members to contribute equally. Tony reflected, “we could all step back and let each other talk … everyone has been fantastic at letting everyone in”.

In-depth probing demonstrated that the supportive leadership style adopted by Greg provided scope for contrary opinions, which was found to enhance collaboration opportunities in Purple. Greg’s “will” to take on the views of others provided a platform for Chris to collaborate. Pre-project, Chris stated that he had a strong need to “put forward” his opinion. Again, to build trust Greg acknowledged Chris’s contribution and took his ideas on board. Additionally, when shown to be wrong Greg quickly acknowledged the value of Chris’s monitoring processes and openly confirmed he had made a mistake. Greg’s actions showed Chris that the CoP in Purple valued diverse views. Analysis revealed that, as the project progressed, Chris’s posting patterns shifted. He embraced roles that “pushed” the team to investigate the problem further and critically evaluated the work in progress. For example, he posted, “I was thinking something along these lines…” or “I reckon we should try this direction… :)” and actively contributed research that informed the problem-solving process. Facebook posts show that Purple collaborated to expand, review and evaluate work initiated by Chris’s comments and suggestions.
The influence of the trust relationships in Purple demonstrate that safe, supported environments can maximise opportunities for creative teams. Greg’s leadership showed that the ability to be receptive to the opinions of others and apply a low-hierarchy leadership approach creates positive relationships. These relationships increase confidence and facilitate opportunities for collaboration across a broader range of project tasks.

The overwhelming power of trust was made evident in Purple through the regard team members developed for each other. Greg’s supportive leadership style quelled student stresses and reduced the need for overbearing tactics. This is strongly expressed by Tony, who proudly reflected on the joint efforts of Purple,

I’m very happy with how we went, each group member put an equal amount of work in and I feel like ours is one of the strongest of the class so I’m very proud.

Tony’s response indicates that a CoP practice that supports inclusive, collegial approaches will create unity and increase the potential to achieve team participation that feels positive and equitable for all team members.

6.1.3 Establishing Decision-Making Power

By establishing trust, Greg was able to increase collaboration and manage processes cooperatively without the need to apply punitive control measures. This was made possible by Greg’s considered application of a leadership style that enabled all students to comfortably contribute to decision-making. Greg was able to apply this process because he had high-level skills and was willing and able to support learning where required. As a result, Purple developed a CoP that allowed students to work together and take risks. This increased individual satisfaction with the team and contributed to achieving a high-calibre artefact that all students were proud to have contributed to.

Review of the data revealed that this most likely occurred uniquely in Purple because Greg took the time to identify the work preferences of his team peers. He then used this information to inform his supportive leadership style. As stated pre-project, Greg intuitively believed that a leadership process that influenced rather than directed would encourage participation. For example, Greg’s journal reflections state that he undertook a process to include and validate peers by asking “what do you guys WANT to do” and “what they can we do within the week” on a weekly basis before assigning tasks. The knowledge gained through this process enabled Greg to understand his peers and engage supportive techniques to motivate them. This inclusive process fostered a collaborative CoP by providing the individual with the choice and opportunity to “build on the work completed in previous weeks” holistically. As a result, collaborative practices across a range of roles and tasks became Purple’s team norm. The positive influence of this approach was made
visible by the observations of the team, which noted that everyone “was SUPER willing to help wherever they could”.

Further analysis demonstrates that personal demeanour helps facilitate collaboration. Greg did not seek out ways to take control or exert power in the team. Instead, he made himself a vulnerable participant, equally willing and able to accept the scrutiny of his peers. Greg’s leadership style helped smooth over team difficulties, support individual needs and facilitate and improve contributions from disenfranchised students.

In practice, Purple’s posting patterns highlighted the flow-on effect of supportive leadership styles. As the project progressed, Tony and Chris’s journals show their views about their design team peer, Sally, had changed. For example, by project end Tony had moved away from his earlier view that Sally was “controlling” and developed respect for her. Tony stated in his journal that Sally was, “very smart and highly skilled, strived for the best and motivates others to do so to”. Similarly, Chris was able to shift from the perception that Sally was “controlling” and view her behaviour in light of the benefit it provided the team. He stated that Sally’s was “driven and produced high quality work”.

In Purple, Greg’s actions showed that a willingness to create a process that engages the team holistically can contribute to increase collaboration. Furthermore, the relationships that evolved demonstrated that positive team experiences have the potential to change perceptions about team work. The transformational influence of Greg’s inclusive style is perhaps best demonstrated by Sally, who—despite a resolute view pre-project that teams were negative—revealed that the experience in Purple had been a far cry from what she had anticipated. Sally stated,

> It is a shame that we won’t have any subjects together after this as there is certainly an (unexpected) level of bonding that happens when you have to pull together to achieve something like this. When I saw how much work everyone had put and how positive the vibe was – I felt genuinely grateful, relieved and proud.

Sally’s comment confirms that when students “pull together” to support each other an “unexpected level of bond” and a “positive vibe” forms.

These findings in Purple demonstrate that inclusive, supportive leadership styles give leaders significant influencing power. By establishing trust, Greg was able to increase collaboration and manage processes cooperatively without the need for punitive control measures. Purple developed a CoP that allowed students to work together and take risks. This increased satisfaction and led to a high-calibre artefact that all students were proud of.
6.1.4 Creating Opportunities for Peer Learning and Support

The CoP that emerged in Purple further benefited the team by creating opportunities for “situated learning” (Lave & Wenger, 1991). FB participation patterns revealed that Greg mentored peers at multiple project points, particularly Tony who, although a business student, had a strong interest in design. Under Greg’s guidance, Tony was able to achieve cross-discipline learning that enabled him to move towards “legitimate participation” (Lave & Wenger, 1991). For example, Greg made positive posts such as, “nice work Tony looks great!” to encourage and guide Tony to complete visual components of the project.

Typical of “peripheral participation”, Tony and Greg also exchanged ideas. Tony highly valued Greg’s opinion and often sought advice from him. Tony deferred to Greg as a master and made posts that expressed a high regard for Greg’s work. For example, Tony asked Greg, “how did you make the circle graphics they look awesome!”. Greg reciprocated, “hehehe I’ll show you in class dude … best part is it’s super easy”. Greg, as shown in this example, facilitated “situated learning” through informal demonstration (Lave & Wenger, 1991). As a result, Tony, albeit in a limited way, acquired cross-discipline knowledge from the project. Evidence of learning in this way was not found in other teams.

An unexpected finding in Purple was the situated interpersonal skill learning through “peripheral participation” (Lave & Wenger, 1991). For example, Greg modelled a different leadership style for Sally and showed her an alternative way to engage with a diverse team. Sally’s “trust” in Greg influenced a behavioural change. Participation patterns indicate that Sally’s trust in Greg enabled her to accept a different leadership approach. As the project progressed, Sally’s FB posts adopted a style that mimicked Greg’s. She moved away from directive Coordinator posts and began using a less formal approach, such as “yoyo where should we meet?” to arrange meetings. She also increasingly made Teamwork posts that invited feedback, with comments like “is this what people envisioned?”, and encouraged peers with phrases such as “go team that was a really good effort”.

These findings suggest that supportive leadership, as shown in Purple, does more than build project skills. This style of leadership also has the potential to create the circumstances required to establish a positive and inclusive CoP that allows individuals to bring variable ideas and knowledge to the team. This approach, while initially intimidating, empowered the individual and created broad learning. This was articulated by Tony in his journal where he stated,

>a wide range of knowledge was discussed which is very interesting to me. While at the start this made me feel like I knew nothing I now know I’m better for it.

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The comment “I knew nothing” highlights Tony’s lack of confidence, while the comment “I now know I’m better for it” suggests that the knowledge acquired has transformed Tony. Posting patterns and journal reflections show that by project end, Tony had changed. His confidence had increased and, as stated, he had acquired unexpected knowledge. Tony’s response highlights the learning potential, at both a discipline and personal level, that an inclusive CoP and supportive leadership affords its team members.

However, supportive leadership approaches such as that observed in Purple, while highly effective, require knowledge, skills and time to create opportunities for appropriately considered decisions. This observation suggests that a balance of high-level organisational and discipline skills are required to foster this style of leadership. In practical terms, Greg had the ability and confidence to comfortably complete the project outcomes. Purple benefited from Greg’s skills, which he demonstrably applied in practice in Implementor, Completer-Finisher and Specialist roles. Greg’s contributions in these roles, the highest across all teams, were instrumental to the development and production of the final design proposal. Observations of team process demonstrated that Greg’s supportive and inclusive leadership style empowered Purple and increased participation. Greg’s approach was less task-focused and, as a result, opportunities for the team to question, explore and engage collaboratively increased. Through feedback and sharing Greg also gave visibility to processes, which helped other team members to become full participants in the team.

The success of Greg’s approach in Purple was clear. Purple received the highest grade—both tutor and peer—of all teams. The findings in Purple demonstrated that by considering others, Greg was able to create a CoP that supported collaboration. Greg’s high-level design knowledge and interpersonal skills helped Purple to develop trust which, in turn, allowed it to operate inclusively with minimal hierarchical structure. Furthermore, by making his own work in progress available for comment and evaluation, Greg encouraged feedback and evaluation. This process signalled to the team that the views of others were valued, which encouraged collaboration across all project stages.

The inclusive CoP in Purple was fundamentally dependent on Greg’s reflective personality. His genuine desire to improve interactions and engagement was integral to the development of inclusive processes in Purple. The findings in the other three teams showed that individuals with the right combination of skills and the “will” to take on leaderships in this way were not common. In fact, in DIT Greg was the only student to demonstrate the full set of requirements. The rarity of
this combination may explain why this inclusive supportive leadership approach is minimally adopted by the remaining teams in the study. The processes applied by other teams are reviewed in relation to Purple to understand further the influence CoPs and leadership styles have on collaborative processes.

6.2 Working in a Team with a Delegating Leader

Analysis of the Facebook entries for the Green team demonstrated that the leadership style applied in this team, delegating leadership, encouraged the team to interact but collaborate less, leaving each team member to work through the design process in a more individualistic way. Participation pattern analysis of Green further revealed that the discipline knowledge, practice skills and views of individual team members influence the CoP that forms in interdisciplinary teams. The individuals in Green were, on average, more experienced students by year level than any other team and, consequently, they tended to operate more autonomously. Not surprisingly, a delegating leadership style naturally emerged in Green.

Investigation of journal entries revealed that Sasha, the team leader and an experienced business student, was aware that his lack of design knowledge could be problematic; he states that “a large percentage of students with a strong design background really daunts me”. Sasha demonstrated the personal insight to reflect on his limitations and acted to appropriately delegate project tasks to match the knowledge and skill level of team peers. For example, Sasha used this leadership style to delegate high-level design tasks to the experienced design students, Tania and Kathy.

This approach created high-level task engagement but minimised collective engagement with the team, which further suited the diverse make-up of the team. Analysis of student journals showed that Green, the only team which had international students, initially developed a fractured CoP due to the differences that presented in the team. The findings revealed that team members highly valued their individual knowledge but had little regard for views and skills that differed from theirs. For example, Tania, the more senior of the two international students, had distinct ideas and views that she noted were often “out of sync” with local students, but which she was unwilling to compromise. This made the delegating leadership approach even more beneficial for Green. Sasha reflected in his journal that he applied a “process to manage the group to achieve a common goal”. By individualising tasks, the potential for overlapping views was minimised and, in turn, the risk of conflict reduced.
In essence, the delegating approach adopted by Green provided the opportunity for all team members to work cooperatively on tasks. FB posts revealed that Green members accepted as normal individualistic work practices that maximised the knowledge and skill resources of the team. This discouraged collective engagement, which diverted the focus away from conflicting views. However, not surprisingly, this also limited the opportunities for the team to collaborate and share knowledge across a range of project stages. As a result, the team had minimal opportunities to optimise its collective capacity or achieve situated practice learning through peripheral participation (Lave & Wenger, 1991).

6.2.1 Team Member Participation by Role

Facebook patterns in Green revealed that student participation mimicked the discipline and personal perceptions identified by team members pre-project. Analysis revealed that Sasha, the leader, demonstrated self-awareness about his knowledge shortfall in relation to the project, which fostered a will to consider ideas and views of the team. Sasha also demonstrated levels of emotional intelligence through leadership activities that gave visibility to the ideas of all team members. In Green, as in Purple, all students had clear perceptions about what their contribution to the team might entail and worked to match these perceptions. For example, Sasha identified as a team leader and took on the leadership role, while Matt, who identified as shy and stated a preference to contribute only in his discipline area, passively contributed in line with his discipline strengths.

Unique to Green, over half the team perceived diversity in teams as problematic. In particular, three students, one international, held the view that ethnic diversity created conflict in teams. Review of student journals revealed that differences in student views and personalities created a fractured CoP. For example, Sasha believed Tania was, “critical and slightly unreliable which makes teamwork hard”. Aaron reflected in his journal that Tania’s ideas did not “suit the local audience” while Matt stated that the differences between himself and both international students were related to poor communication skills, stating that Tania and Kathy were “not always very understandable” limiting their ability to clearly express ideas.
Facebook posting patterns showed that Green minimally collaborated in Shaper, Resource Investigator and Plant roles. Belbin identifies that these roles “challenge” teams to “explore ideas” and accept “new ideas and approaches”. Given the contrary fixed views of individual students in Green, it is not surprising that the team undertook minimal broad project problem investigation in these roles. This diversity and a lack of willingness to accept peer views limited the development of trust in Green. For example, Figure 6.2, shows a strong tendency to focus attention on coordination in this team. Green make the highest number of Coordinator posts across all teams. Analysis showed that many of these posts aimed to “push forward” individual ideas and control functional processes. In particular, Kathy made multiple attempts to direct processes and decision-making. Equally interesting is participation in the Monitor/Evaluator role, where Tania, the highest contributor, believed she “contributed a mature way of thinking”; yet her posts merely point out small details that, while relevant, did not contribute to or evaluate the team ideas. This finding suggests minimal self-awareness and limited objectivity in decision-making.

Consistent with Belbin (2010), this behaviour fits the “allowable weaknesses” in the Coordinator role but falls short of demonstrating the “maturity” and “confidence” required to be respected as a team leader and “chairperson”. Highlighting further that qualities observed in Greg (Purple), such as leadership that instills trust and encourages collaboration require skills that extended beyond directive coordination. This finding presents a vexed problem for educators, where the combination of professional and personal attributes each individual brings to a team is often unknown, making it difficult to find ways to balance differences in short-term team projects.
6.2.2 Developing Team Trust

As mentioned, Green was led by Sasha. Review of Sasha’s leadership style helps to understand further the distinct qualities in leaders that were found to influence team practices and collaborative opportunities. Sasha, like Greg, brought to team leadership a strong will to listen respectfully to team peers, the ability to coordinate workflow and the ability to lead discussion. The findings show that Sasha initially applied these qualities using an inclusive leadership style. Analysis of journals showed that Sasha was respected for his ability to be inclusive. For example, Aaron perceived Sasha to be a strong conceptual thinker who was “good at brainstorming and incorporating other team members ideas into the project”.

However, as in Purple, design students in Green placed high value on the practice codes of their design disciplines. Unsurprisingly, therefore, Sasha—who unlike Greg was not a design student—was not able to provide his team with evidence of design knowledge and skills. The data suggest that this limited his ability to be trusted by the highly skilled international design students, Tania and Kathy. For example, Tania expected of Sasha a contribution of “solid local knowledge about the city”, while Kathy expected a contribution that was “less conceptual”. Viewed from an assessment perspective, Tania and Kathy’s views had validity. The assessment measures in DiT focused on the development of a high-level design proposal.

Further analysis revealed that a lack of discipline knowledge can in many ways be overcome by a reflective, self-aware leader. Analysis of the journal data shows that Sasha acknowledged his knowledge shortfalls and moved towards a delegating leadership style. This enabled him to create a cohesive CoP and foster confidence through the well-advanced skills of the individual. This reliability bridged differences and enabled trust in Green. This finding, congruent with Contu and Willmott (2003), showed that the level at which the individual was able to practice influenced the level to which they were able to participate in the CoP. For example, Green engaged each team member with the project to maximise the benefit of their discipline skill which contributed to creating a high-calibre artefact. By providing opportunity to students to apply their skills, the team was able to see and appreciate the value the individual brought to the team. For example, in Green Tania and Kathy, both with proven design prowess, were able to achieve trust through their design ability. Tania’s design production skills were highly valued by Green. Posting patterns revealed that Tania made a significant contribution to design and production. Green valued this contribution and demonstrated a high regard for Tania’s design work. Aaron, posted, “that’s awesome!!!” in response to her interior designs. Similarly, Kathy in her journal stated, “Tania turned our idea into an amazing 3-D model”.

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Interrogation of Facebook posting patterns further shows that Sasha also aimed to give all team members a voice. For example, he organised a site visit to validate the ideas of all individuals in Green. Sasha posted, “all our ideas can be integrated, we don’t have to pick just one”. Sasha reflected,

I feel as though we understand what each member has said and our concept is really beginning to move in the right direction.

Sasha’s assessment was correct. The journal reflections of Matt, a design student, reveal that Sasha’s opinion was trusted. Matt stated,

Sasha helped us to decide on the idea of making a tourist hub somewhere in the city that would serve as the first stop destination for tourists.

The practice-focused CoP that emerged in Green marginally contributed to collaboration or situated learning. Instead, the knowledge and skills of the individual benefited the production of task requirements without engaging the team holistically. This finding in Green suggests a misalignment between unit learning intentions and project requirements may contribute to misaligned student processes. This finding is consistent across all teams in DiT and further highlights the difficult problem of achieving collaboration in short-term team projects in higher education.

Analysis of leadership in Green showed that, as in Purple, trust in a leader required evidence of the ability to be a team advocate who could speak publicly on behalf of the team. To achieve this, the “leader” needed to be receptive to all ideas and have the ability to anchor disparate ideas and direct a cohesive whole. The evidence from Green shows that, despite his lack of design knowledge, Sasha demonstrated these qualities and was able to inspire confidence, which was sufficient to facilitate reliance on him as the team leader. For example, Aaron reflected “Sasha is our team leader he always stands up and takes control of group discussions and presentations”. Similarly, Matt stated Sasha “has very good speaking skills and can answer the questions”. These findings mirrored those from Purple, where Chris stated that Greg “was able to always beef up what the rest of us were saying to make sure we were relating back to the topic”. Team members in both Green and Purple expressed trust in the belief that Sasha and Greg “would pull them through” at presentation and assessment points. The ability of these two students to discuss and present team ideas convinced both Green and Purple that these individuals “knew”, which added conviction that work project requirements were being met.

Data analysis in Green also demonstrated, as it did in Purple, that as cooperation increases so does trust. Facebook patterns showed that all team members increased participation in the “teamwork” role. This opened up opportunities for team members to display their vulnerability and ask for help. For example, Tania posted, “can anyone help me write my section my English
skills are really bad”, while Kathy posted numerous questions, such as “what I understood is that we should do is ... Is that right?” to seek team advice.

The shifting participation patterns shown in both Purple and Green suggest that, despite existing perceptions, if trust is established students in due course are able to adapt behaviour to work together despite the constraints of the CoP that forms. This is consistent with the literature, which has shown that safe environments foster increased participation opportunities. Furthermore, this evidence in Green highlights the link between decision-making power, trust relationships and the individual’s potential to openly contribute in creative teams.

6.2.3 Establishing Decision-Making Power

Not surprisingly, the findings in Green suggest that differing individual perceptions can create barriers in teams and limit collaborative decision-making opportunities. In Green, individuals used direct and indirect processes to gain power and “push forward” their ideas. These processes significantly impeded trust relationships and created a CoP that accepted individualistic work processes as normal. Considering this finding, it is not surprising that many students, as shown pre-project, prefer to be placed in homogeneous teams.

Further investigation showed that diversity can negatively contribute to and reduce unity in interdisciplinary design teams. In Green, the unique understandings of practice approaches, combined with ethnic diversity, contributed to create conflict. The problem of diversity was made obvious in Green through Aaron’s and Tania’s journal reflections. Aaron stated, “Tania’s thinking was not always in line with the team”. Similarly, Tania had a low regard for Aaron’s ability, writing of his work that he “couldn’t nail his part”. The lack of common ground between the pair was reciprocal, with neither able to respect the ideas and views of the other. An example was Tania’s violation of the CoP code acceptable to Aaron, and indeed the rest of Green, in taking action to garner support for her idea via the tutor. Aaron states,

Out of nowhere she tells the tutor our team idea is building a multi faith centre... gee I was pissed!

Tania’s approach infuriated Aaron, but no process to address these differences was developed. Instead, as evidenced by Aaron’s journal statements, approaches to “politely shut down Tania’s ideas” were applied by the team.

The specific differences in joint enterprise and mutuality shown between Tania and Aaron created misalignment that was deeply felt by both students. Aaron’s reflections suggest that the misalignment was felt not only at a cultural but also at a discipline level. He stated that Tania, “lacked local culture awareness” and “did not understand the concept of brainstorming ... which
was weird and awkward”. Neither student was able to bridge these differing views and, as a result, mutual respect did not develop.

While the misalignment in Green minimised opportunities for collaboration, the delegating leadership style applied by Sasha did allow a collegial working relationship to develop between the pair and the team more broadly. Analysis of Facebook patterns demonstrated that, in an experienced team, two roles—Completer-Finisher and Specialist—can facilitate workflow and maximise the benefit the individual brings to the team product while avoiding interdependence. Sasha’s delegating leadership style facilitated a CoP in Green that supported and valued the production skills individuals brought to the project. This allowed all students to contribute their strengths with minimal conflict. For example, design students contributed significantly to artefact development while business students focused on the financial aspects of the project. Rarely was there a need for paths to cross.

Facebook posts in Green also made it obvious that this approach allowed the high-level skills of the individual to be acknowledged, which made students feel valuable. For example, Sasha posted, “yeah that’s sick! Good work” in response to Kathy’s design work. The full delegation of responsibility this approach facilitated is reflected in Aaron’s journal comments, such as, “Matt took care of the branding” and was supported by Kathy, who stated, “Matt did very good work with the graphic products like the logo, presentation and final documents”. The comments here demonstrate the trust placed in Matt to develop content in his specific discipline area.

Further interrogation of Facebook posts and journal entries revealed that while Sasha’s processes improved workflow, the individualistic nature of the processes applied in Green failed to address the misalignment in team views and limited the development of respectful relationships. Nonetheless, the findings show that delegating leaderships can feel fair to students. For example, Tania, typical of students, placed significant emphasis on equity and was satisfied with the team. She stated in her journal that Green “functioned together well because everyone had their part and jobs were divided equally and voluntarily”.

However, where the leader did not accurately match tasks to skills, this style of leadership had the potential to leave students feeling under-utilised. For example, Kathy did not feel she adequately contributed to the project and stated, “I could have been more productive”. The restrictions placed on her by Sasha’s delegation process are further emphasised by the comment, “I helped Tania with some final renderings and graphic finalisation”. The use of the words “helped Tania” suggests that Kathy felt relegated to a subordinate role that did not maximise her skills.
The findings in Green demonstrate that overbearing personality traits and the power of persistence had the potential to force decision-making. For example, Kathy’s discontent with the team’s design application emphasises the power of “voice” in teams. Tania showed tenacity and commitment to her ideas and demonstrated little hesitation in resorting to tactics that her team peers considered unorthodox. Sasha stated that Tania “sticks to her guns when she believes in something, she will fight for her ideas and is not easily swayed”. While the team did not choose Tania’s specific idea, the design application did align directly to her skill set. In contrast, posting patterns in Green revealed that Kathy and Matt both made minimal contributions to ideas in the early design stages. This was particularly relevant to the less-vocal Kathy, where Green’s design focus, outside of Kathy’s particular design expertise, minimised the scope for her to apply her distinct design skills, leaving her disenfranchised.

6.2.4 Creating Opportunities for Peer Learning and Support

Analysis of the data for Green reveals that Sasha’s delegating leadership style empowered the individual and provided opportunities for students to develop effective work process. As stated above, this allowed a strong appreciation of the discipline contribution of peers to develop. Posting patterns showed that the CoP that developed in Green as a result of a delegating leadership style provided opportunities for “shy” students to contribute their ideas. This is best evidenced by improved participation by Matt, who stated,

The process our team developed helped us to function well together and gave me more confidence to speak up about my ideas.

Matt’s comment indicates that the delegating leadership style in Green provided surety for all students and allowed the team to function effectively to produce a high-level outcome. As stated above, however, the delegating style adopted by this team focused on known skills. This reduced opportunities for shared practice and, as a result, students did not gain practice knowledge from their peers.

In Green, students were not equipped with adequate processes or resources to effectively bridge difference barriers. This significantly limited opportunities to collaborate and learn from each other. This was most evident in peer assessments, where the contributions of the most different student, Tania, despite being significant, were not perceived as being of equal value. Tania consistently received the lowest peer score in Green.

The CoP and leadership styles adopted by Yellow and Blue were different again. Both team leaders applied more directive approaches. As a result, these teams developed CoPs that restricted individual contributions, which limited the opportunities for collaboration. The patterns
that emerged in Yellow and Blue are discussed in sections 6.3 and 6.4 respectively to understand the internal machinations of each team.

6.3 Working in a Team Without a Design Leader

Section 6.3 presents findings from the Yellow team. Analysis of the Facebook entries demonstrated that the leadership style applied in this team, directive leadership, discouraged team interaction. The design process was undertaken individually and there was little collaboration across stages of the design thinking process. Analysis of participation in Yellow reveals that Briana led the mostly inexperienced team using a structured directive style. This approach is congruent with approaches known to be typically used in low-skilled teams, where providing guidance and surety around requirements increases engagement opportunities for inexperienced team members. However, Yellow uniquely had a stronger business representation and, as a result, formed a CoP that was not strongly concerned with the design practices and processes that directly aligned to the core requirements of DiT. This finding is consistent with the literature, which shows that individuals have difficulty valuing practices outside what is known to them.

The directive leadership style was not unique to Yellow. All teams applied directive approaches to some extent to compensate for experience and knowledge imbalances. In particular, the final team, Blue, used an exclusively directive leadership style. In all instances, the application of directive task-focused approaches increased individualistic processes, minimised opportunities for collaboration and inhibited discipline learning through “peripheral participation” (Lave & Wenger, 1991).

6.3.1 Team Member Participation by Role

Further analysis of Yellow made evident the tendency of students to maximise efficiencies by focusing contribution efforts on what they know. As the leader, Briana did not demonstrate any inclination to consider the ideas and views of her team. Some of the students in Yellow did demonstrate levels of EQ through reflections on their own contributions, but little effort was made to understand team peers. Instead, the team generally acted in accordance with existing self-perceptions. With the exception of Ted (the only design student in the team), all students adopted roles considered normal for them in teams. The findings in Yellow showed that students, again typical to all teams, elected to undertake work that matched existing discipline knowledge and skills. Briana identified as a leader and coordinated and guided the team direction. David and Gill perceived themselves as shy and were less active participants. Paul valued team interactions and contributed significantly to facilitating teamwork. Ted stated that he intended to contribute less than usual in DiT due to personal reasons; however, as the work progressed Ted was unable to
remain a passive participant and reverted to a leadership role more typical for him. Ted’s response in Yellow highlights the power of perceptions about what is typical participation; despite his intention to change his actions Ted was drawn into the team to act as usual.

Figure 6.3 – Yellow roles by student

Figure 6.3 shows that participation patterns in Yellow mostly strongly align (61%) with the Team Worker role. This emphasised the propensity, found in all teams, to acknowledge and support the work of individuals within their team.

Facebook posting patterns showed that Briana’s directive leadership did not encourage initiative, provide feedback or facilitate opportunities for collaboration, in effect avoiding the core processes that add rigour to the design process. Instead, the CoP that developed accepted as normal a structured workflow that allocated tasks to team members for individual completion. This approach, in contrast to that of Green, limited participation to specific tasks at the discretion of the leader and without consideration of how to maximise strengths. For example, Briana stated that work tasks were allocated to ensure “everyone contributed in some way this really helped us to establish our team dynamic”. The experienced business students felt comforted by these directives and worked consistently to deliver assigned tasks as requested.

The findings show that this process discouraged evaluation and high-level finishing. Yellow showed minimal participation in Monitor-Evaluator and Specialist roles. The findings in Yellow further revealed that misaligned knowledge and skills, manifested particularly in the leader, contributed to misdirection and significantly disadvantaged the team. For example, the discipline distribution in Yellow was weighted towards business (four business and one design). Considering
this in light of Belbin (2010), it might be assumed that business students, inexperienced in design practice, were insufficiently equipped to tackle the evaluative processes integral to the design process both individually and collaboratively.

Investigation of posting patterns revealed that the shared repertoire of the majority in Yellow created a CoP that valued knowledge and processes that did not align with the design codes and practices required by DiT (Lave & Wenger, 1991). Entries in student journals support this. Ted, the only design student, considered the team to be ineffectual, stating that,

when I posed questions to them regarding the tasks that would need to be completed in order to implement our concept, they were unable to contribute any reasonable ideas to the process.

The business students, in turn, reflected that Ted’s work was “different to most of ours” and “helpful with implementation steps”, which implies that Ted’s design-focused approach did not align with the majority.

Facebook posting patterns also reveal that Yellow made few posts in Shaper, Resource Investigator and Plant roles. This finding, coupled with Briana’s directive leadership approach, suggests the team had little scope to expand problem-solving. For example, Ted described in his journal that Briana was, “confident in putting her opinions forward” but unwilling “to hear alternative options”. Briana, confident in her design knowledge, showed little regard for the divergent opinions of her peers, thus contributing to a CoP that did not foster respect for the ideas of all team members.

The findings in Yellow show again that overbearing team members have the potential to control team participation. In Yellow, Briana gave significant attention to the Completer-Finisher role but focused on tasks that were misaligned with the unit requirements. Her leadership style was not consultative, and the rest of the team were therefore disinclined to put forward opinions and, instead, chose to “keep notions to themselves”. This problem, considered in light of the discipline imbalance found in Yellow, further highlights the need for effective team selection and pedagogical guidance to enable teams to develop support structures that facilitate equitable, collaborative practices that can benefit the team and team product.

6.3.2 Developing Team Trust

The research shows that Purple and Green trusted leadership that balanced effective team management skills, relevant discipline knowledge and the ability to bring together and present holistically the ideas of the team. In Purple, these qualities were inherent in the leader, Greg. In Green, the leader, Sasha, was aware of his design knowledge shortfall and delegated tasks to
compensate. Both approaches assumed leadership in teams in line with the shared knowledge and practice of the experienced majority, design. This created a CoP that valued and favoured design discipline codes.

However, as noted above, Yellow presented a unique demographic make-up with a strong business team representation. As a result, the CoP minimally understood, and consequently under-valued, the design codes and practice that were integral to project development in DiT. In Yellow, the less design-experienced team members needed strong guidance and valued equitable participation. Consequently, the CoP that emerged was task-focused and relied on Briana’s knowledge, albeit out of sync with the unit, to direct project tasks.

Briana’s directive leadership made her reliability obvious to peers. Briana was described as a “good communicator and a good leader” who “made sure all tasks were completed”. Her value was clear to the team; for example, Paul said that “she shined [sic] through as a natural leader who kept everyone on schedule”. Facebook posting patterns show team members were compliant and completed tasks as requested by Briana.

Review of student journals revealed, however, that no student in Yellow expressed the high regard for Briana that team members in Purple did for Greg. This might suggest that Briana, perhaps due to the low design skills in Yellow, did not need to inspire the same team confidence in her ability that Greg did in Purple. As with Sasha in Green, no student in Yellow commented positively on Briana’s design expertise. However, as noted above, unlike Green the majority of Yellow knew little about design and, therefore, did not undertake activities that focused on adding design value to either ideation, evaluation or production. As a result, Briana did not need to prove her design prowess; she was simply able to direct tasks to her low-experience team at her discretion.

The discipline imbalance in the team also contributed to constrain the team’s interaction with the collaborative design process it was set up to achieve. For example, Briana was resolute that her ability would compensate for any design shortfall and did not seek contributions from Ted, the only design student. She stated, “I’m good with Photoshop and photo editing and that kind of art stuff”. The alignment of design skills with software knowledge in this statement make transparent Briana’s lack of understanding and appreciation of the design codes and practices needed in DiT, where project production had little reliance on photo editing or “art stuff”.

The majority of Yellow visibly accepted and supported Briana’s work. For example, FB posts state “great work” in response to Briana’s designs. To the more experienced design student, Ted, the same work made clear the team’s inability to engage in an appropriate design process and judge design quality. Ted reflected in his journal that Yellow was unable to “work collaboratively” and stated that Briana’s work “did not meet his aesthetic”.

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In Yellow, an additional factor, obligations external to the team, further reduced participation. Ted, the only design student, had little “will” to actively engage with the project and he exonerated himself from the team outcome. For example, Ted revealed in his journal reservations about Briana’s skill level and stated,

I was not a big fan of the aesthetics of the presentation slides or production means, but I did not commit any work to the slide design or choice of program so I cannot complain.

Despite having little trust in Briana’s ability to make appropriate decisions, Ted’s personal commitments were more important to him. Therefore, he did not question processes in the early project stages, leaving Briana – unlike Sasha – to lead unencumbered.

This finding is critical in contemporary higher education settings, where students are faced with numerous conflicting demands. The team offers students an opportunity to minimise these demands. For example, in Yellow Ted openly stated pre-project that he would only “dutifully” participate as he was aiming to achieve a balance between conflicting demands. This finding suggests that less “willing” students may work cooperatively to minimise work requirements in team projects. However, the evidence suggests that this is minimally present, as this response was only noted in Ted.

6.3.3 Establishing Decision-Making Power

Further analysis of Yellow demonstrated that, like trust, decision-making power was established early. Briana’s confident style, coupled with her directive leadership, gave her significant control. This limited the opportunities individuals had to contribute independent views and thus hindered unbiased decision-making. For example, FB posts revealed that Gill responded positively to Briana’s work – she posts “looks great” – yet Gill reveals in her journal that she was “really against” the work but did not feel comfortable disclosing this to the team. This example highlights the decision-making power created by Briana’s self-assured style, with less experienced students deferring to her even when they had doubts about the value of her contribution.

The findings reveal that Briana’s style gave her almost exclusive decision-making power. The evidence suggests Briana had limited ability to reflect on the team’s engagement with the project requirements. For example, she perceived the team as working well, stating that “no-one was rude or disrespectful to others which established a good team dynamic”. Patterns in Yellow did show that the team was highly cooperative and polite; however, the dynamic was such that the team became disinclined to “push” beyond the boundaries set by Briana. This finding is consonant with the literature; Yellow, under Briana’s directive style, developed a CoP that clarified task goals but did not hear the ideas of all team members. This approach focuses on team
consensus but minimises the team’s ability to develop working processes that enable collaborative idea generation and effective solution analysis.

Further evidence from Yellow demonstrates the restrictive nature of directive leadership. The findings suggest that Briana’s directive leadership style provided certainty but did not create a respectful culture that supported open communication. Team members acknowledged in their journals that they experienced Briana’s leadership as controlling. For example, Gill expressed a reluctance to express comments that contradicted Briana, while Ted stated Briana was “rather close minded to outsider perspectives or hearing alternative options”. In Yellow, team members Gill and Ted displayed a tendency to ‘play it safe’. The ‘play it safe’ response demonstrated in Yellow has been consistently shown to form a participation barrier that restricts creative individuals and limits the application of collaborative practices that lead to new ideas (Jaskyte, 2008; Hoegl & Gemuenden, 2001; Decusatis, 2008).

The analysis revealed that the directive style applied by Briana can put the needs and perceptions of the individual ahead of the team. This finding is particularly critical in the context of the interdisciplinary team, as it further highlights the potential limitations of poorly constructed teams and imbalanced team roles. In Yellow, this approach created a highly controlled environment that individualised work practices and discouraged collaboration. This approach limited Yellow’s ability to understand the complex problem from multiple viewpoints and, in turn, evaluate the solutions holistically. Gill’s journal entries confirm Yellow’s design process was cooperative but that the team rarely worked together collaboratively. Idea development was found to be undertaken independently and idea selection made by consensus without adequate evaluation processes. Gill described Yellow as “[coming] together after working apart to cement a concept”. This approach, not unique to Yellow, was contrary to the shared interdisciplinary learning objectives in DiT.

Further analysis suggests that in “novice” student teams, controlled workflow can limit the ability younger students have to contribute to addressing problems that occur at a team level. For example, Paul, an inexperienced business student, recognised that Yellow’s processes were not leading the team towards a singular goal. He felt that the team idea lacked unity and stated that the “presentation gave us the realisation that we need a more centralised approach on a more specific idea”. Despite this awareness, neither Paul or any other business student voiced concerns or actioned change in Yellow. It was not surprising that the first-year business students likely lacked the knowledge, skill and confidence to question Briana. However, what was surprising was that these same students willingly followed the lead of Briana but undervalued the contributions made by Ted, the only experienced designer, who came to be considered a non-contributor in this team.
The view that developed in Yellow about Ted suggests that there may be a strong relationship between early participation and perceived contribution value. In Yellow, Ted’s lack of early FB contributions suggested to the team that Ted added little value. For example, David stated of Ted, “he has no opinions or leadership skills”. This perception became entrenched in Yellow and despite changes to participation and visual evidence of high-calibre contributions late in the project, Ted did not gain the team’s confidence in the same way Briana had.

Deeper investigation of reasons for perception in Yellow revealed the specific challenges discipline differences create for students in interdisciplinary teams. In particular, the findings in Yellow suggest that under-represented disciplines by number have difficulty establishing processes and practices that are out of sync with the majority. This is consistent with the literature, which shows that when individuals in teams do not meet the expectation of the team, they are less likely to form trust relationships with their peers, which can compromise team cohesion and learning (Jarvenpaa, Knoll & Leidner, 1998).

For example, Ted was aware of the core unit requirement to establish collaborative practices in Yellow but was unable to engage the students actively in this process. In his journal he noted,

> I am not feeling super confident at how the group is moving forward. There seems to be a lack of direction as to how the project will come together. Working with the team was unsettling, less a team effort and more of a solo task, though not for lack of trying. I made effort to engage the team and to get their input, but they were unable to contribute any reasonable ideas to the process.

This example highlights the differences in working process between discipline pairs, where what seemed normal practice to one discipline representative was deemed unacceptable to the other.

Patterns in Yellow further revealed that students were disinclined to shift from their known approaches. For example, Yellow’s CoP developed a culture of dependency that inhibited the team’s ability to “engage” in collaborative idea-sharing. As a result, Ted, unable to foster collaborative practices in Yellow, adopted the processes accepted by the majority and contributed the benefit of his knowledge using a directive task-led approach. He reflected,

> It became clear to me that the group was not functioning well. The presentation lacked order and clarity. I decided I needed to step into a management role if the project was to be completed to any kind of acceptable standard.

Facebook posts showed that Yellow members were able to focus on design tasks and contributed as requested when directed by Ted. For example, Gill stated that Yellow “began looking at brands and trademarks” (an early design task) in Week 10, a week after Ted “stepped up”. The positive team response to direction was in direct contrast to Ted’s attempts to engage
the team collaboratively. This finding suggests that the directive approach, once established in an under-skilled team, is difficult to shift.

The patterns shown in Yellow illustrate the influence of knowledge imbalance under the leadership of an ill-equipped leader. Analysis identified how a significant discipline knowledge imbalance and skill shortfalls in a team can contribute to the development of outcomes that are misaligned with project requirements. This finding, while not surprising, does highlight the core problem of assessment in interdisciplinary teams. In DiT, the requirements of the unit itself did not compensate for interdisciplinary differences in teams. As a result, Yellow, with lower levels of design knowledge, was inadequately equipped to meet the assessment criteria. This emphasises the vital need for educators to ensure that equitable results can be achieved by all teams regardless of the discipline expertise of individual students.

6.3.4 Creating Opportunities for Peer Learning and Support

The findings in Yellow reinforce the views noted in Chapter 5, namely that the interpersonal skills gained through the team experience were valued by students. Review of journal responses in Yellow demonstrated that most students felt positive about the team experience in DiT and believed it had contributed to improve their knowledge of how to work and interact with others. Furthermore, the evidence revealed that developing students can achieve this learning under directive leadership.

The leadership style in Yellow had many benefits. Analysis revealed that the systematisation of work processes and setting of clear tasks and goals made requirements clear, which increased participation opportunities for less experienced students. In effect, the CoP that formed in Yellow provided a transparent safety net for shy and inexperienced students and developed a team culture that felt “fair”. For example, David, a shy student, felt Yellow to be “very democratic” and stated that Briana’s task-focused approach made participation easy: “we would be given weekly tasks which will help us work towards the final product”. Feelings of fairness were aided by the attitude of team peers who,

> [a]ll seem nice and want to achieve the same goals as I do. This is very important to me, as I like working in a team that has the same goals and are approachable both in class and on Facebook.

Similarly, Gill, also shy, stated that the dynamic of the team enabled her to “warm to the team”. Gill reflected that once she “knew the standard of work expected” she was able to participate more effectively. Findings in Yellow suggest that friendliness and familiarity contributed to build trust and confidence. David and Gill’s posting patterns and journal reflections show that this trust can translate to increased participation confidence. For example, many of Gill’s early posts, such
as, “Would you like me to …?”, sought direction and clarification, while later posts, such as, “Hi guys, put this together last night…”, show increased initiative and confidence. This shift suggests that the clarity afforded by allocated tasks and directive leadership styles may build confidence and improve interpersonal team skills in students.

The findings in Yellow also highlighted the importance of discipline balance in a novice team. The general lack of design knowledge and skills of the team contributed to misaligned expectations both within and external to the team. Yellow’s grade showed that, in interdisciplinary teams, assessment criteria has the potential to handicap student teams. The discipline imbalance was not adequately addressed and this significantly hindered the team’s ability to achieve a high grade.

Despite this, Yellow showed that directive leadership, by providing clear information about task requirements, enables inexperienced teams. Methodical approaches and reliable participation help form trust and enable participation for more inexperienced students. However, directive styles limit opportunities for students to interact and participate outside expectations and, therefore, do not foster collaborative practices. In addition, team members are unlikely to work on tasks together, reducing opportunities for cross-discipline skills to be gained.

The influence of directive leadership on interdisciplinary student teams is further demonstrated in Blue, where John, a highly skilled design student, also applied a structured directive approach but created a different team dynamic.

### 6.4 Working in a Team with a Directing Design Leader

Section 6.4 presents findings from the Blue team. The analysis of team interactions in Blue further revealed the influence that team demographic make-up has on the team ecosystem. In Yellow, the lack of discipline knowledge resulted in a CoP that, due to a lack of sufficient shared knowledge of design principles and processes, were led to make inappropriate design decisions. In Blue, the CoP had a leader with expert design knowledge leading a team of “novice” peers. The differences that having a skilled leader made to team collaboration are discussed below.

Analysis of the Facebook entries demonstrates that the leadership style applied in this team, directive leadership, contributed to disengagement in the team and reduced levels of peer interaction. The findings reveal that, despite having a strong design leader, the design process in Blue was undertaken under strict direction. Team contributions were made individually and minimal collaborative participation in the design thinking process was noted. The evidence suggests that this can be best explained by the skill level imbalance in the team. Blue, in contrast to Yellow, had a majority of design students (3). Not surprisingly, the dominant beliefs and practices of the CoP relied on the shared knowledge of design codes and valued design practice
The most senior student, John, was a highly skilled designer, which made him a full participant. Congruent with the literature, John had significant decision-making power in Blue, which enabled him to influence and control the novice participants in his team.

Not surprisingly, John defaulted to the role of team leader and, like Briana, applied a directive leadership style. The findings in Blue demonstrated again that highly structured directive leadership styles contribute to creating compliance with a common goal, generally at the discretion of the leader. For example, John, unlike Briana in Yellow, had extensive design knowledge and team management skills. This experience and knowledge gave John the ability to develop efficient processes as well as take responsibility for quality assurance. He posted on FB, “I’ll do the layout and put together the presentation”. The findings showed that John’s displayed expertise allowed other students to acquiesce to his directive approach. Team members fulfilled John’s highly structured work requests and complied with the requirement expectations he set. As in Yellow this approach limited team interaction and participation breadth among the less experienced members. Facebook posting patterns demonstrated little initiative in Blue and team members contributed minimally beyond the tasks John led.

The evidence in Blue demonstrates again that directive leadership styles do not encourage awareness of others and that, therefore, this style of leadership has the potential to minimise the team’s ability to collaborate. The CoP that developed in Blue, like that in Yellow, accepted as normal isolated individual work practices, and this limited knowledge-sharing through collaboration. As a result, the opportunities for “peripheral participation” were reduced and the younger design students did not acquire discipline-specific skills from John. Despite this, Blue achieved a high-calibre artefact. This finding further highlights the misalignment between intended learning aims, team practices and assessment requirements, where directive leadership supplied by high-knowledge leaders can effect a high-level outcome yet fail to deliver opportunities for students to use the team experience to build knowledge about how to engage fully in collaborative practices or “situational learning”.

6.4.1 Team Member Participation by Role

The power of directive leadership style as shown in Blue and Yellow can be attributed to a great extent to the inclination shown by all students to limit team participation to discipline knowledge. The findings in Blue show that the leader, John, did not develop a method to engage the ideas and views of all team peers. The evidence further suggests that most students in Blue were not inclined to reflect on themselves, nor did they take the time to understand peers. Instead, they all acted in accordance with existing self-perceptions. For example, John identified as a highly organised designer and team leader and contributed to lead Blue to match this perception. Tina perceived herself to be shy and lacking confidence; her participation was timid and understated.
Kelly and Max both stated their intention to contribute their discipline knowledge and their participation aligned with this expectation.

Figure 6.4 – Blue roles by student

Analysis of Blue’s posting patterns (Figure 6.4) suggests that, in Blue, core design practices – such as problem investigation, solutions exploration, idea review and evaluation of work in progress – were not conducted collaboratively. Investigation revealed that Blue also significantly contributed primarily in two roles, Team Worker and Coordinator. Uniquely to Blue, posts in these two roles represented 83% of the team’s participation. This finding shows that Blue were unable to achieve a balanced participation across roles. In particular, Blue showed low participation in Resource Investigator and Plant roles, which Belbin (2010) suggests limits a team’s ability to develop and expand ideas. The team also showed no participation in the Shaper or Monitor-Evaluator roles. Consistent with Belbin’s analysis of low-Shaper teams, Blue was minimally motivated and showed little initiative. However, the impact of the lack of a Monitor-Evaluator role was less apparent due to John’s high-level design skills, which, in this instance, adequately compensated for the lack of team participation in this role.

Review of project outcomes revealed that Blue was able to develop a high-calibre artefact despite the lack of contribution across roles. This finding suggests that John, who made significantly higher contributions by post, also compensated for participation shortfalls in other roles. This pattern further highlights the problem of equity in teams and demonstrates that imbalanced knowledge and experience have the potential to limit broad participation and create situations where students, near single-handedly, complete the project requirements.
6.4.2 Developing Team Trust

Practice shown in Blue, as in Yellow, confirms that structured directive leadership can promote participation by less experienced team members by facilitating access to task requirements. Student reflections showed that the reliability of the directive leadership style contributed to establishing a strong trust relationship in the team. For example, trust was established in Blue in a clear linear fashion. John’s leadership was methodical and demonstrated appropriate team processes and discipline knowledge to the team. Consequently, the team members accepted John’s lead and did not obstruct any of his processes. The CoP that developed in Blue was dutifully compliant; all team members followed instructions and contributed to allocated tasks cooperatively in a timely manner. Tina’s journal confirmed the structured nature of John’s directive approach in practice; she stated, “John has taken position as a leader figure and sets out all that we each have to do”.

The lack of participation across roles that facilitate idea development in Blue and Yellow suggest that it is unlikely to create the “safe” environment creative teams are known to need (Amabile, 1998, Dewett, 2006; Druskat & Wolff, 2001, Edmonson, 2016; Paulus & Dzindolet, 2008; West, 2002). However, analysis of the impact of John’s leadership style on others reveals that a transparent approach can facilitate trust associated with reliability. For example, Tina stated,

John is a very strong person in the way he communicated with us the other members and leading the group. I would very much say he is a great leader.

John’s ability also contributed to trust within Blue. Kelly stated, “John definitely showed me that he was a very capable person”; words like “definitely” and “very” imply that John’s discipline knowledge and skills were strong and apparent to first year team peers. This evidence allowed the team to rely on John’s opinion. In addition, John was transparent and made his intentions to modify peer work clear to the team. He posted, “I have made a brief start on Kelly’s…”, then detailed the changes he intended to execute.

The findings in Blue show that a directive leadership style can suit both high- and low-experience students in student teams. The evidence suggests that guided tasks increase participation opportunities for low-skilled team members and facilitate workflow for more experienced individuals. The approach was beneficial to all team members, including John. The benefit was made obvious by John, who subscribed to the view that teams worked more efficiently when someone “directed the flow of requirements”. His systematic approach provided clear delineation of task work and made requirements clear. John enabled the team by providing processes to facilitate workflow, such as delegating tasks to match discipline knowledge, providing detailed instructions and periodically checking progress. For example, John made specific, detailed pre-meeting notes to ensure the team was prepared for the specific work task requirement,
Our meeting will be 8–9pm tonight. If you could each choose three talking points and think of one concept. Add your part to the presentation then save as a PDF. Not too many words on each page, get some nice images. You have three pages: demographics, implementation, feasibility and only 1.5 mins.

Further analysis demonstrated that Blue trusted in John’s discipline knowledge and judgement because he had displayed his expertise to them early in the project; therefore, the CoP accepted his directive leadership as both normal and in its best interest. Tina’s journal reflection confirms the acceptance of John’s approach; she stated, “John has taken position as a leader figure and he sets out all that we each have to do”.

This finding suggests that directive teams with highly skilled leaders use their knowledge to mask the disparities in skill within their teams. This approach, while likely to improve grades, significantly limits opportunities for collaboration and full participation. Blue did not form team interdependence, leaving the team to benefit from John alone rather than the collective efforts of the team.

It is interesting to note that, despite high levels of structure, Blue experienced John’s leadership as typical rather than controlling. Kelly identified that the team leader typically “had the power to make decisions” which she considered to be “advantageous” to the team. This finding further highlights an awareness among students that directive leadership is to the benefit of low-experience students in interdisciplinary design teams.

6.4.3 Establishing Decision-Making Power

The evidence that emerged in Blue made it clear that directive leadership can lead to unequal decision-making power. The findings show that the trust that developed in John’s ability gave him exclusive decision-making power. This is not surprising, as John did have expert knowledge and skills that best matched the unit assessment requirements. Blue viewed him as the knowledge “master” in the team and unquestioningly followed his lead (Lave & Wenger, 1991).

For example, Tina referred to the rest of the team as “us”; this suggests that a delineation between John and the rest of the team was perceived by Blue. John’s capacity consolidated his position as leader and gave him exclusive decision-making power. For example, John stated,

I am doing the grunt of the work and supporting the rest of the members through by giving them direction. The others turned to me for what to do next and I had the majority of the initiative. The others had good ideas but weren’t confident enough to put it forward themselves.

Analysis of participation patterns suggests, however, that directive leadership by an expert, such as the supportive leadership in Purple, places high demand on the leader. John’s journal showed...
that John felt this pressure when students were tardy. For example, he reflected that when tasks were supplied late, he was “put under the pump”. John’s posts further reveal that participation inequity occurs in teams when skill and knowledge levels are imbalanced. John’s posting pattern illustrates the disparity this can cause, with his contribution to Blue’s posts almost the equivalent of the rest of the team combined. This finding highlights the need for the application of effective processes that enable the formation of well-balanced teams to achieve equity in interdisciplinary teams.

Further analysis of team interaction in DiT make it clear that one reason this imbalance occurs is that assessment in project-based learning in design education generally focuses on grading design practice. It is, therefore, not surprisingly that John, like Greg, focused his efforts on achieving a high-calibre visual artefact. As a result of John’s effort, Blue achieved a higher grade than Yellow, where Briana lacked core design skills. The finding implies that where the core knowledge of the team leader closely matches the assessment requirements, the team is more likely to achieve a higher assessment result.

Facebook posts in Blue made it evident that interactions that lead to collaborative reflective design practice are less likely to occur under directive leadership. Instead, participation patterns in Blue demonstrated the limiting potential of controlling leadership styles, with John’s highly structured approach minimising the need for students to participate beyond delegated tasks. For example, posts made by Blue members were generally responsive to John, such as “will do” or “I’ll have it done by the morning” or “yeah sure I’ll find a few images”. These patterns demonstrate that directive approaches focus on task efficiencies, which, while productive, are counter to collaboration and do not actively engage the team in processes such as problem investigation and solution evaluation.

The findings demonstrate that by facilitating clear process, John in effect minimised the need for students to meet and work together. The evidence suggests that by changing the work of peers, John avoided the need to provide constructive feedback to his less experienced team peers. This contributed to inverse trust relationships, minimising the potential for the team to take risks and confidently share knowledge. Consequently, learning opportunities were minimised; for example, Tina – shy and inexperienced – made multiple posts (20) attempting to organise team meetings both online and on campus but had little success. As the project progressed, Tina’s contribution was increasingly unsupported, and her participation waned from 20 posts in the first assignment to a single post in the final assignment. This finding suggests that Blue developed a culture in which face-to-face meetings and peer support were not encouraged, which in turn limited the potential of individual students to interact and contribute holistically to the team.
6.4.4 Creating Opportunities for Peer Learning and Support

Data analysis shows that, despite few discipline learning opportunities, John’s directive style did positively impact on the development of interpersonal skills in the team. For example, Tina stated she felt that she developed the presentation skills she showed a particular interest in pre-project. Tina reflected,

It went well, I felt a lot more confident talking in front of the class. This class was a good way to strengthen my presentation and speaking skills, which are good to have in the professional world.

This statement indicates that Tina, who pre-project stated a desire to improve speaking confidence, did develop the skills she sought through participation in DiT.

Interestingly, John’s directive approach highlighted an unexpected benefit of directive leadership in short-term project work. An early structured process can increase interpersonal skills through task engagement. For example, Max stated that the task-based team engagement approach created opportunities for him to participate when time was limited. He stated that in teams it was hard to learn,

how to cooperate with new people like week one we didn’t know each other, and we had to get to know each other within five minutes and go from there. Being productive helped us to do this.

Max’s comment, “we had to get to know each other within five minutes”, highlights the difficult problem of time in short-term team project work. His statement “being productive helped us to do this” suggests that engaging in action “helped” to build relationships in Blue. This unexpected finding provides valuable insight for educators about the potential benefits of structured processes for relationship-building in teams and further highlights the need for careful pedagogical frameworks and processes that support equity in interdisciplinary teams.

These findings in Blue reveal the important role the ‘leader’ plays in student teams. Leaders consolidate discipline knowledge with the peer- and self-perceptions students bring to the team to form a working CoP. John, by not using approaches that were inclusive, encouraged minimal collaborative idea investigation, monitoring or evaluation. This created a compliant team and reduced the need for students to participate beyond delegated tasks. Yellow and Blue showed that directive styles that split tasks improve cooperation and completion. Both approaches, however, revealed that directive leadership has less potential to create opportunities for broad participation and collaboration in key roles that contribute to idea development and evaluation in interdisciplinary design teams.
6.5 Conclusions

Chapter 6 has discussed the findings of the team processes in four interdisciplinary design teams in higher education. Many of the findings presented are congruent with previous research on CoP, team roles and leadership styles. The analysis in this study shows that respectful communication improved team interactions and contributed to the development of a CoP that worked more collaboratively.

Analysis of team roles shows that collaborative opportunities are influenced by leadership styles. Three leadership styles were apparent: supportive, delegating and directive. A supportive leadership style, with a CoP that encouraged students to voice their opinions across all project stages, was found to facilitate increased opportunities for team members to interact and collaborate. The supportive leader gave value to every individual in the team and contributed to developing respectful trust relationships. The evidence suggests that the CoP that develops under this style of leadership is more likely to engage the entire team in the collaborative process.

Participation data further reveal that a delegating leadership style works well to maximise individual potential while minimising potential conflict in highly skilled but diverse teams. The evidence suggests that the autonomy created through appropriate delegation allows students to work cooperatively towards a shared outcome and achieve a high-grade result. However, the evidence suggests that this approach results in a CoP that supports less team interaction and collaboration.

The third style of leader was more directive and operationally focused. These leaders were organised, established clear boundaries and made participation requirements clear but, like delegational leaders, minimised the team’s ability develop a safe CoP. Not surprisingly, team interaction under this style of leadership showed lower levels of collaborative engagement in the design process. Little time was spent investigating and/or evaluating as a team and often decision-making was left in the hands of the leader.

The findings in this chapter provide important insights into the relationships that develop in teams and an understanding of the interplay between the trust and decision-making power relationships. Multiple factors linked to the CoP and leadership style in each team were found to contribute to influence the practice environment that formed. In turn, these factors contributed to the collaboration opportunities the interdisciplinary teams afforded their participants. Chapter 7 will discuss the implications of these findings and provide insights for educators conducting interdisciplinary team project work in higher education.
CHAPTER 7

Collaboration in Interdisciplinary Student Teams

This study set out to answer the question, what factors influence collaborative practices and working relationships in interdisciplinary design teams in higher education? The study was undertaken with the aim of exploring how team interactions contribute to influence the collaborative process in interdisciplinary student teams undertaking semester long project work. Such a study was important to undertake because design thinking methodologies using interdisciplinary teams are increasing in popularity in higher education. The major findings of the study and recommendations for future research are outlined in this chapter.

7.1 Factors Influencing Collaboration

The research showed that three core factors, leadership, emotional intelligence and curriculum design, were integral to the team’s ability to interact and work collaboratively across all stages of the design process. These three factors were found to be interconnected. The style of leadership that developed in each of the teams reflected the levels of emotional intelligence and discipline knowledge observed in the leaders. When both were found to exist at a high level in the team leader, the team was better able to develop structures and processes that facilitated positive team interactions and supported collaboration across all stages of the design thinking process.

On the other hand, leaders with either low discipline expertise or minimal self-awareness limited team interactions and hindered opportunities for teams to participate fully across the stages of the design process.

All teams were affected by the curriculum design, which motivated the team to interact to achieve the goal of a highly-polished design outcome. This encouraged all teams to interact and work cooperatively (rather than collaboratively) and limited the will of the teams to fully engage in the design research and solution evaluation stages. Considered in light of the design thinking process, factors that limit team interaction and collaboration might also be viewed as potential barriers to innovative development. The following section will discuss each of these factors to examine how they interlink to influence collaboration in interdisciplinary student teams.

7.1.1 Effective Team Leadership in Student Teams

The study findings suggest that supportive leadership styles develop interpersonal relationships between peers that increase collaborative opportunities for team members and can effect change in student team interactions. A supportive style of leadership enables students to build interpersonal skills and the individual confidence to interact with peers across all stages of the
design thinking process. As shown in Purple, a supportive leader, such as Greg, is able to facilitate team interaction that enables collaborative consideration of all ideas and encourages both broader exploration and analysis of the problem and proposed solutions. This evidence confirms Hersey and Blanchard’s (1993) theory that supportive leadership builds skills and confidence in less-experienced peers.

To understand why differing styles of leadership emerge in student teams, we need to look more closely at the individual. Interactions in teams have a relationship to deep personal responses influenced by past student team experiences. For example, the confidence student team leaders have in their ability to make higher-quality judgements than their peers influence the leadership style that develops in interdisciplinary design teams. Leaders with high levels of confidence in their ability, and theirs alone, to make expert discipline judgements have a tendency to expedite the process by limiting the participation of team peers. For example, both John and Briana had confidence and conviction in their ability to complete the project and therefore applied directive leadership, such as re-doing tasks or limiting peer contributions to less critical tasks to allow their own ideas to “push forward”. This approach, by its controlled nature, limited the natural flow of collaborative opportunities.

Student leaders give their peers clear signals about the “rules of engagement” in their teams. The findings suggest that this influences the level and type of interaction that occurs and can constrain the collaborative opportunities made available to all participants. These “rules of engagement” are influenced by leader qualities and dispositions; the evidence shows that the wants and/or needs of the team leader can contribute to create informal structures that block participation for some. For example, in Blue John had a strong will to develop an efficient team; therefore, he established an informal directive structure that controlled contributions. On the other hand, Greg, had the will to create equity, which manifested a leadership style that supported all individuals.

The impact of these rules was most evident in the two teams where different leadership styles were applied by design discipline experts, Greg in Purple and John in Blue. Both teams had “novice” team members, but the leadership style applied created a distinctly different engagement style within the team. Greg’s inclusive, empathetic style encouraged the development of a collaborative CoP, while John’s directive, explicit tasks and instructions reduced team interdependence (Michaelson et al., 2004) and limited the need for the team to work collaboratively.

The above suggests that directive leaders can distance students from decision-making and limit the team’s ability to feel safe or welcome to contribute. For example, John displayed a disregard for peer work, which contributed to creating a subservient team that cooperated but did not interact to collaborate or put forward ideas. The evidence suggests that distancing individuals
from decision-making creates uncertainty. This may occur because when the individual has little control, the chance that an idea or contribution is unsuitable increases.

It is not surprising that directive leadership applied in this way can reduce motivation in willing and eager students. Looking again at Blue, we can see that Tina adapted to meet John’s leadership style and shifted from an active participant to passive follower who engaged only at John’s direction. It is accepted that creativity relies on intrinsic motivational factors (Amabile, 1983); therefore, in the context of the interdisciplinary design, team factors that limit motivation may also hinder team interactions and limit collaboration in key creative processes.

In contrast, the supportive leader, Greg, showed that a willingness to accept diverse views can contribute to the development of a team dynamic that does not require controlling tactics. Greg’s natural will to listen and provide feedback for all ideas, not just his own, and to have his own ideas critiqued contributed to creating a team that showed both higher levels of interdependence and intrinsic motivation (Michaelson et al. 2004; Amabile, 1983).

The evidence suggests that the manner in which the team leader engages or validates the ideas of team peers contributes to providing team members with both the confidence and will to collaborate. This knowledge is particularly important in the interdisciplinary team, where differences across a range of issues are more likely to present. This finding, demonstrated by the vastly reduced need for coordination in Purple, extends what is known about team interdependence generally to the more specific needs of creative interdisciplinary teams. The benefits of the supportive leadership in Purple highlight an important connection between leadership and motivation in creative student teams. This team demonstrated that when supportive processes are put in place, they allow the team to function as a whole. This finding extends on studies that show that a shared vision increases opportunities for teams to achieve a common goal (Paulus & Dzindolet, 2008) by identifying the core role the leader plays in the interdisciplinary team.

The study further reveals that, in educational settings, teams are susceptible to the leadership style of those students most willing to take on this role. From a pedagogical perspective, the study added another important piece to the puzzle by answering to some extent the question of how leadership forms in student teams. In all teams, the students who displayed levels of confidence in their abilities “stepped up” to Coordinator roles. This finding suggests that collaborative pedagogies, common to design education, offer few possibilities for students to build leadership skills in less confident students. This important observation requires further consideration, given that the research findings suggest a strong link between collaboration, supportive leadership and levels of emotional intelligence. The following section clarifies some of these links and discusses how they influence collaboration in teams.
7.1.2 Emotional Intelligence: The Cornerstone of Collaboration

Another way of looking at the influence of leadership is through what is known about emotional intelligence (EQ). Data analysis in this study revealed that EQ plays a significant role in teams. This is especially true in interdisciplinary student teams, where a higher level of tolerance to diverse views is necessary for the team to afford all its members full opportunities to collaboratively discuss and explore diverse ideas.

As discussed in Chapter 2, EQ refers to the individual’s ability to respond appropriately to their emotions. Individuals who display high levels of EQ have a strong ability to reflect on themselves as well as the ability to understand and empathise with others (Goleman, 2005). The evidence demonstrates that the EQ displayed by the leader influences leader practice. Leadership styles in the study reveal that leaders who demonstrate high levels of EQ, such as reflective awareness and understanding, are more likely to facilitate collaborative opportunities for their teams. More specifically, leaders who have high levels of self-reflection and are “willing” to accept criticism and create opportunities that expand design thinking. For example, in Purple, Greg’s positive response to critique encouraged his team to contribute feedback and evaluation in the Monitor-Evaluator role. This leadership style was found to better create the circumstances to contribute to ideas as well as opportunities to evaluate and develop ideas. In this way, high levels of self-reflection, as demonstrated by leader Greg, contribute to foster collaborative participation across a range of project stages.

Analysis suggests that the leader’s ability to put aside personal perceptions and support the requirements of the team is dependent on EQ. The reason for this may be that leaders who are self-aware and reflective have a stronger ability to accurately assess their true strengths. For example, Greg, in Purple, was aware of his shortcomings and encouraged his team to interact and voice their opinion. It follows, then, that they are more able to apply reflective thinking about themselves and their peers to guide collaboration in interdisciplinary teams. Equally, high-EQ individuals are able to acknowledge their limitations, allowing them to bring more expert peers into the team to collaborate. For example, with limited design expertise Sasha, in Green, repeatedly sought contributions from design discipline experts.

In contrast, it appears that the opposite is true for self-confident leaders who demonstrate low EQ, as they tend to make decisions that support their self-perceptions over the project. In these instances, leader confidence may be used to override team judgement and, consequently, truncate the design process. As shown by Briana in Yellow, low self-awareness and high self-confidence created a strong leader who directs from a personal rather than project perspective.

The evidence further suggests that leaders who demonstrate high EQ through a will to understand others create opportunities for team members to function both collaboratively and autonomously.
This finding supports research suggesting that the leader’s style of engagement with the team and team’s motivation to contribute are aligned in successful teams (Akila & Thangavel, 2013; Schoo, 2008, Shek & Ma, 2016). For example, Greg, who showed a strong will to understand his peers, influenced the development of a team culture that trusted and respected each individual. This culture fostered a team spirit and created a natural will for team members to contribute and collaborate, thus reducing the need for coordination.

The study reveals that a culture akin to the leadership style can develop in teams. The findings in all the teams showed that the team to some extent mimics the behaviour of the leader. This is consistent with Akila & Thangavel’s (2013) study that found in professional settings teams mirrored the emotions and attitudes displayed by the leader. For example, leaders with high EQ who demonstrate a will to listen to peers create a team that is also willing to listen. This is underscored by the change in behaviour of Sally towards Tony and Chris in Purple. Sally follows Greg’s lead and develops the ability to listen to and value her team peers. This key finding highlights the reliance of collaboration on high levels of EQ at both the leader and team level and might imply that understanding and empathy are as critical to team collaboration as discipline knowledge. Considered in light of “situational learning”, the finding further suggests that, in interdisciplinary teams, opportunities to become “legitimate participants” are equally influenced by knowledge and EQ. In the context of Purple, collaboration and learning occurred as a result of egalitarian values, open dialogue and expert knowledge.

These findings about the influence of EQ in leaders suggest that a reduction in directive intervention facilitates broader engagement and creates opportunities for “novice” participants to develop skills and confidence towards “legitimate participation” (Lave & Wenger, 1991). As displayed in Purple, interdisciplinary teams that have a low-hierarchy system coupled with an open team culture can increase participation across all team roles. This presents a challenge to the highly hierarchical “master/apprentice” model fundamental to CoPs in design education and implies that measures that foster inclusive processes may be needed to avail self-directed teams of peer learning opportunities. To understand this further we need to look more closely at what the study revealed about the processes students apply to decision-making to help manage their emotional needs.

The study suggests that unstructured collaborative teamwork in general has the potential to create situations that do not support the engagement of all individuals. This lack of structure allows more dominant individuals to control participation and create a dynamic within the team that is counter-productive to the development of interpersonal skills. This is consistent with the research of student experiences in university settings which has shown that students report that strategies used in collaborative projects are ineffective and that students are not developing the
leadership and emotional skills required to meet the future career demands (Shek & Ma, 2016). For example, students with low EQ manage the strong feelings of stress and anxiety often associated with teamwork by avoiding or minimising collaborative situations. The analysis reveals that students equalise their emotions by reverting where possible to solo decision-making. This can lead to misguidance in student teams, as shown in Yellow, or reduce student confidence, as shown in Blue. Furthermore, and potentially more problematically, strong inclinations to manage personal emotions lead students to apply maladaptive practices that minimise participation in the design thinking process and reduce learning opportunities. This is consistent with Shek & Ma’s (2016) study that showed that students found it difficult to facilitate productive processes in small teams often due to negative emotional response to individuals in the team. For example, as shown in Blue, students are more likely to complete work for others than provide feedback to foster learning and further engagement. This style of team interaction has the ability to cause significant limitations for the interdisciplinary design team. The process used by Blue is contrary to the very essence of design thinking, where the aim is for all ideas to be considered, evaluated and developed by the team collectively.

Further investigation of this issue revealed that a self-aware reflective leader can help team members to manage emotions by providing reassurance that all individual needs are being met. For example, in Purple, Sally modified her controlling maladaptive behaviour once she received reassurance, in the form of work produced by the team, that team goals aligned with her goals. Sally’s change in attitude highlights an important link between EQ and common vision or goals. The evidence suggests that empathy and understanding develop a commitment to the team that helps to foster safe and open interaction. This commitment signals unified goals and creates trust, which calms stress and nerves and reduces the need at an individual level for students to apply practices that are self-, not project-, focused.

The findings in Purple add to our understanding key knowledge about an important link between supportive leadership and high EQ in student teams. Data reveal that the processes discussed thus far in teams do not occur by chance. Instead, they are strategically considered and applied by students who demonstrate high levels of self-reflection and awareness of others. This was made apparent by Greg in Purple who, pre-project, expressed a strong intention to develop fair and equitable processes in his team. Greg’s process helps to shed light on factors that facilitate collaboration. Greg shows us that opportunities that give “voice” to peers help to develop a safe team space, unify a team and, in turn, increase opportunities for collaboration.

The contrary nature of these highly personal factors demonstrates the degree of complexity involved in understanding the layers of interactions in this context. In a design team, fluid participation across all roles is required; however, the findings suggest that without formal
structures, student interdisciplinary teams are unlikely to develop effective work processes that support this fluid practice. The only exception, Purple, suggests that without high EQ at a leadership level, teams are unlikely to develop processes to enable fluidity across roles. As a result, the pedagogical intention of bringing students together to collaborate is often marred by negative feelings and inability to develop respectful relationships between team members. These revelations about leadership style and EQ show that both contribute significantly to the team’s “will” to collaborate.

The problems of team make-up do not end there. Team composition can also leave teams ill-equipped to meet complex project requirements or, conversely, create teams that rely on a highly skilled leader to create high-level outcomes – which limits engagement and minimises the application of collaborative solution-finding processes. The study revealed that in order for a team to benefit from interdisciplinary collaboration, the team needs to have the disciplinary knowledge to address all aspects of the problem. Again, analysis suggests that high levels of EQ can assist teams to overcome this problem by acknowledging shortfalls in knowledge and accepting the advice of team peers in areas less known, as Greg did in Purple in relation to business-related activities that were outside his expertise. However, leaders with under-developed EQ steer teams away from interactions across a range of roles, which restricts the team members’ ability to add their knowledge to the process. This challenges the premise of collaborative pedagogies – that students, when brought together in teams, will actively engage in joint practice – and suggests that, contrary to expectations, the design process minimally benefits from multiple discipline participants in interdisciplinary student teams.

The study highlights that the decision-making process is likely to be undertaken by the leader regardless of their ability. The evidence suggests that leaders who lack adequate knowledge are less able to reflect realistically on the value of their contribution and are more likely to impose an inappropriate direction on the team. This has the potential to limit the team’s ability to interact to interrogate the problem and develop a solution that benefits from the joint knowledge of the members. This evidence challenges the effectiveness of interdisciplinary design teams led by under-skilled individuals. As shown in Yellow, many team members suspected Briana’s judgement was misaligned but were reluctant to voice this opinion due to the closed style of leadership. In a learning environment, this issue has the potential to create a lack of confidence or frustration among team peers, which can negatively impact on learning.

In the context of the team, the findings in DiT add knowledge about the links between leadership style, EQ and expert knowledge. Analysis of patterns in DiT make evident the pervasiveness of the final outcome in team projects, making it difficult for students to step aside from their personal ability to meet project requirements and thus limiting the team’s capacity to work collaboratively.
towards team goals. The findings about the important roles leadership and EQ play in joint vision might suggest that task design and assessment are not working to effectively engage interdisciplinary design teams. The last section of the discussion addresses the specific role of task design and assessment in supporting innovative development in the interdisciplinary team context.

7.1.3 Assessment Requirements that Influence Collaboration

An important factor that can influence how teams collaborate is the assessment design. The study reveals that assessment structures that focus on outcome rather than interpersonal interactions create opportunities for individuals within the team to complete projects primarily on their own. Study findings further showed that artefact-led assessment criteria did not encourage collaboration and, instead, funneled students’ best efforts towards creating a high-level product. These findings challenge common assumptions among tutors that team project work will encourage students to work together and that the interpersonal skills integral to collaboration will serendipitously emerge.

The findings reveal that the view of assessment held by the team majority has the potential to inhibit learning in teams. For example, the study suggests that self-managed teams, the cornerstone of collaborative pedagogies, have the potential to create project outcomes that are misaligned with learning intentions and assessment design. Furthermore, evidence suggests that peer-to-peer learning in interdisciplinary teams is guided by the level of skill and knowledge of the most advanced student in the dominant discipline. For example, in Yellow, participation reflected the majority despite some of the team identifying a misalignment between project requirements and team knowledge. Yellow, willingly applied processes that were inappropriate or inadequate. Therefore, it might be said that haphazard team selection processes used can create teams that are poorly balanced in terms of knowledge and skills. This imbalance can negatively influence peer-to-peer learning in interdisciplinary teams and offer little potential for this learning to translate to “legitimate participation” across disciplines.

Furthermore, the study shows that assessment processes have the potential to reward learning that does not align with the learning intentions. This highlights the limitations assessment can impose on teams from both discipline and interpersonal learning perspectives. The evidence suggests that individual students gain minimal knowledge from the interaction with peers in team-based project work. In addition, where low knowledge and low EQ are combined, the team dynamic has the potential to create negative learning in students. As shown in Blue, a task-based team approach can exclude team participants and, consequently, minimise collaborative creative
thinking opportunities. Despite this lack of collaboration, grade results in DiT showed that all team members can achieve a high result. This raises the question, what are educators are really assessing in team project work.

Interestingly, the study shows that the core factor that defines leadership for team members is the demonstrable ability of an individual to coordinate a product through to completion. This pattern, while most obvious in Yellow, was noted in all teams with most students prepared (to differing extents depending on their personal circumstance) to “leave things to the leader”. This highlights a possible problem in curriculum planning and might suggest that the assessment requirements are not working to motivate team interaction and engagement with the collaborative process. This problem can create opportunities for individuals to “leave things” to others, which can develop situations that teach students that teamwork is neither fair nor conducive to collaborative learning.

In the specific area of teamwork, new processes emerging in the design discipline are yet to be applied effectively to educational processes. More specific to creative design thinking, the results in DiT suggest that, in a visual discipline, the problems associated with assessing the team product are compounded by the immediacy of personal responses. Study analysis demonstrated that students, regardless of discipline, are quick to make judgements about the value of tangible creative solutions. These judgements are often based on personal responses to the visual work. Across all teams, students provided overt positive acknowledgement for visual work, liberally using terms such as “awesome” and “I love it” to express judgements and apply these personal responses to guide design direction.

On the other hand, some students are reluctant to provide negative evaluative feedback to peers and, instead, students applied “work-around processes” such as “fixing up” peer work to ensure the work produced met the assessment criteria. This knowledge provides a different way of looking at the problem of minimal evaluation known to exist in design education. Research in design education shows that, despite the emergence of a new paradigm in design education, students are unwilling to undertake thorough evaluative processes (Cross, 2011; Frascara, 2017; Nini, 2005). Analysis of teams give clarity to this problem. Review of assessment data highlights that the focus is the final product. Not surprisingly, the findings show that this focus tempts students to minimally evaluate to avoid conflict and potential time delays. This evidence highlights a strong need for pedagogical review in the area of interdisciplinary team-based learning.

The study reveals that to develop effective processes for teaching interpersonal skills, both task design and assessment criteria require review and redress. While this was not the focus of this study, observation of learning materials and task design suggests that design processes that encourage collaboration across the project stages are not being rewarded. While the reasons this
might occur were not directly reviewed in this study, it might be hypothesised that academics are inadequately prepared to develop instructional design that focuses on collaborative processes because they themselves have not been taught to approach design problems in this way (Frascara, 2017). As a result, pedagogical approaches focus on assessment of known practice rather than the development of interpersonal and/or emotional intelligence skills. Whatever the reasons, the interconnection between individual student perceptions and engagement with the CoP in DiT makes it clear that current artefact-led approaches are not effective on their own. Further research is warranted to address this knowledge shortfall.

The results of this study highlight the need to develop more effective team allocation processes. The findings also show, however, that the indeterminate and complex nature of “what” individuals within the team bring to the process makes it difficult to overcome this problem. This finding suggests that it might behoove educators to develop pedagogies that encourage new teams to use the “design thinking” process itself at the early project stage. This process could provide opportunities to enhance leadership skills and EQ at the individual level and help facilitate safe CoPs before the team applies itself to address the project problem.

7.2 The Discipline Codes that Matter to Students

This discussion considers the findings presented in relation to the conceptual theory underpinning the research on Communities of Practice (CoP). By examining interdisciplinary teams through this theoretical lens, this research addresses the sociocultural aspects of team-based learning. The findings show that the discipline knowledge and codes students bring to the team are integral to the working community that emerges. This suggests that discipline practice codes are acquired early by students. Students form distinct perceptions based on practice codes and use these codes to judge the value of peer contributions. As shown in Purple, evidence of acceptance of shared discipline codes is immediately visible and understood by discipline peers regardless of their year level. The practice codes and contribution patterns that developed in DiT teams, on the surface, support Lave and Wenger’s theory of joint enterprise, mutuality and shared repertoire, presented in Chapter 2.

However, to be a CoP a team must share more than ideas or discipline codes. They must also develop a method to work together and learn from each other (Lave & Wenger, 1991). The unique ecosystem that developed in each team demonstrates that, in an interdisciplinary design team, this is unlikely to emerge naturally. CoPs that are safe and respectful of all ideas can be formed in a relatively short timeframe in interdisciplinary student teams. For example, individuals in Purple were able to overcome diversity and develop structures to share different knowledge and tolerate evaluative feedback. This suggests that, where a CoP emerges, knowledge is likely to be shared
between individuals and, as a result, open, collaborative team engagement is more likely to occur (Lave and Wenger, 1991).

In addition, diverse teams may avoid open discussions or negotiations with peers to avoid potential conflict. This “conflict avoidance”, considered in light of Situated Learning Theory (Lave & Wenger, 1991), may provide some explanation as to why the misaligned team knowledge is difficult for students to reconcile. The evidence suggests that, for the most part, students undertake the majority of the project work at an individual level based on the instructions of team leaders. This approach limits exposure to alternative practice and restricts sharing opportunities to the will of the most knowledgeable and/or confident students.

This finding supports the notion that a CoP primarily works to maintain dominant beliefs and practices within the team rather than to provide opportunities to expand to new learning or, as might be expected in this instance, innovative solution-finding (Contu & Willmott, 2003). For example, with the exception of Purple all teams minimally questioned the quality of knowledge of their cross-discipline peers. Instead, they viewed these peers as being experts or “full discipline participants” and as such allowed these experts to make contributions without question. The shortfall in judgement demonstrated by students is particularly evident where knowledge imbalance is obvious. For example, Yellow elected to follow Briana over Ted, the only design student, supporting the codes dominant in the CoP over possibly more relevant knowledge.

To understand how this works in a team, we can look to the way that connections were formed in teams in DiT. The study shows that perceptions that guide teams are more aligned to alliances with discipline codes and personal perceptions than project requirements. In this way, the CoP that forms becomes reliant on the internal team resources. Where strong skills, knowledge and views are balanced across disciplines and individuals, as in Purple, team collaboration and team product improve. Conversely, where imbalance presents, as in Yellow and Blue, under-developed interpersonal and discipline skills and knowledge contribute to minimise evaluative dialogue, inhibiting opportunities for collaborative engagement.

Further analysis reveals that a shared social similarity is critically important to students in teams. The evidence suggests that all students prefer to work in teams with individuals who have interests and world views that align with their own. This finding supports research that suggests that where teams inadequately address the need for a shared system outside the practice realm, it is difficult for an effective CoP to form (Handley, Sturdy, Fincham, & Clark, 2006). As shown in DiT, in all teams the fundamental disposition of the leader contributed to guide the social system that emerged and the team’s understanding of the role of the individual within that team (Barnett, 2007).
This study shows that shared interests, such as music or sport, are a point of reference that helps students make quick determinations about the “trust” relationships that might form in teams. This alliance contributes to decision-making power, as the alliances are strongly felt and difficult to overcome in the short term. For example, in Green, majority perceptions about the cultural values of international students limited the likelihood that the ideas of these students would be given serious consideration in the developmental stage of the project, thereby limiting the ability of these students to influence decision-making. This finding supports views about the critical role of safe environments in developing creative teams (Amabile, 1998, Dewett, 2006; Druskat & Wolff, 2001, Edmonson, 2016; Paulus & Dzindolet, 2008; West, 2002). It could be argued that, in a creative context, the social knowledge individual students bring is likely to create CoP barriers that, in the context of the short-term team, are unlikely to be overcome.

Further analysis demonstrates that, in practice, the need to maintain a link to personal views and perceptions in interdisciplinary CoP is high. This need evokes strong emotional responses which, as shown in DiT, can cause the ideas that sit outside the codes accepted by the majority to be sidelined. For example, in Green Aaron was unable to tolerate either Tania’s idea or her practice of seeking tutor support. This finding adds to the literature important knowledge about the barrier lack of EQ raises to effective CoP. The responses here, from both Aaron and Tania, are heightened emotional responses aimed at getting their own way. These students show low levels of EQ, being neither willing or able to manage their feelings or reflect on and consider the views of their peers. In contrast, Greg, in Purple, was able to avoid this potential barrier through his ability to not only reflect on himself but also to demonstrate to others the benefits that could be gained through understanding and reflection.

In consideration of what has been presented thus far, it might be said that collaboration in teams is a byproduct of leader EQ and assessment. Suffice to say that when both work together, a common goal is achieved. Viewed in the light of CoP theory, we might further say that teams that develop codes and practice to support joint goals and vision are more likely to develop collaborative team processes that allow ideas to develop within a supported community. The consequences of this finding are vitally important to design educators using the design thinking process, which is known to rely on open discourse (Brown, 2008; Owen, 2007). As shown in DiT, the diversity that presented in Green contributed to shutting down ideas different to those of the majority and sent a message that open discourse was only supported if it aligned with the majority. In Green, the most overtly diverse team, the team sidelined the ideas of international students Tania and Kathy. Green limited the contributions of Tania and Kathy to the application of high-level 3D design skills. It should be noted that these skills were lacking in the team majority.
The findings further demonstrate that the need to maintain the status quo is strongly felt and evokes emotional responses. For example, in Green Aaron’s responses to Tania’s attempt to engage tutor support (to push forward ideas contrary to the team majority) were emotionally charged and show little evidence of high EQ at an individual level. The will of the team to “sideline” Tania further demonstrates a lack of acceptance of ideas outside the codes upheld by the CoP. These revelations in DiT add to emerging research on and understanding of the link between perceptions at the individual level and the development of positive trust and power relationships within interdisciplinary teams.

Analysis clearly shows that differences within and between teams influence the team’s ability to develop the shared vision and trust required to create a collaborative team mindset. The study findings reveal that underdeveloped EQ can lead students to apply opaque and unorthodox practices to manage social and personal differences. This poses a significant barrier to forming an effective CoP for interdisciplinary teams and creates a significant challenge for design educators aiming to integrate collaborative practices as part of the creative problem-solving process.

7.3 Motivating a Team Spirit in Student Teams

The impact of the results in DiT have significant implications for educators and raise many questions about the effectiveness of collaborative pedagogies. As stated above, and shown in multiple studies, understandings of the impact of shared social structures in an interdisciplinary team context in education are still quite theoretical. The evidence in DiT suggests that teachers give minimal consideration to social factors when allocating teams due to the difficulties the process poses and, as a result, teams are left to manage often difficult dynamics with little structured guidance.

This study suggests that pedagogies and assessment criteria commonly used to guide creative teamwork provide insufficient structures to motivate students to build the interpersonal skills that facilitate collaborative engagement. This is particularly pertinent to the interdisciplinary design team where, as shown in Green, Yellow and Blue, discipline differences and diversity left unaddressed have the potential to increase independent work which, in turn, limits the opportunity for collaborative participation.

The findings suggest that there may be a need to develop new processes for assessing teams. The propensity of all teams to remain aligned with the explicit assessment criteria suggests that a process that shifts the team focus from artefact development to interpersonal skills may provide the answer. By applying a process that assesses interpersonal skills specifically rather than incidentally, team-based projects may help to align student activity with these skills.
The evidence also suggests that the team majority forms a practice and/or knowledge barrier that can limit collaboration in teams. Findings show that misalignment between student knowledge and learning aims, as presented in Yellow, limit team participation to known and accepted practices and processes. The implications of this issue require further consideration to develop a deeper understanding as to the types of pedagogical approaches that can be used to build effective leadership qualities and improve EQ in student teams to support diversity.

The results in DiT provide some insights that might help guide this pedagogical development. The findings revealed that team members are likely to imitate leader behaviour, with all teams in DiT adopting some aspects of the behaviour modelled to them (such as a will to be inclusive and respectful of peer contributions). This suggests that the demonstration of positive behaviours in teams has the potential to play a key role in interpersonal skill building. This might further imply that the processes of interdisciplinary teams could be improved by teaching collaborative skills in the first instance.

The unique processes shown by leaders in DiT provide the opportunity to define some of the behavioural factors that are important to collaboration. The differences in team development in these teams highlight the need to develop leadership skills that allow individuals to support their peers. For example, Greg, in Purple, demonstrated the power of a supportive leadership style and empathetic disposition. Conversely, Briana in Yellow and John in Blue demonstrated the negative impact of directive leadership styles, showing that task-based approaches shut down rather than expand collaborative opportunities.

Evidence from all teams suggests that leadership styles contribute to controlling team participation by limiting peer roles. This raises many questions about the effectiveness of pedagogies that allow student teams to “free-form” roles. The results in DiT demonstrate that a lack of structural planning in teams can inadvertently place the team leader in a powerful position that has the potential to control who contributes what to the team process and outcome. This process, as shown in Blue, can lead to exclusion and disengagement. This important finding sheds new light on the “non-contributor”, identifying that the style of leader contributes to create a dynamic that has the potential to limit the individual student’s ability to actively participate.

The findings also suggest that interpersonal skills might not be taught explicitly but rather, as demonstrated by Greg, be intrinsic to the individual. More concerning is the finding in the study that implies that the value of these skills is not clear to students. As shown in teams Blue and Green, the success of the team artefact creates feelings of student satisfaction with the team process regardless of the level of collaborative participation. Considering this in light of indirect team teaching strategies, the mainstay of collaborative pedagogies, we might say that this pedagogical approach is unreliable. The approach seemingly shifts the burden of responsibility
for developing integral interpersonal skills to the student, on the assumption that the individuals in the team will "naturally" develop appropriate relationships. The results of this process, as shown in participation patterns in DiT, suggest that the relationships most likely to develop are cooperative. All teams showed a propensity to engage in the Team Worker role, which suggests that students are likely to be intrinsically motivated to develop processes that create interpersonal interactions that ensure team processes are smooth rather than seeking out opportunities to fully explore the project problem and develop innovative solutions.

Furthermore, the study highlights one of the difficulties of assessing interpersonal skills. From the tutor’s perspective, the level of interpersonal skills of the individual student is rarely visible and difficult to define. In addition, the tutor is often not privy to “behind the scenes” team processes and, therefore, cannot accurately assess the acquisition or application of these skills in individual students or the team. As shown in DiT, this leaves the assessment of these skills to peers. The findings in DiT showed that peer feedback can be unreliable and inaccurate. As shown in Green and Yellow, students were reluctant to mark down peers with whom they aligned themselves even where the evidence suggested that processes applied, and the contributions made were misaligned with the unit and project requirements. This creates a conundrum for educational developers and raises further questions, such as, what processes are likely to motivate the development of critical interpersonal skills, and what evidence will be used to assess the level of knowledge acquisition given the opaque nature of these skills?

Combined, the findings about assessment reveal a complex dilemma for educators developing team-based project work. While Greg’s processes in Purple revealed much about the interpersonal skills that facilitate collaboration, the more general inclination of students to be grade-focused confirmed that, in teams, student motivation mirrors what is known about the power of assessment more generally (Geske, 2008; Visser, Chandler, & Grainger, 2017).

From the findings in this study, it might be concluded that effective application of collaborative pedagogies relies on task design and assessment criteria that specifically focus on teaching interpersonal skills. This rings especially true given the propensity shown in DiT by students to respond positively to structured activities in teams. The results consequently leave little doubt that task design and assessment criteria are the central foci of teams, which suggests that addressing these issues is critical to improving collaboration in student teams.

7.4 Conclusion

The aim of this PhD study was to investigate how individual students brought together for one unit in one semester to participate in an interdisciplinary team collaborate. The interactions that occurred between students were the focus of the study. The manner in which team members
engaged with each other to complete the project brief was examined to understand how the interactions facilitated or inhibited the design process of interdisciplinary design teams in higher education.

The study context was design education in an Australian university. In order to establish the relationships between individuals, the research used a qualitative, case study methodology to review the practice of four teams. Case study was selected as it allows for patterns and processes that occur in any system, including teams, to emerge over time. This created a rich and complex account of the team phenomena in accordance with the qualitative approach used for this research.

The study argued that while there is increasing evidence regarding the continuing effect of vocational tradition in design education, there remains little empirical evidence about the adaptation of design pedagogies to team-based learning in contemporary design settings. The literature suggests that core processes, such as team allocation, project selection and task design, focus on the application of emerging practices, the effectiveness of which in an educational setting is largely untested. The findings presented here show that the application of team-based learning in this way has several implications for both the theoretical debate and pedagogical development for design educators. Most significantly, design educators have little way of gauging the effectiveness of team-based learning beyond the evaluation of practice demonstrated through the artefact.

The evidence highlighted in this thesis demonstrates the highly complex nature of collaborative engagement in this context, identifying the layers of interconnectivity between preconceived perceptions, individual behaviour, learning outcomes, task design and assessment. The findings raise questions about the efficacy of team-based pedagogies generally and the specific focus on interdisciplinary teams provides the basis for all educators to understand team-based learning from a more specific set of categories than previously available.

The analysis of participation demonstrates that team leaders with high EQ can create CoPs with increased self and team awareness which increases opportunities for collaboration. These teams are more likely to expand their thinking beyond individual opinions. High EQ in this way contributes to collaborative learning pedagogies by encouraging openness to the views of peers. The study shows that where this occurs inclusive working relationships and participation across a range of team roles, as expected by collaborative learning, is more likely to occur. Furthermore, higher levels of EQ also contribute to facilitate the design problem solving process in interdisciplinary teams by allowing the relationships and trust required to facilitate the iterative design process to be developed. Team leaders with higher levels of EQ are more likely to develop inclusive relationships with peers which allows them to review and generate opportunities for ideas of all
participants to be heard and seriously considered. These teams are therefore more likely to develop working processes that increase the opportunity for all team members to collaborate and apply design thinking across more project stages.

On the other hand, leaders with lower EQ are more likely to be self-focused and apply directive approaches that curtail peer contributions. Lower EQ leaders tend to restrict the development of inclusive working relationships and therefore, contrary to collaborative pedagogies, restrict opportunities for team peers to participate across a range of team roles. In effect the iterative design thinking process is truncated by this self-focused and directive approach. In these teams’ opportunities for the ideas of all individuals to be considered seriously are reduced. Problem investigation and solution finding is limited to the views and knowledge of the leader which hinders the innovative solution finding process these teams are brought together to facilitate.

The limiting effect interpersonal factors have on the working relationships that develop in interdisciplinary teams indicates that design educators need to consider a broader range of variables before developing tasks and allocating teams. The findings suggest that assessment design needs to be clearly targeted to encourage the development of high levels of self and team awareness to facilitate the design thinking process. However, teaching and judging interpersonal development of the individual and transferring the value of this contribution to a grade is no easy task. Tutors require further resources to address the lack of connectedness between student perceptions, behaviours and the intended learning outcomes.

The research presented in this thesis has sought to provide a greater understanding of factors that facilitate and inhibit collaboration in interdisciplinary teams. The knowledge achieved can be practically applied by design educators and educators more broadly who included teamwork in the curriculum.

From my perspective as an educator, the study has achieved the aim of bringing to light the multiple complex factors that influence collaboration in interdisciplinary teams that are brought together for short term project work. The research process in itself has strengthened my ability to recognise the complexity these teams face. The analysis in this study has taught me much about the benefit of measured consideration, allowing me to shift significantly from my personal assumptions. Furthermore, it has allowed me to think more laterally about constructive approaches that might facilitate team development with the aim of building teams that are able to tackle projects together.

### 7.4.1 Contributions of the study

This study contributes to current research and challenges the efficacy of team pedagogies in undergraduate design education. It shows that, in semester long projects with interdisciplinary
team members, the style of leadership, personality of the leader and assessment design significantly influence a team’s ability to establish a working community that has the will to tolerate and explore diverse and novel ideas. The study identifies that supportive leadership not only guides developing teams but also, if provided by a high EQ individual, contributes to the development of a CoP that works more collaboratively to review the project problem. This increases the potential the team has to apply the design process holistically across all stages of development, including research and evaluation, reducing the opportunities the team has to be limited by existing skills and knowledge or preconceived views.

The study also highlights the benefits of analysing Facebook data to gain unique insight into the day to day interactions of individual students in a team and their engagement in the project. Facebook provided the opportunity to observe behavior more naturalistically and the language used by the students suggests that interaction and engagement in interdisciplinary team projects occurs in a relaxed fluid manner. Facebook data combined with students’ personal reflection journals created a holistic view of team interactions. The use of the journal reflections provided insights into individual student’s perceptions about their team members and the team processes. The analyses of these two data sets revealed significant differences between actual participation, personal perceptions of participation and the perceived value of contributions made. This evidence suggests that students may be inclined towards developing a team persona online that masks their true views and opinions.

The study reveals that the level of interaction and collaboration that is likely to occur in interdisciplinary students, brought together for one unit in one semester, is strongly influenced by the team dynamic and that poorly balanced interdisciplinary teams, may contribute to limit the team’s potential to fully engage the design process. Participation patterns, in particular revealed that differences are strongly felt by individual students and therefore can influence the level of risk taking that occurs. These differences occur at both discipline and personal levels however in the context of the interdisciplinary team the differences are more often expressed in alignment with the views and codes that students are learning to develop a normalised regard for. In effect, the knowledge they are developing in their discipline practice has the potential to limit the ability the student teams have to share and expand on ideas and create the innovation solutions they are set up to achieve.

Considering the increased numbers of interdisciplinary teams in higher education this knowledge adds critical insight for educators. The study shows that the establishment of teams based on random discipline distribution can be effective where a discipline balance is achieved. However, from a discipline level, the codes that students are learning bear significant influence on student perceptions of idea suitability and quality despite the fact that students are not yet experts in their
discipline areas. This has the potential to negatively impact on teams when students rely on limited existing knowledge to make judgements the result of which was shown in the study to hinder the team’s ability to develop ideas beyond the obvious. This insight is particularly critical to the developers of interdisciplinary student design teams as the observed practices of students showed that these teams tend to rely on the discipline knowledge they have, which reduces the potential the team has to push creative boundaries and resolve complex problems reduces.

The link found between emotional intelligence, team interaction and collaboration add to the research knowledge about the interconnection between these skills and effective participation across a range of role in teams. This insight is important in an educational context, as it highlights a need for EQ skills to be fostered to enable student teams to develop an internal support structure that can build student confidence to interact and participate honestly. The study also highlights the need for educators considering the use of interdisciplinary team project work to give more consideration to team development and encourage students to have difficult conversations to acknowledge differences and develop strategies to collaborate through difference.

7.4.2 Implications for practice

The insights in this study provide key knowledge for educators who are designing collaborative problem-based learning courses. The evidence presented in this study revealed that the development of the interpersonal skills required to successfully collaborate is not an easy task for students, and rarely occurs “naturally”. The study demonstrates the critical role assessment plays in team projects and shows that positive engagement between peers is unlikely to occur without the presence of external motivating factors.

This suggests that educators using collaborative approaches need to include project work and assessment requirements that help foster development of EQ in individual students and specifically encourage students to engage with their peers. This is particularly important for interdisciplinary design teams which are brought together to develop creative innovative solutions to complex problems. Design educators need to find approaches and strategies that focus on the development of EQ at the individual level to build confidence in all students. This confidence may increase the potential each individual has to honestly contribute their views and opinions about team ideas and solutions. Once established the transfer of these interpersonal skills to the team needs to be encouraged to enable the team to develop a supportive and encouraging CoP.

To achieve this, educators might consider the learning benefits that can be achieved through sequenced learning in discipline-specific education. This might lead educators to consider whether students would benefit from a scaffolded process that focused on teaching interpersonal
skills, such as leadership and EQ, to enable the team to build social relationships before they engage to develop solutions to complex problems. This pedagogical approach might make “team development” the first project. Reflective thinking might be central to this process, with consideration given to past experience and to team and personal perceptions, all of which determine what might be considered reasonable in the newly established team context. These insights may provide opportunities to help students build EQ through self- and peer reflection, which may be useful for limiting the impact of assumptions. This process might increase opportunities for the team members to develop a clear vision and code of practice. For the creative interdisciplinary team in particular, this process might include tasks that develop interpersonal trust to help facilitate a safe CoP that has the potential to tolerate a multiplicity of ideas.

Other tasks central to “team development” might include processes that develop appropriate internal team structures and allocate tasks that facilitate opportunities for all team members to participate in a range of roles. These strategies may serve to broaden the scope of participation for each student and minimise the individualisation of project tasks. Broader participation may also increase opportunities for critical evaluation across project stages, as it is likely that more students will have involvement in project decision-making across a larger range of project stages. Finally, “team development” could include tasks specifically focused on evaluative skills to improve individuals’ ability to contribute and receive feedback, enabling the lower-EQ individual students to develop more holistically. This stage would provide core skills for all students to contribute to the design thinking process and expand the opportunities for the team to develop innovative solutions collaboratively.

7.4.3 Limitations of the Study and Recommendations for Future Research

There are many issues that the study has only touched upon and that require further research. Drawing on the CoP theory literature, this study has given consideration to the influence of personal and discipline perceptions on four creative teams. Belbin’s Team Roles provided a mechanism to understand participation patterns and gave clarity to the gaps in student team processes. This evidence provides a window into the student lived experience and reveals much about the factors that enhance and inhibit collaborative practice in interdisciplinary design teams.

The team participation patterns analysed in this thesis allow for tentative conclusions to be drawn and future directions to be proposed. However, the scope of the study – a single unit of study in one university setting – limits the potential to generalise the findings to a broader context. More research into how students interact in various different contexts would add to our understanding of collaborative interdisciplinary teamwork in higher education more broadly. Furthermore, while
this study observed practice, this was limited to online interactions on Facebook. To understand fully the social engagement of the team, it would be useful to examine face-to-face team interactions. In-person observation would add knowledge about non-verbal cues and individual personalities that are not visible online.

This study has focused on the experience of students to the exclusion of the teachers. To provide a more complete picture, further research is needed to understand the project selection and planning processes of design educators. This research will increase knowledge about the influence of the educational experience of the teacher on the processes and projects they provide for their students. These studies could help answer questions such as, What is considered when tasks are developed for interdisciplinary teamwork? What kinds of tasks facilitate ongoing interaction and effective collaboration? What are the core criteria for assessment? Are these aligned with design thinking and innovative development processes?

The literature highlights the important role assessment plays in motivating student participation. This study has been limited to the researchers’ review of assessment practice and the processes undertaken by tutors. It did not however, consider the tutor’s disciplinary background and influences on tutors’ judgements. Further research is required to understand how teachers make judgements in assessing interdisciplinary projects and what influences their judgments, in particular whether teachers from different disciplinary backgrounds assess interdisciplinary projects differently.

This thesis found that inclusive interactions have a high potential to create a team community that allows all students to participate. Research that expands understanding of the role the individual plays in the team could be undertaken to identify whether structured interventions, such as in the role allocation process, may benefit the project team. This research could contribute insights as to the interventions that can be applied to “level the playing field” in teams to improve collaborative opportunities for all students. This is especially relevant to addressing issues of non-contribution in teams that have expert and/or overconfident or outspoken students.

Finally, this study proposes that the solutions may lie in pedagogical intervention and suggests that a process that requires the team to look inward and define itself before undertaking more complex solutions may be beneficial. However, the efficacy of this or other direct team-forming interventions remain largely untested, particularly where differences in student expert knowledge exist and project content and requirements are out of sync with learning expectations. This seems an important line of research to improve students’ ability to interact and develop effective collaborative team skills.


Cennamo, K., & Brandt, C. (2012). The "right kind of telling": Knowledge building in the academic design studio. Educational Technology Research and Development, 60(5), 839–858.


## Appendix A. Pre-Project Interview Themes (Example)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>THEMES USED FOR DATA ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing views and perceptions</td>
<td>View of teamwork • Strong teams have equal member participation.</td>
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<tr>
<td>of students</td>
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<td></td>
<td>Personal qualities that impact on teamwork • Has high work ethic is critical for success.</td>
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<td></td>
<td>Workload distribution • Works to strengths is in the groups best interest and creates the</td>
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<td></td>
<td>Learning expectations • How to work with others.</td>
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<td></td>
<td>Beliefs about others • Quiet/shy students contribute less.</td>
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<tr>
<td>Student 1</td>
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<tr>
<td></td>
<td>• Shared personal relationship help develop respect which leads to trust.</td>
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<td></td>
<td>• Rejects authority and doesn’t like to lead younger students unless absolutely necessary.</td>
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<td></td>
<td>• Knowledge work ethic and expectations determine individual contribution.</td>
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<td></td>
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<tr>
<td></td>
<td>• How to work with others.</td>
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<td></td>
<td>• Teamwork is a critical work skill that will build confidence.</td>
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<td></td>
<td>• Teaches you how to express your opinion tactfully.</td>
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<td></td>
<td>• Younger student not as effective.</td>
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<td></td>
<td>• Confidence or lack of can dramatically impact on the ability of the student to make a</td>
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<tr>
<td></td>
<td>• Shy individuals less likely to participate to the same level.</td>
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<tr>
<td>Student 2</td>
<td>• Working in a team with students with similar views avoids conflict and is an easier process.</td>
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<td></td>
<td>• When things run smoothly a lot of learning that occurs.</td>
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<td></td>
<td>• Strong design skills and hard worker, takes lead and extra work to alleviate stress wants</td>
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<td></td>
<td>• Very strong opinions and believes ideas, views are right.</td>
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<td></td>
<td>• Need to work on time and meet deadlines.</td>
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<td></td>
<td>• Students take up roles in their areas/strengths as this is easier.</td>
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<td></td>
<td>• Design student, sees other work as easy or not that valuable.</td>
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<td></td>
<td>• Builds confidence and exposes different ideas.</td>
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<td></td>
<td>• Experience important for the real world.</td>
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<td>• Communication skills or roles not taught.</td>
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<td>• Bad experiences offer learning, what not to do.</td>
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<td></td>
<td>• Controlling group members do not help groups to work well.</td>
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<td></td>
<td>• Starts from a trust position.</td>
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<td></td>
<td>• Shy individuals less likely to participate to the same level.</td>
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<tr>
<td>Student 3</td>
<td>• Positive team view if all pulls their weight and contribute.</td>
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<td>• Prefers not to work with friends, rely on him to do work.</td>
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<td></td>
<td>• Less engagement, more distractions when team knows each other.</td>
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<td></td>
<td>• Finds it easier to work in teams where she is made to feel comfortable.</td>
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<td></td>
<td>• Is shy and this can limit participation. Language barrier can also negatively impact.</td>
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<td></td>
<td>• Fair work distribution is important.</td>
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<td>• Larger teams make workload more manageable.</td>
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<td>• Project scope is important.</td>
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<td></td>
<td>• Learning is limited to the part of the project you undertake.</td>
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<td></td>
<td>• Learn interpersonal skills such as managing conflict and finding resolutions.</td>
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<td></td>
<td>• Other students can be harsh and will shut down ideas that they do not consider appropriate.</td>
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<td></td>
<td>• Being outspoken and convincing is powerful.</td>
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<td>Student 4</td>
<td>• Diverse groups expand outcomes.</td>
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<td></td>
<td>• Same goals, strong work ethic important.</td>
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<tr>
<td></td>
<td>• Prefers to work with people doesn’t know can be more honest.</td>
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<tr>
<td></td>
<td>• Grades primary motivator.</td>
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<td></td>
<td>• High achievers work more consistently.</td>
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<td></td>
<td>• Age a factor.</td>
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<td></td>
<td>• Early banter, important to getting to know each.</td>
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<td></td>
<td>• Compromise key to success.</td>
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</tbody>
</table>
### Appendix B. Pre-Project Interview Responses (Example)

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>BELIEFS</th>
<th>TRUST</th>
<th>POWER RELATIONS</th>
</tr>
</thead>
</table>
| Student 1 | • Believes first-year students will not be effective team members as they are young and not design students.  
• Designer look enough to convince individual will be an effective team member. | • Intuition tells you who to trust.  
• Early discussions show you who you have similar views to.  
• Does not trust first years believes they will need guidance.  
• Attributes this to maturity and lack of discipline knowledge. | • Believes that this team will need guidance.  
• Plans to take on the leadership role to keep an eye on things and have control over the situation.  
• Believes the team is happy for her take on this role. |
| Student 2 | • Believes level of participation is linked to year level of student.  
• Having first-year students in this team may have a negative impact. | • Notes one student wants to take on the leadership role in the team, leaving him to take on his preferred role, second in charge.  
• Not comfortable with the ability of younger students and believes they will need to be directed early or they may leave him to carry the load. | • Not comfortable leading younger students in teams.  
• Identifies early a possible conflict in personality with one of the students. |
| Student 3 | • Believes one team member is controlling and has high expectations.  
• Thinks this could have a negative impact on him. | • Reassured by having one team member that he knows. | • Fears that he will not be able to meet high-achieving team peer expectations and this will limit his participation. |
| Student 4 | • Believes four is a large team number that could pose management problems. | • Reassured by having one team member that he knows. | • Concerned about personality differences.  
• Has noticed differences between himself and another team member and believes there could be conflict. |
### Appendix C. Team Role Analysis (Example)

<table>
<thead>
<tr>
<th>ROLE</th>
<th>FACEBOOK POST</th>
<th>FUNCTIONAL ANALYSIS TEAM</th>
</tr>
</thead>
</table>
| **Shaper**   | • Post ideas for preferred ideas in the form of visual samples to direct and guide the “look and feel” of the logo.  
• Post: “Me personally I was thinking something along these lines” (uploads 2 links as samples).  
• Post: “I think the visuals of the layout should be finetuned so that they don’t have such a google docs vibe. I have made a custom background that reads back to the factors we were discussing and I think it looks more bespoke.”  
• Post: “What you’ve posted is good but maybe add at least one more light-hearted one. I don’t know I feel it’s just a bit too dark straight off the bat.”  
• Post: “Font probably needs changing, I’m more into cleaner designs like the bottom of this album, link provided, I definitely like the bottom 2 the most the 3rd being my fav.” | • Influence the team’s design direction, post ideas for preferred ideas.  
• Influences team to revisit selected solution and develop new ideas  
• Creates work that shapes the design direction for the team.  
• Influences the team to re-shape their thinking and include different ideas or images to create a broader appeal.  
• States views clearly to shift the teams thinking to preferred visual approaches. |
| **Implemener** | • Post: “Here is some of the research that I did considering bike systems in cities. I’ve read the bicycle plan for our city and I have put all the important information in the document. I’m here on Facebook if you have any questions.”  
• Post: “Hi guys, put this together last night. It is a basic rundown and costings for site hire at the venue and also includes patron capacity, lift access, water access points and I put a map of the site on it as well. I just thought this would help with some of our costing formulas.”  
• Post: “So this if the beginning of the survey question, hope this is good enough to start with.”  
• Post: “Hey guys, here is a media plan with a rationale attached. It’s a rough plan but it shows how we will promote the event.”  
• Post: “Here’s a bit of a mind-map. It is just a template so you can use as a guide.” | • Acts early to conduct research and implement ideas.  
• Works to create content on a specific area that has been discussed. Identifies clearly what has been actioned.  
• Begins work to implement a survey the team is proposing.  
• Prepares one of the requirements that have been discussed.  
• Formulates a way to engage the team by implementing a template approach. |
| **Completer-Finisher** | • Post comment: “I am reformatting and tweaking it a bit so it is consistent”.  
• Post comment: “Once I get design material and advertising content we will be done”.  
• Post: “Here’s an updated version of my rationale for promoting, I have now added a” | • Refine work to improve work to match personal preferences.  
• Reports on project progress.  
• Updates work to add new sections and complete previous parts. |
TV section as well as a second version of the billboard.”

- Post: “Final post here are some memes that come under the social media, promoting section. These will be used for our posts on Facebook and Instagram. I recommend we put these in both the workbook and folio.”
- Post: “Checked spelling, grammar, fixed up some slight errors.”
- Post comment: “Here is a list of the things we tried to brainstorm”.
- Post comment: “I’m going through the brief again and preparing a bunch of notes that I’ll use for any ideas we put out there”.
- Post comment: “We’ve decided that our main idea is a tourist hub…the small ideas like the bike is a small part of this”.
- Post comment: “Look at the problems, what we identified as an issue that could be expanded on or has potential as a viable project in the city. Provide evidence as to why this may or may not work i.e. population statistics and demographics, precedents around. Think of costs. Is it feasible given the budget provided”.
- Post comment: “In terms of the format for the presentation on, I feel as if we should delegate ourselves specific parts of our ideas so far. Any thoughts?”
- Post comment: “Let’s meet up before class tomorrow to collate the presentation and have a discussion about it?”
- Post comment: “Oh, and business attire for tomorrow! We get marked down if we don’t.”
- Post comment: That looks really good man, nice job!
- Post comment: We believe in you, it’ll be good “motivational speech”
- Post comment: I’m really bad at writing man. The decisions I made are all based on team discussions…I don’t know what else to say can you help me to polish off expression.
- Post comment: S1–hahaha awesome, love what you did with the mission statement, A+
- Post comment: S2–Thanks. Making it sound like we know what we are doing 😛
- Post: So since in our team everyone is dying of the plague, I’ll have a look at what’s required for next week’s presentation and discuss it on here.”
- Coordinator

Coordinator
- Post comment: “Here is a list of the things we tried to brainstorm”.
- Post comment: “I’m going through the brief again and preparing a bunch of notes that I’ll use for any ideas we put out there”.
- Post comment: “We’ve decided that our main idea is a tourist hub…the small ideas like the bike is a small part of this”.
- Post comment: “Look at the problems, what we identified as an issue that could be expanded on or has potential as a viable project in the city. Provide evidence as to why this may or may not work i.e. population statistics and demographics, precedents around. Think of costs. Is it feasible given the budget provided”.
- Post comment: “In terms of the format for the presentation on, I feel as if we should delegate ourselves specific parts of our ideas so far. Any thoughts?”
- Post comment: “Let’s meet up before class tomorrow to collate the presentation and have a discussion about it?”
- Post comment: “Oh, and business attire for tomorrow! We get marked down if we don’t.”
- Team Worker

Team Worker
- Post comment: That looks really good man, nice job!
- Post comment: We believe in you, it’ll be good “motivational speech”
- Post comment: I’m really bad at writing man. The decisions I made are all based on team discussions…I don’t know what else to say can you help me to polish off expression.
- Post comment: S1–hahaha awesome, love what you did with the mission statement, A+
- Post comment: S2–Thanks. Making it sound like we know what we are doing 😛
- Post: So since in our team everyone is dying of the plague, I’ll have a look at what’s required for next week’s presentation and discuss it on here.”
- Supports the individual in the team.
- Seeks input or assistance from the team.
- Friendly communication acknowledges and shows support for the work completed.
- Willingness to help out when team peers are not well.
- Manages processes, summary notes.
- Provides information about project brief and work in progress.
- Consolidates ideas and provide directive lead.
- Provides project summary to direct the team.
- Manages processes to ensures requirements are effectively met.
- Manages meeting times and requirements.
- Provide clarity about assessment requirements.
<table>
<thead>
<tr>
<th>Resource Investigator</th>
<th>Post: “Feel free to make changes if you want.”</th>
<th>Invites peer input.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Post: “Hey guys, I was looking for some public space initiatives in other cities and I’ve found one you should look at, The House of Vans in London. Public space and skating, Sasha perfect project, LOL.”</td>
<td>Researches to expand thinking and posts alternate ideas to expand team thinking.</td>
</tr>
<tr>
<td></td>
<td>Post: “Awesome food truck…thought I’d post here. It’s a pizza parlour inside a 35 foot storage truck containing a 3500 pound Italian wood-fire oven that cooks pizza in 90 seconds.”</td>
<td>Influences team to expand and modify the design solution</td>
</tr>
<tr>
<td></td>
<td>Post: “Hey all, found this great PDF on the population as well as heaps of data on the reasons people travel to the CBD. Got some cool stuff from it to discuss tomoz, but yeh. Feel free to go through it, there is a lot of pages, uploads link.”</td>
<td>Uses research findings to encourage the team to think more broadly.</td>
</tr>
<tr>
<td></td>
<td>Post: “Download the Gantt Project software from this site.”</td>
<td>Provides valuable resources for the team.</td>
</tr>
<tr>
<td></td>
<td>Post: “They are considered sacred sites, the gardens have indigenous significance so can’t be used for certain events. There is also the issue of public liability around certain types of events.”</td>
<td>Investigates locations and provides information that is critical to location selection.</td>
</tr>
<tr>
<td>Plant</td>
<td>Post: “How about we focus on expanding the night life to city “hot spots” that already exist. To make this economically viable we could use allocated government land which will provide long-term lease for cultural events though explorative art, performances or food.”</td>
<td>Presents new ideas to the team.</td>
</tr>
<tr>
<td></td>
<td>Post: “I was thinking something along the lines of a coloured logo and maybe some sort of a natural theme, uploads two links.”</td>
<td>Influences team design development.</td>
</tr>
<tr>
<td></td>
<td>Post: “With our project focusing around food I found this “food policy” to make sure everyone has access to good quality food interesting. I think our project should aim to work within this existing structure/policy.”</td>
<td>Expands on ideas the team is considering.</td>
</tr>
<tr>
<td></td>
<td>Post: “We could put together some really cool logos for our team like some arty tree, or some sort of cycle like drawing, hard to explain in typing will elaborate what I mean tomorrow.”</td>
<td>Influences team design development.</td>
</tr>
<tr>
<td></td>
<td>Post: “Improving on those ideas. This could also work to improve visits to the city. Transport as we know could use some work haha. Environmental factors are important too, I think we could maybe look into advancing or new age technologies and how we could use them to not only improve the</td>
<td>Give the team different views and perspectives to consider.</td>
</tr>
<tr>
<td>Monitor-Evaluator</td>
<td>Specialist</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>• Post: “Why not both then if we discuss the objectives, the concept, then how the concepts fulfills those objectives, that’d be good.”</td>
<td>• A logo and extra brightness in the reception desk would be nice.</td>
<td></td>
</tr>
<tr>
<td>• Influences team to revisit selected solution and find supporting evidence.</td>
<td>• Contributes specialist discipline knowledge at a detail level.</td>
<td></td>
</tr>
<tr>
<td>• Post: “We can’t use areas outside of the CBD as they are not within our reach cos the project has to focus in the city specifically.”</td>
<td>• Post: I am reformatting and tweaking it a bit so it is consistent.</td>
<td></td>
</tr>
<tr>
<td>• Seek clarification about solution in light of project scope.</td>
<td>• Uses specialist skills used to fine-tune work.</td>
<td></td>
</tr>
<tr>
<td>• Post: “Definitely say it all but just type the main points on the presentation. So you are not reading exactly what it says on the screen. A general presentation tip.”</td>
<td>• Post: “Are you able to add shadows, using a black/grey silhouette can make your job easier, also avoid repeating people and check proportions the ceiling height is 2.5m.”</td>
<td></td>
</tr>
<tr>
<td>• Monitors contribution quality.</td>
<td>• Contributes specialist discipline knowledge at a detail level.</td>
<td></td>
</tr>
<tr>
<td>• Post: “I was wondering if we should make the text on the left a bit larger (the titles) as they are not very readable at the moment.”</td>
<td>• Post: “The bottom one is clean and simple, upward facing leaf represents forward thinking. The second from the top is the most bland but it is meant to demonstrate an encompassing, well rounded and friendly approach. There’s one more coming which I am working on now :).”</td>
<td></td>
</tr>
<tr>
<td>• Monitors contribution quality.</td>
<td>• Contributes specialist discipline knowledge at a detail level.</td>
<td></td>
</tr>
<tr>
<td>• Post: “I think this risks pigeon holing the concept. Could we have a couple more maybe one with a fast food outlet or something else.”</td>
<td>• Post: “I get that the environmental theme is important but in regards to this photo I have major issues with this kind of work and I think we should keep the design simple with abstracted themes running through it.”</td>
<td></td>
</tr>
<tr>
<td>• Influences team to decide on a different solution.</td>
<td>• Uses specialist knowledge to direct the team.</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix D. Facebook Data/Journal Entries (Example)

<table>
<thead>
<tr>
<th><strong>FACEBOOK POST</strong></th>
<th><strong>JOURNAL ENTRY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wohoo awesome, love, love, love the very last one.</td>
<td>Feels she is on the “same wavelength” with this student and feels a lot of effort has been put in to come up with great ideas.</td>
</tr>
<tr>
<td>Hey guys I just did some reformatting because I had some extra time this arvo.</td>
<td>Resents this unit feels success relies on the competency of the team which causes stress. Assessment is too heavily based on group efforts so needs to improve the quality of the work.</td>
</tr>
<tr>
<td>I really like yours it is very nice.</td>
<td>Feels that there are stylistic differences and that disharmony may result in the near future. States: “There have been some little issues regarding the more ‘stylistic’ parts of what we are doing.”</td>
</tr>
<tr>
<td>Here is the design brief for the building, can everyone confirm so I can go ahead with the design?</td>
<td>Feels she is the only student who is contributing “maturely” to the team outcome. Peers are saying a lot of “we are going to” but there is little action, was expecting others to do their part.</td>
</tr>
<tr>
<td>I added some detail to the images...have a look if you like it.</td>
<td>Feels that her skills are not fully utilised and this makes her feel as though she did not contribute to the best of her ability.</td>
</tr>
<tr>
<td>S1 – Can I have the prices for furniture being used, don’t know what you are making it out of. I suppose you can make is up, then uploads a link to IKEA.</td>
<td>S1– Feels S2 has own agenda and is not contributing in a cooperative way, persistent in her thinking which is not always in line with the group. S2– Feels S1s not able to “nail his part” and does not make adequate contribution to the team project.</td>
</tr>
<tr>
<td>This is awesome! Thanks for doing it.</td>
<td>Feels this student has proven themselves as a strong communication designer.</td>
</tr>
<tr>
<td>Hey everyone, we really need to get this presentation sorted.</td>
<td>Feels uneasy that the work is not being completed until the last minute as is very nervous about presentations. Feels the team is “struggling a bit to come together”.</td>
</tr>
<tr>
<td>S1 – Here are a couple of draft templates for our presentation. S2 – Looks great 😎</td>
<td>S1– Feels the team is “tracking nicely towards completion”. The concept has been selected and everything has been decided on. S2– Feels this presentation was somewhat rushed together, states ‘pitch’ needs to be stronger to be at the level of the other teams.</td>
</tr>
<tr>
<td>Start by fleshing out the what. Possibly create mind maps to show the spread of the idea.</td>
<td>Feels the team could not complete this task so decided to complete it himself.</td>
</tr>
<tr>
<td>Perfect dude that’s exactly the kind of thing we need! If we can all get info like this we’ll be golden 😊</td>
<td>Believes the business students and have skills fall outside the project expertise and consequently they are finding it hard to get on board with the requirements of this project.</td>
</tr>
<tr>
<td>Please send me your part and a brief layout of your pages, words and images. Remember I don’t want pages to be too cluttered.</td>
<td>Feels peers make some effort but leave everything to the last minute. “I was the person that glued together the team and project and I had majority of the initiative”. Peers feel he is a strong communicator and a great leader. A very capable person with delegating work. He didn’t seem to mind doing “slightly a little bit more work”.</td>
</tr>
<tr>
<td>I’ll try to make it to class but if I don’t just let me know what work I need to do! Was sussing out that a cash flow needs to be done and I know how to do them so just a heads up.</td>
<td>Student feels her strengths are in her business knowledge which she feels she has more than her peers, she feels made a significant contribution to the team. Peers considers she lacks input however acknowledges that what she does is helpful to the team.</td>
</tr>
<tr>
<td>Okay I see it now, good work!</td>
<td>Feels team peer always has “excuses that have holes in them”. Doesn’t trust this student or understand why they are lying.</td>
</tr>
</tbody>
</table>
### Appendix E. Pre-Project Data/Journal Entries (Example)

<table>
<thead>
<tr>
<th>PRE-PROJECT</th>
<th>JOURNAL COMMENTS</th>
</tr>
</thead>
</table>
| Cultural diversity causes problems in teams. | S1– In previous weeks most of the team was on the same wave, except for an international student who did not really listen when we discussed our ideas and themes as a group.  
S2– One of our international students forced her idea on the tutor because she hadn’t been very active in team discussion and had missed some classes. I think she wanted to been seen as being really productive. In the long run it put us backwards.  
S3– Our international students did a good job at coming up with ideas, especially when it comes to the construction/design aspects of the centre, however because of the language barriers they are not always very understandable or clear. |
| Face-to-face meetings are better for teams. | S1– Facebook is a valuable vessel for communication but people usually use their time on Facebook to relax, rather than do work. They may try to avoid using the group on Facebook and miss notifications and begin to fall behind. I think really there is no substitute for meeting the other members in person.  
S2– As a team we decided to do most of our talking online as that enabled us to be contactable and allowed us to see when other members have commented or seen messages. While this format will enable us to juggle our commitments it also means we may miss out on some critical face-to-face time which would allow us to get to know each other and the way we all work, which would benefit us greatly moving forward.  
S3– We communicate by Facebook group. In my opinion it is the easiest way to communicate now since everyone is online on Facebook at least once a day. Everybody seemed very open to pass on their contact details. |
| Unlikely that everyone will participate evenly. | S1– One of our team member has a weakness, he doesn’t get work done on time and doesn’t communicate what he’s not yet done.  
S2– It was a little bit annoying that in such a pivotal week nearly half of the group was missing. Three of us decided to take initiative and divide the work to people and they would just have to cop it, it was all pretty basic stuff we handed out like costing’s and references.  
S3– Our coordinator didn’t seem too bothered to be doing maybe slightly a little bit more work than the rest of us. |
| Teams are not very structured and work is undertaken by the most able or willing. | S1– Sometimes throughout the semester were times where there was lack of communication, or lack of work being done on time by others. It didn’t hurt that the work was late to be added or was not well prepared as we still managed but we could’ve definitely worked more efficiently in some aspects throughout the semester.  
S2– I feel as if we should have been a lot more organised. It was evident that our work wasn’t prepared early enough and we didn’t have any real reassurance on our idea we were presenting pretty much was on the fly.  
S3– I made efforts to engage the team and to get their input on the chart but when I posed the questions to them regarding the tasks that would need to be completed in order to implement our concept, they were unable to contribute any reasonable ideas to the process. At this point I decided to write it myself to save time and effort. |
| Easier to work with students who are similar to you. | S1– Lovely, Intelligent, CONFIDENT people, but not usually people I would find myself in a group with. I was worried because I felt like none of them had common ground with me, both in my personal and professional life; I was worried because I felt like none of them had common ground with me, both in my personal and professional life; I was worried that this would affect our thinking process.  
S2– We were able to find something we all had in common, some of the time we would get talking during class time about outside things such as music which I think helped us bond more, as we all connected it made for a strong team.  
S3– Reasons for this being the mindshare of what we want to achieve, how we are all on the same level. Having a shared perspective is always important within effective team work. |
| Teams cause stress and make you nervous. | S1– As the presentation was approaching I started to worry as I had been absent from class the past fortnight, and although we had all been communicating via our Facebook group, I still felt under organised.  
S2– Everyone had posted their ideas. I was quite nervous to, as I thought they may be dumb ideas. We were supposed to have had a meeting on Sunday night to further discuss.  
S2– This week we presented our groups idea in class. I decided to put my hand up to present first as I like presenting quickly to get it done with. |
## Appendix F. Project Stage Distribution (Example)

<table>
<thead>
<tr>
<th>SCHEDULE</th>
<th>DESIGN DELIVERABLE</th>
<th>ASSESSMENT</th>
<th>ROLE</th>
<th>POSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Review brief&lt;br&gt;Identify and discuss possible topics&lt;br&gt;Research possible topics</td>
<td></td>
<td>Shaper</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Plant</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resource Investigator</td>
<td>2</td>
</tr>
<tr>
<td>Week 2</td>
<td>Discuss topics selection&lt;br&gt;Review research&lt;br&gt;Develop ideas and presentation</td>
<td></td>
<td>Teamwork</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implementer</td>
<td>3</td>
</tr>
<tr>
<td>Week 3</td>
<td>Topic Selection—Presentation</td>
<td>One</td>
<td>Coordinator</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specialist</td>
<td>2</td>
</tr>
<tr>
<td>Week 4</td>
<td>Review feedback on topic selection&lt;br&gt;Develop ideas</td>
<td></td>
<td>Coordinator</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monitor-Evaluator</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Completer-Finisher</td>
<td>6</td>
</tr>
<tr>
<td>Week 5</td>
<td>Select ideas</td>
<td></td>
<td>Teamwork</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implementer</td>
<td>4</td>
</tr>
<tr>
<td>Week 6</td>
<td>Review costing and feasibility</td>
<td></td>
<td>Teamwork</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specialist</td>
<td>2</td>
</tr>
<tr>
<td>Week 7</td>
<td>Prepare draft presentation</td>
<td></td>
<td>Teamwork</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Coordinator</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Completer-Finisher</td>
<td>3</td>
</tr>
<tr>
<td>Week 8</td>
<td>Draft Presentation (5-minute pitch)</td>
<td>Two</td>
<td>Coordinator</td>
<td>3</td>
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<td></td>
<td></td>
<td></td>
<td>Teamwork</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implementer</td>
<td>5</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Completer-Finisher</td>
<td>10</td>
</tr>
<tr>
<td>Week 9</td>
<td>Review feedback on presentation and ideas</td>
<td></td>
<td>Coordinator</td>
<td>7</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Monitor-Evaluator</td>
<td>1</td>
</tr>
<tr>
<td>Week 10</td>
<td>Refine and develop final idea for presentation</td>
<td></td>
<td>Shaper</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Teamwork</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Completer-Finisher</td>
<td>5</td>
</tr>
<tr>
<td>Week 11</td>
<td>Prepare final presentation</td>
<td></td>
<td>Teamwork</td>
<td>12</td>
</tr>
<tr>
<td>Week 12</td>
<td>Final in class Presentation</td>
<td>Three</td>
<td>Teamwork</td>
<td>15</td>
</tr>
<tr>
<td>Week 13</td>
<td>Submit Final Design Proposal</td>
<td>Four</td>
<td>Specialist</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monitor-Evaluator</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Completer-Finisher</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Teamwork</td>
<td>8</td>
</tr>
</tbody>
</table>
## Appendix G. Perceptions about Trust and Power

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Trust</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>First couple of weeks show what team members are like. Unsure about trusting younger students.</td>
<td>Older, more mature students committed to the process will have control.</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>Trust takes time to develop. Wants to start from a position of trust. Experience has made him wary of this.</td>
<td>Very important to have someone directive otherwise everyone is asking what to do.</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>Does not trust that everyone will participate evenly.</td>
<td>Leader/Coordinator is organisation role although not always controlling.</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>First impressions are important and you weigh up at an early stage whether you believe the student will participate.</td>
<td>Wants to do well but that is not the utmost of importance, so someone driving that can have a negative effect.</td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>Learns to trust if builds friendship, does not translate into trusting that their opinion/work is good. Teacher makes quality judgement will follow even if doesn’t trust that opinion is valid.</td>
<td>Teacher is most powerful as the decisions made highly influenced by teacher’s opinion.</td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>Can learn to trust or not. The process shows you who you can trust by end of the project. I learned “probably need to keep an eye on what’s going on a little more”.</td>
<td>Overbearing types take control and makes projects difficult. Differences of opinion can lead to conflict about the way forward.</td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>Learn quickly who is reliable on based on Facebook response speed.</td>
<td>No comment</td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>Trust is difficult because people say they will do something but then don’t and you need to learn how to work with this.</td>
<td>Groups where there is a controlling group member to not work well “it is pretty rude.”</td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>Trust can form quickly.</td>
<td>When team members know each other and have similar views, they can present similar ideas and influence others.</td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>Non-participation cannot be changed by other team members.</td>
<td>Teacher has ultimate power. Mature students have more power.</td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td></td>
<td>Individuals with dominant personalities and more experience have more power.</td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>Relationship developed on personal level create respect, leads to trust. Completion of work leads to trust, those who don’t fulfil their obligations you can’t really trust these people.</td>
<td>Idea developer has power because they are the leader and have knowledge to progress idea.</td>
</tr>
<tr>
<td><strong>Gill</strong></td>
<td>Feels others trust the leader will have a commitment/responsibility to the team.</td>
<td>Strong personalities or forward individuals selected ideas and drive direction. Being outspoken and convincing gives you power.</td>
<td></td>
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<td>----------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>David</strong></td>
<td>Design students don’t trust students from other disciplines can do produce practical outcomes to the same standard they can.</td>
<td>Team members leading took control and this limited participation and learning.</td>
<td></td>
</tr>
<tr>
<td><strong>Blue</strong></td>
<td><strong>John</strong></td>
<td>Need to be honest with the group.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No comment</td>
<td></td>
</tr>
<tr>
<td><strong>Tina</strong></td>
<td>Takes a while to get to know if someone is competent. You need that to trust them.</td>
<td>Fear of rejection or criticism minimises power.</td>
<td></td>
</tr>
<tr>
<td><strong>Kelly</strong></td>
<td>No comment</td>
<td>Older students who are high achievers tend to run and control projects.</td>
<td></td>
</tr>
<tr>
<td><strong>Max</strong></td>
<td>Trust difficult when team members have little interest in participating at a high-level.</td>
<td>Personality is the major determinant.</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix H. Individual Dispositions and Qualities

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Dispositions</th>
<th>Qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>• Willing to learn</td>
<td>• Self-discipline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unwilling to engage with difference</td>
<td>• Carefulness towards work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Will change work of others to meet her</td>
<td>• Motivated to achieve high grades</td>
</tr>
<tr>
<td></td>
<td></td>
<td>expectations</td>
<td>• Little respect for others</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>• Willing to explore new ideas</td>
<td>• Respectfully engages with team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Determination to reject authority and convention</td>
<td>• Self-discipline</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>• Willing to listen to others</td>
<td>• Carefulness towards work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to listen to others</td>
<td>• Support others emotionally</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>• Willing to engage with students with similar</td>
<td>• Restraint due to lack of confidence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>views</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>• Willing to learn</td>
<td>• Stubborn</td>
</tr>
<tr>
<td></td>
<td>Tania</td>
<td>• Willing to explore new experience or new ideas</td>
<td>• Clashes with others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unwilling to explore new experience or new ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Little respect for others</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Strong opinion believes she is right</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>• Willing to learn</td>
<td>• Open and adaptable to a range of situations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to listen to others</td>
<td>and roles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>• Willing to engage only with what he knows</td>
<td>• Self-discipline to work but only in his</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respects others and feels responsibility to the</td>
<td>discipline area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>• Willing to learn</td>
<td>• Happy to follow others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to provide feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>• Willing to engage with others</td>
<td>• Tolerant of others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respects others and feels responsibility to the</td>
<td>• Slack, under contributes at times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>• Willing to learn</td>
<td>• Strong work ethic</td>
</tr>
<tr>
<td></td>
<td>Briana</td>
<td>• Willing to explore new ideas</td>
<td>• Honest but respectful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unwilling to explore new ideas</td>
<td>• Strong mind</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td>• Willing to explore new ideas</td>
<td>• Respects others and feels responsibility to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to broaden engagement with others</td>
<td>the team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Happy to follow others</td>
<td>• Happy to follow others</td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>• Willing to explore new ideas</td>
<td>• Resilient and able to rectify problem if</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to engage all team members equally</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>Gill</td>
<td>• Willing to learn</td>
<td>• Respectful and tolerant of others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new experiences</td>
<td>• Open-minded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respects others and feels responsibility to the</td>
<td>• Negotiator able to resolve situations.</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>• Strong will to learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas and engage with</td>
<td>• Respect of others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>others</td>
<td>• Authentic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas and engage with</td>
<td>• Self-discipline feels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>others</td>
<td>• Values teamwork</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>• Willing to explore new ideas</td>
<td>• Self-discipline and organised</td>
</tr>
<tr>
<td></td>
<td>John</td>
<td>• Willing to broaden future perspectives</td>
<td>• Determined to create high quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Will to change work of others if work does not</td>
<td>outcome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>meet his standards</td>
<td>• Not respectful of others</td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>• Willing to learn</td>
<td>• Self-discipline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to explore new ideas</td>
<td>• Organised</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to develop relationships</td>
<td>• Respectful of others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consultative and authentic.</td>
<td>• Consultative and authentic.</td>
</tr>
<tr>
<td></td>
<td>Kelly</td>
<td>• Will to learn</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Willing to engage with the team and project</td>
<td>• Self-discipline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Minimal demonstration of strong will to</td>
<td>• Organised and good at keeping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>positively engage.</td>
<td>everyone on track</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lacks self-discipline and focus</td>
<td>• Distracted by other team members</td>
</tr>
</tbody>
</table>
## Appendix I. Perceptions about Team Roles

<table>
<thead>
<tr>
<th>Team</th>
<th>Participant</th>
<th>Past roles</th>
<th>Role selection</th>
<th>Perceived role importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purple</td>
<td>Sally</td>
<td>Leader/Coordinator</td>
<td>Self-nomination Roles change when student don’t deliver</td>
<td>More direction and clear outline of roles can help students who are new to group work. Older students more likely to lead.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decided by team</td>
<td>Good to undertake leadership role at university for experience. Leadership as a role of an older person.</td>
</tr>
<tr>
<td></td>
<td>Greg</td>
<td>Prefers second in charge, influence without responsibility</td>
<td>Emerges through time</td>
<td>There is ‘kind of a leader in every group because someone has to handle that eventually’.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Based on skills</td>
<td>Coordination is the biggest role.</td>
</tr>
<tr>
<td></td>
<td>Tony</td>
<td>Coordination but not his preference</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>Lead teams and delegated roles</td>
<td>Based on skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>Tania</td>
<td>Prefers leadership role</td>
<td>Depends on who “steps up”</td>
<td>Coordinator/leader guides the team to understand the brief and the process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sasha</td>
<td>Leadership/Coordinator role</td>
<td>Designated by team</td>
<td>The team leader most difficult role especially when Individuals that don’t participate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Team player</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Matt</td>
<td>Has been leader but prefers not to take on this role</td>
<td>Based on teacher instruction</td>
<td>Team leader has organisational responsibility.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kathy</td>
<td>Likes to be the leader</td>
<td>Personality and personal preference</td>
<td>Important to have complementary roles to share responsibility.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aaron</td>
<td>Does not take on leader role</td>
<td>No comment</td>
<td>Tolerance of each other and working together more important than roles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Briana</td>
<td>Coordinator role</td>
<td>Assigned to individual strengths</td>
<td>Leaders do more than other group members. Group where someone takes on an early leadership role have consistent contribution.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paul</td>
<td>Not a leader prefers not to take on this role</td>
<td>Roles to be naturally established from within the team</td>
<td>Communication is the key teams where “people disagreeing without any reason are doomed”.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>No preference</td>
<td>Selected team idea initiator should lead as most knowledgeable</td>
<td>Contribute should be individual appropriate. I Get to know team to finding out work processes and the sort of person they are.</td>
</tr>
<tr>
<td>Name</td>
<td>Organiser but not an idea driver</td>
<td>Teacher assign roles</td>
<td>Older students usually coordinate.</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------</td>
<td>----------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Gill</td>
<td>Team player goes along with the majority</td>
<td>Stronger personalities take control</td>
<td>Directive leaders can minimise participation.</td>
<td></td>
</tr>
<tr>
<td>David</td>
<td>Coordinator has instructional style</td>
<td>Depends on who “steps up”</td>
<td>Role of the Coordinator is very important, work must be delegated step by step.</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>John</td>
<td>Coordinator to keep team on track</td>
<td>Coordinate are important to distribution of work at regular meeting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tina</td>
<td>No role preference</td>
<td>Assigned by teacher</td>
<td>Coordination role is important to keep the project moving forward.</td>
</tr>
<tr>
<td>Kelly</td>
<td>Max</td>
<td>Has coordinated preference to work on delegated tasks</td>
<td>No comment</td>
<td>As long as everyone puts in assigned part all is okay.</td>
</tr>
</tbody>
</table>
Appendix J. Plain Language Statement

Project: Interactions and collaboration in interdisciplinary teams.

Introduction

1.1 Your name and contact details have been drawn at random from the list of students currently enrolled in the unit Design in Teams. As a student undertaking this unit, we would like to invite you to participate in our research project. The aim of this study is to investigate whether the interactions and dialogue that occurs influences design problem solving and design direction. This project has been approved by the Human Research Ethics Committee (MGSE HEAG).

What will I be asked to do?

Should you agree to participate, you would be asked to contribute in four ways.

First, you will be asked to attend a preliminary individual interview. This interview will be used to get an understanding of your previous experiences with collaborative group work. It will also provide information about your thoughts and feeling about the project before the project has commenced. With your permission, the individual interview would be audio-recorded so that an accurate record of what you said can be made.

Second, you will set up a Facebook group, which your design project team will use as the primary source of project communication. You will be asked to provide the researcher with access to this group only. The researcher will be able to see what each member contributes to the process but will not actively participate in the group. The content of this group will not be used for assessment in any way and will remain confidential.

Third, you will be asked to provide a copy of your self-reflection journal and give access to your assessment measures to the researcher. This will be used to understand your personal responses to the team’s processes throughout the semester. The research will not review your self-reflection journal for assessment purposes and the contents will remain confidential.

How will my confidentiality be protected?

The researchers intend to protect your anonymity and the confidentiality of your responses to the fullest possible extent, within the limits of the law. Your name and contact details will be kept in a separate, password-protected computer file from any data that you supply. Only the researcher/s will be able to link you to your responses, this will only be done if it is required that we send your interview transcript to you for checking. In any publication based on this research, you will be referred to by a pseudonym. Any references to personal information that might allow someone to guess your identity will be removed; however, you should note that as the number of people we seek to interview is very small, it is possible that someone may still be able to identify you. The data will be kept securely for five years from the date of publication, before being destroyed.

How will I receive feedback?

Once the thesis arising from this research has been completed, a brief summary of the findings will be available to you on application at the Melbourne Graduate School of Education. It is also possible that the results from this study will be presented at academic conferences and published in academic journals.

Will participation prejudice me in any way?

Your participation in this study is completely voluntary and will in no way impact on the unit assessment. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice. The researchers are not involved in the ethics application process. Your decision to participate or not, or to withdraw, will be completely independent of your dealings with the ethics committee, and we would like to assure you that it will have no effect on any applications for approval that you may submit.

Where can I get further information?

Should you require any further information, or have any concerns, please do not hesitate to contact any of the researchers on the numbers given above. Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, Human Research Ethics (MGSE HEAG), The University of Melbourne, on ph: 8344 2073, or fax: 9347 6739.

How do I agree to participate?

If you would like to participate, please indicate that you have read and understand this information by signing the accompanying consent form and returning it in the envelope provided. The researcher/s will be available during the first class in this unit to collect forms and clarify interview process and explain Facebook group setup.
Appendix K. Consent Form

Project: Interactions and collaboration in interdisciplinary teams.

The aim of this study is to investigate the factors that influence collaborative practices and working relationships in interdisciplinary design teams in higher education. The Human Research Ethics Committee has approved this project.

☐ I have read the Plain Language Statement and understand the participation requirements.

☐ I agree to participate in a preliminary interview which will be recorded, provide access to the design team’s Facebook Group and participate in an interview at the completion of the semester.

☐ I understand that the information obtained by the researcher will remain anonymous and that no reference to actual participants will be drawn.

☐ I understand that the researcher will securely store the information for a period of five years after which it will be destroyed.

☐ I understand that participation in this study is completely voluntary and will in no way impact on the unit assessment. Should you wish to withdraw at any stage, or to withdraw any unprocessed data you have supplied, you are free to do so without prejudice.

Signature  Date
Appendix L. Design in Teams – Project Brief

1. Project Background
This brief is a vehicle to build your understanding and knowledge of the process of creating a professional creative proposal. The brief is intended to offer a foundation for your team to create its own project around a theme.

This unit demands a developing appreciation of personal and group management skills through active learning. The unit will both inform and presume basic management skills that will be required and developed through the course of this project.

Through the agency of this project we are assessing your capacity to manage and require evidence of the development of elementary project management skills in a team context. These requirements are universal to all creative disciplines.

Creative projects operate within a context of business. Creative teams are often commissioned to work for a client and to develop solutions that achieve specific business objectives. A client will choose the best possible creative group to develop concepts and execute the idea based on their proposal document and its presentation.

One way in which clients choose designers is through the process of pitching. Clients often engage a selection of creative groups to pitch a proposed solution to their brief. This proposal will comprise a document that outlines the broad concept, its strategy, timeframes and costs for execution. This proposed solution is then presented “pitched” to the client for selection.

Therefore, it is vital for a creative group to be able to articulate their ideas through effective and comprehensive proposal documentation. It is also important for a creative team to understand the importance of viability to the client. Your proposed project needs to clearly outline what you offer as a group, your proposed timeframe and your project management cost before any work commences.

2. Explanation of Project
2.1 Design Brief
Your class will be split into groups comprised of five members. This group will constitute your creative team—effectively a small multi-disciplinary design consultancy who will be pitching for a project.

Your group is required to outline and develop a comprehensive project concept and proposal document to a professional standard that would be submitted to a professional client.

In a business environment your team would be competing with other creative groups, so your proposal will need to possess both a high degree of flair and professionalism. It will need to demonstrate your team’s capabilities in project management, costs analysis and projection and management, teamwork synergies together with a clear understanding of the client’s interests.
Background to brief

The project contains 11 Talking Points. These form the basis for your project.

<table>
<thead>
<tr>
<th>Talk Business</th>
<th>Talk Global</th>
<th>Talk Public Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk Culture</td>
<td>Talk Knowledge</td>
<td>Talk Service</td>
</tr>
<tr>
<td>Talk Destination</td>
<td>Talk Living</td>
<td>Talk Sport</td>
</tr>
<tr>
<td>Talk Environmentally Sustainable</td>
<td>Talk Moving</td>
<td></td>
</tr>
</tbody>
</table>

This brief requires that your group select one of these Talking Points as the basis for building a project proposal. All offer diverse possibilities for design exploration.

Use the proposal structure (proposal structure .ppt) on Blackboard to guide your interrogation of the topic. Your tutor will guide and discuss your ideas during tutorials.

Your team will then develop and refine your selected project, creating a detailed proposal document to explain and rationalise your idea.

Your draft proposal will be pitched formally in class (as directed by your tutor usually in tutorial 8 or 9). It should offer an innovative idea/solution in a thorough and persuasive manner. This will constitute the second part of your formal assessment.

After refining and finalising your proposal, your team will present its project proposal for final assessment. This will constitute the third part of your formal assessment.

Your proposal document, workbook and peer evaluations will also be submitted for assessment.

Overall project criteria
- Identifies a solution to identity and/or need through sound research and concept generation
- Shows the effective application of all disciplines/capacities of your group
- Demonstrates a clear and comprehensive use and understanding of proposal documentation

2.2 Design Limitations

Proposed ideas may be service or product based but must work within the given budget. The Budget is strictly limited to $500,000. From this your team will deduct a fee of $15,000.

2.3 Considerations

Consideration should be made on the environmental impact of your proposal concepts. Other considerations you should make include:
- Manufacturing and production
- Performance, testing and maintenance
- Cost of manufacturing, installation
- Promotional activities

2.4 Final proposal  75% of Unit Mark

Your final proposal needs to include the following:
- The final proposal must be presented as an A3 bound document. (examples will be shown)
- Stapled, clipped or loose sheets will not be accepted for assessment or grading.
- A workbook will document the progress and evolution of the project and will comprise of two components.
- The first component will be a team submission that fully documents meetings, decision pathways, the roles of group members and their contributions at all points of the project (not just a summary of what they did, but documented evidence of each members contribution).
- The second component will be an individual submission that fully documents personal reflections and observations of group process and contributions. These are to be submitted individually to your teacher.
The proposal should include:

- A clear concept definition
- Comprehensive and well-articulated proposal concepts and visuals
- A summary of your areas of group expertise and relevance to the project
- Cost breakdown of project and implementation
- Project management timeframe and deadlines
- Other potential partners
- Sustainability—minimising the impact of project
- Your product/service advantage over others
- Potential income and extra revenue or measurable social benefit

Additional requirements:

- Facebook group — you are to set up a Facebook group for communication purposes, you are to invite your tutor to be part of this group. (Not assessed).

3. Requirements and deliverables

Your groups will be required to submit the following:

- One printed and bound A3 proposal
- A process journal comprising two components. Team process journal, which covers in detail, the process, development and individual contributions towards your project. Individual process journal, which covers in detail your own view of the processes and development that occurred.
- Your proposal in (PDF format)

4. Project Deadline

Proposals and all assessable materials must be submitted directly after your group presentation(s) approximately 3, 9 and 12. Specific times and locations will be advised. Each group will be allocated a specific time and duration for their presentation. The presentation will be formal and will be assessed at the time of presentation.

5. Teaching Method

A 30 min in class lecture will be delivered to provide key points of reference and background information. A 2.5 hour tutorial class will enable project-based consultation where student groups will be required to develop and progress and confer about their assignments.

6. Learning Objectives

At the completion of this unit students should be able to:

- Work in an interdisciplinary team and apply principles of effective leadership and teamwork;
- Utilise fundamental project management practices reflecting all professional creative practice;
- Utilise real-world and conceptual investigations to underpin concept development for a large scale project;
- Articulate the relationship between creative thinking, business and innovation through proposal documentation;
- Develop a persuasive and professional quality design proposal that realistically addresses budget and legal considerations;
- Organise and undertake succinct, well-structured and persuasive visual and verbal group presentation

7. Assessment Criteria

Assessment criteria for this project are based upon the following:

*Creativity and financial feasibility proposed solution (10%)*

To differentiate one project over another often the originality and innovation associated with a proposal is important. Not only the degree to which the idea is innovative, but also how effectively the idea would be implemented and executed. How financially viable is the idea? Will it actually work and is it feasible within the given budget? How financially sustainable is the solution for the future?
Workbooks (20%)  
Group workbook, documentation of research, development and progress of the project by the group (10%). Individual workbook, documentation of personal reflections to the process and progress of the team and project (10%).

Report contents (40%)  
Has the proposal been articulated well? Is it easy to understand and well structured? Does the document reflect an appropriate standard of professionalism? Is each section appropriately detailed? Is there enough information to make an informed judgement of the idea?

Layout and design of document (15%)  
Does the layout reflect professional levels of presentation? Is there sound attention to detail? Good use of visuals and type. Is it easy to read (indexing and use of type)? Does the document reflect the nature of the topic/project?

Presentations x 3 (25%)  
Was the information presented clear and succinct? Is the presentation of a professional standard? Does the presentation make good use of visual support? How well did all members of the creative team manage and contribute to the presentation? This will establish the group project assessment.
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